United Arab Emirates

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Ministry of Water and Environment (MWE)

3.4. United Arab Emirates

Introduction

FAO has approved a two year regional project (TCP/RAB/3202) entitled "Strengthening capacities towards the establishment of a regional platform for the detection of genetically modified organisms». The participating countries include Lebanon, Jordon, Syria, UAE, Yemen and Sudan. The aim of the project is to strengthen regional capacities and to enhance regional information exchange and dialogue in biosafety that would lead to the establishment of a regional platform for handling and managing GMO detection and related procedures through increased regional cooperation and standardization of GM detection and analysis procedures within the region.

Given the strong trade relations among the countries of the region, the shared borders, the heavy imports of food products, and new investments that the area is attracting; such a network could also represent an economic opportunity. It could reduce dependency and costs associated to GM detection activities on one side, and generate additional resources through the charges from the services provided by the reference laboratories on the other side. In addition, as GMO detection activities are necessary for the release of permits, the project will favor more balanced public-private sector collaboration for better organization and management of imports within the national regulatory frameworks and standardized procedures. Through the project it is expected that the six countries (Lebanon, Jordon, Syria, UAE, Yemen and Sudan) will reinforce the ties between agriculture and environment at national and regional levels, increase training opportunities, share experience and know-how. It will also aim to increase North-South and South-South collaboration in this area.

The project started its activities with an inception workshop held in Central Khartoum, Sudan from 17 -18 December 2008. The meeting was attended by participants from FAO Rome, ICARDA, AARINENA, and National Project Coordinators (NPCs) from Lebanon, Syria, Jordan and Sudan. The NPCs from Yemen and UAE could not attend this meeting.

The main outputs of the Inception Meeting were:

- A thorough review of the work plan adjustment to fit to the time frame of the project.
- National consultants proposed and nominated for each of the participating countries.
- Finalization of a common format for country stock taking of existing capacities in GMO detection, biotechnology and biosafety.

- International consultants proposed and agreed that FAO Rome will initiate contacts and take final decision.
- Consultants should start immediately the surveys and submit their reports as indicate in their TOR by March 2009.

Consultation in Biosafety, Institutional Collaboration and Partnership Building

Under the general supervision of the Regional Representative for the Near East (RNE), the technical supervision of the Officer-in-Charge of the Seed and Plant Genetic Resources Service (AGPS) and in close collaboration with the AGPS and the Research and Extension Unit (NRRR) technical officers and the NPCs, Prof. Dr. Magdy Madkour was selected as the International Consultant to anchor and provide the perspective and vision in developing the Regional Platform for GMO detection through preparation of documents, participation in meetings, interaction with partners on all aspects of GMO detection procedures and related institutional aspects.

Mr. RASHID BURSHEED, Director of Research, Ministry of Environment and Water, Dubai, UAE in his capacity as the National Project Coordinator, together with Prof. Madkour formed the team which was tasked to conduct the National assessment on the status of biotechnology, biosafety and GMOs in the United Arab Emirates .

A series of meetings, interviews and visits with Ministry of Environment and Water officials, Academic staff, Private Laboratories and International Organizations working in the UAE were made possible through the efforts of Mr. Bursheed. The assembled data has led to a comprehensive presentation of major aspects relating to biotechnology and biosafety in the UAE, identifying existing gaps and thus suggesting recommendations and the way forward.

The outcome of the consultation and discussions with all concerned is hereby highlighted in this National Assessment Survey for the UAE.

Meetings Held:

Meetings with Ministry of Environment and Water officials:

Individual meetings were arranged with the following high officials at the Ministry of Environment and Water:

- HE. Dr. Rashid Ahmed Bin Fahd, Minister of Environment and Water (MEW)
- Dr. Mariam Al Shanacy, Advisor to HE Minister of Environment and Water
- Mr. Obaid Al Matrohi, Assistant Deputy Minister for Fisheries,
- Mr. Abdallah Al Moalla, Assistant Deputy Minister for Water and Land,
- Mr. Sultan Abdallah Olwan, Assistant Deputy Minister for Agriculture Affairs,
- Eng. Mansour Ibrahim Mansour, Director of Agriculture, MEW.

Meeting with the International Center for Biosaline Agriculture (ICBA) officials:

- Dr. Shawki Barghouti, Director General
- Dr. Ahmed Almasoum, Deputy Director General,
- Dr. Faisal Taha, Director of Technical Programs
- Dr. K. Rao Manduri, Plant genetic resources specialist
- Dr. Rachael McDonnell, Water policy and governance scientist

A visit to the laboratories and experimental field station of ICBA and discussion with several scientists from the center took place on May 6, 2009.

Meeting with ICARDA's Director of the Arab Peninsula office, Dubai:

Dr. Ahmed Tawfik Moustafa, Regional coordinator, ICARDA regional office, Dubai

Meeting with the Advanced Biotechnology Center (ABC), Dubai:

- Dr. Mohsen Sulaiman, Director and DNA fingerprinting expert (by phone)
- Dr. Sanjeet Mishra, Technical Manager and Deputy Director.

After the meeting, the laboratories of the ABC center were visited and the equipment used in DNA fingerprinting, sequencing and molecular characterization was inspected.

1. Biotechnology in the United Arab Emirates (UAE)

The United Arab Emirates (U.A.E.), proclaimed on 2 December 1971, is set up of seven Emirates with Abu Dhabi the capital of the State. U.A.E., with a total land area of 83,600 km² (including approximately 200 islands) is inhabited by 2.443 million.

Climatically, the country is divided into two ecological zones, which greatly influence the agricultural production: These are the coastal region with hot and humid summers and warm winters, and the inland region, which is dryer.

1.1. Parameters of the Investment Environment in UAE

During the year 2006 UAE has realized a rate of development which has matched 10.7% measured by the real price, against 4.5% realized during 2002 i.e. an increase rate of about 237%.

- The GDP amounted about US$ 190 billion during 2006 against US$ 75 billion during 2002 i.e. an increase of about 135%.
- The Balance of Trade has realized a surplus that amounted US$ 56.3 billion against a surplus of US$ 14.2 billion during 2002 i.e. by a rate of increase of 296%.
- The per capita income during 2006 has reached about US$ 31700 which was doubled fourteen times compared with the per capita income of US$ 2200 in the Middle East & North African regions as a whole.
- UAE enjoys a political, economical, financial and fiscal stability. The economical system is deemed as free and open while the banking system contains a broad spectrum of credit facilities packed with enough liquidity which is free of any limits in foreign exchanges. Moreover, the entry visa issue policies to UAE allows for easy importation of foreign workers and employees.
- There are no direct taxes on profits earned by companies or on personal incomes (except for the fixed rate of 55% to be paid by oil companies and 20% levied on foreign banks' branches out of the net profit earned). As for custom duties it is 4% with many exemptions provided also it is allowed to transfer 100% of the capital of the professional companies, the foreign companies' representative offices and of the free zones companies.
- A fit and deep-rooted legal frame of work is envisaged in the companies' Act together with a clear ownership basis allowing expatriates for property rights up to 49% of the capitals of companies and 100% of the professional companies, foreign company's representative offices and free zones companies. On the other hand UAE has one of the best infrastructures worldwide, the matter that has contributed to attract international companies those who have enhance UAE's boom.

- UAE has occupied a leading position amongst Arab countries in terms of competitiveness in international markets and has positioned in the sixteenth rank in the international competitiveness index issued by the International Economic Forum of 2005/2006 also UAE has lead Arab countries in terms of the standards regarding technological development, public organizations management, overall economic stability, the degree of business competitiveness and the local business environment.

1.2. Date palm in the UAE

”Provide me with sustainable agriculture, i will ensure you a civilized society”

His Highness The Late Sheikh Zayed bin Sultan Al Nahyan

His Highness Sheikh Khalifa Bin Zayed Al Nahyyan, gives agriculture in general and date palms in particular huge care and put it on the top of his priorities. This Generous auspice comes as a continuation of the philanthropic demarche established by His Highness the late Sheikh Zayed bin Sultan Al Nahyan. This special attention of His Highness, The President, is clearly demonstrated in the increasing efforts exerted to improve Date Palm plantations all around the Emirates in terms of quantity, quality, productivity and the exploitation of available resources, which led to the leading position in the Date Palm business worldwide that the country is enjoying nowadays where the actual date tree population in U.A.E. is about 40 millions, of which 8.5 in AL-AIN region.

The annual date production in U.A.E. has jumped from less than 8,000 metric tons (MT) in 1971 to more than 240,000 MT in 1995, an increase of about 30 fold. The date fruit import had consequently dropped from 100,000 MT (1989) to 12,000 MT (1994). The decline corresponds with an increase in the country’s production of 100,000 MT over the same period. The export of dates had also jumped from zero (0) in 1971 to above 50,000 MT in 1998 with a value of US$ 15 million.

The U.A.E. date harvested area has increased from less than 60 hectares (ha) in 1971 to 31,005 ha in 1996. This increase in area is about 48 times and allowed the country to be internationally classified as the Seventh major producing country with six percent of the world date production. This date palm area constitutes 15% of the total cultivated land (about 200,000 ha).

1.3. Physical facilities dealing with Biotechnology:

Most physical facilities and Laboratories dealing with biotechnology in U.A.E concentrate on various aspects of Micropropagation and tissue culture of date palms. These facilities belong to Academia and private sector. Besides the commercial units, most of the institutions are targeting the establishment and development of biotechnology techniques to encourage and strengthen higher education and research, as well as training and industry support

Examples of such facilities and its description are presented below.

1.3.1. Date Palm Tissue Culture Laboratory (DPTCL)

The DPTCL, founded in February 1989, belongs to the UAE – University in Al Ain and took several years to reach its technical establishment. A new and adequate facility was built in 1993. The DPTCL receives the continuous attention of H.H. Sheikh Nahayan Mabarak Al Nahayan, Minister of Higher Education and Chancellor of the UAE – University. The DPTCL is internationally recognized as one of the major commercial Date Palm Mass Propagation Unit, The application of tissue culture techniques for date palm, also called in vitro propagation, has many advantages in comparison to the two traditional techniques (seed and offshoots propagation). The following are a few highlights to describe the Project.

Budget and Infrastructure

Annual Operational Budget	2.6 Million AED
Laboratory Superficy	2,400 m^2
A date palm gene pool area	20 hectares
Hardening facilities	17 Greenhouses and 7 Nurseries (5 hectares)
Growth Chambers	Eight (8) with 90,000 cultures capacity for each
Working Stations for Cultures and Subcultures	32 (16 Air Laminar flow Hoods)

Personnel

Laboratory Technicians & Assistant Technicians	77
Greenhouses and Nurseries Staff	16
Laboratory & Hardening Supervisors	2
Managerial Staff (Director, Assistant Director & Financial / Administration Officer	3

Production Capacity

So far the DPTCL had produced and distributed about 400,000 date palms of different varieties. The actual project aims to strengthen the existing unit and targets an annual production of one million date palms as from 2008. A second working shift is to be installed along with new laboratory extensions and buildings.

Varieties Mass Propagated

The following date palm varieties are in vitro propagated in the DPTCL: Khlass, Barhee, Rziz, Sakii, Jech Ramli, Maktoumi, Lulu, Nmishi, Chichi, Sukkari, Khisssab, Abu Maan, Sultana, Nabt Sabif, Khadraoui, Hilali, Khenezi and a male named MY2.

The project is implementing an annual program to introduce new date selected varieties and to reintroduce the previous ones in order to continuously have young cultures available

1.3.2. AL WATHBA MARIONNET LLC – U.A.E.

«Al Wathba Marionnet LLC» is a leading plant bio-technology company established in Abu Dhabi in 1997, as part of the U.A.E. Offsets program between France and the United Arab Emirates. It is considered to be one of the world's most important producers of Date Palms through plant tissue culture technology. Al Wathba owns a laboratory in Al Ain city where it propagates high quality varieties of date palm in mass quantities to satisfy the increasing demand locally and internationally. Thus, making U.A.E. an important center to supply the region and the world with pest-free, true-to-type tissue cultured date palms. Al Wathba Marionnet propagates more than 14 date palm varieties with origins from; U.A.E, Saudi Arabia, Iraq and Morocco. Additionally, Al Wathba looks into the rare date palm varieties of superior quality and propagates those which thrive under the climatic conditions of U.A.E. and the region. Hence, making rare varieties of date palm available to farmers in big quantities and at reasonable costs.

Superior varieties produced:

Zamli, Nawader, Ashal Al Hassa, Ashal Khalas, Um Ed Dahan, Mumtaza in addition to the males: Ghannami and Al Sekka. In the other hand, Al Wathba Marionnet dedicate itself on producing high quality date palm trees. This shows clearly in its strict and accurate production protocols and procedures, which are kept updated with the latest developments of Tissue Culture technology.

As part of its commitment in ensuring the genetic constancy and true-to-type state of the trees, Al Wathba Marionnet attaches a great importance to monitor their genetic stability all along the in-vitro process through carrying out genetic finger printing tests. These tests are regularly carried out on random samples of plants at several growth stages by the G.E.V.E.S. «Group for Control and Survey of Varieties and Seeds» which belongs to the French Ministry of Agriculture. Nowadays, hundreds of thousands of Al Wathba Marionnet palms are producing tons of high quality dates in different parts of the U.A.E. along with 16 other countries all around the world

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1.3.3. Green Coast Nurseries

Green coast nurseries is based in Fujairah, one of the seven emirates forming the United Arab Emirates. We are into the production, management and selling of «Tissue Cultured Date Green Coast nurseries Palm Plants», tender coconut palms, other palms like Livistonia, Brahea, Royal Palm, Blue Palm, etc. and a vast array of fruit and ornamental plants.

Our specialization is in the production of high quality (female) date palm plants which have been propagated (spelling) through the technique of «Tissue Culture» and special variety of male date palm yielding the highest & best quality of dates. These plants have been produced in our laboratories in close collaboration with a UK. Company who have been in this field since the last 30 years and have successfully researched for the development and production of date palms. Our company's reliable, well controlled system generate commercial quantities of high quality, genetically uniform plants of the most select and desirable varieties

Growth and development of tissue cultured date palms

Growth and development of tissue cultured date palm plants go under several steps:

I. Importation of the highest quality of date palm trees from around the world for the sole purpose of propagation using state of art tissue culturing technology.
II. The active heart tissues are taken from the selected plant and under the highest hygienic conditions are then planted in a proper media in our labs.
III. From the developing embryo to a green plant takes place in our labs equipped with a proper life support system controlled by temperature, humidity and light & closely monitored.
IV. The newly developed plant is then taken to the glass houses where it is gradually hardened and accustomed to the normal environment in which it will be planted in. This process takes almost 3 months.

The nursery period takes 3 to 6 months time in which the plant is developed and accustomed to the real life temperature and conditions and is closely monitored by our trained specialist and engineers in our Bidyah site. After this period the plants are ready to be planted anywhere.

1.3.4. Al Rajhi Laboratory

Varieties Mass Propagated in Al Rajhi Laboratory

Khlass, Barhee, Rziz, Maktoumi, Khadraoui

Production capacity

50, 000 trees per year

1.3.5. International Center for Biosaline Agriculture (ICBA)

The establishment of the Center was based on a strategic decision in the early 1990s to build a research and development institute focusing on the problems of salinity and using saline water for irrigated agriculture.

The Islamic Development Bank under the visionary leadership of its President, Dr Ahmed Mohamed Ali, took the lead in establishing the Center to build world class modern research facilities and to recruit international scientists to conduct research on improving the well-being of poor farmers cultivating under marginal conditions. A team of dedicated staff from the Islamic Development Bank and the Government of the United Arab Emirates worked hard to establish the Center in Dubai. The Center Government of UAE, the Arab Fund for Economic and Social Development, the OPEC Fund for International Development, the International Fund for Agricultural Development and the Municipality of Dubai to support the Center's activities.

Over the last ten years, the Center has been able to evolve strategically from the initial focus on applied research and technology development in saline irrigated agriculture, to the broader mandate of improving agricultural production within an integrated water resource system approach. Significant support from donors and fellow researchers and partners in national programs has encouraged this evolution in the Center's research agenda. ICBA is presently conducting over 15 projects at its Research Station covering the broad areas of its mandate in marginal water and biosaline agriculture.

Location

The International Center for Biosaline Agriculture (ICBA) is located 23 km from Dubai on the Dubai-Al Ain Highway and is easily connected to the rest of the UAE through the nearby Emirates Highway and Dubai Bypass Road.

Land area

The total area of ICBA>s headquarter is about 100 hectares, out of which 65 ha of mainly 2-5 meter high sandy hummocks is left undeveloped for the protection and rehabilitation of natural ecosystems common in the area. Fully developed for research, the remaining 35 ha are divided into 14 blocks, 2.5 ha each. Field salinity control can be achieved up to the plot level. Fields supplied with low salinity water are allocated for plant propagation and seed multiplication. Of the soil taxonomic class, the native soils are loose, nonsaline, fine sand in texture, very deep, somewhat excessively drained, moderate to rapidly permeable, strongly calcareous and moderately alkaline. Hardpan is also encountered in some areas.

Facilities

- Auditorium and training building
- Genebank
- Central Analytical Laboratory
- Seed unit
- Greenhouses
- Shadehouses
- Storage facilities
- Plant processing and drying rooms
- Machinery and workshop building

Investigation of elite date palm varieties for salt-tolerance

The objective is to evaluate the long-term impact of irrigation with marginal quality water on the growth, fruit yield and quality of elite date palm varieties in the Arabian Peninsula. Ten common varieties in the United Arab Emirates and 8 from Saudi Arabia are used in the trial which commenced in 2001-2002. Salinity levels used are 5, 10 and 15 dS m-1 (3,500- 10,500 ppm). The field is laid out in a split split plot design with three replications and five trees in each replication. All varieties showed promising growth under saline irrigation. Among local varieties, plant trunk height varied between 65.1 to 126.9 cm and fruit yield between 3.9 and 25.8 kg/plant. Lulu had the maximum trunk height (126.9 cm) crown diameter (316.3 cm) and maximum fruit yield followed by Barhi. Among Saudi varieties, Sukkari had the maximum plant height, crown diameter and fruit yield (22 kg/plant).

Conservation and sustainable use of plant genetic diversity to improve productivity of marginal ecosystems

The main objectives of the program are to promote agricultural production, energy generation, environmental greening and ecosystem rehabilitation in marginal environments by identifying, introducing, conserving and distributing suitable plant species. For the last ten years, ICBA has been assembling the germplasm of species with proven or potential salinity tolerance to provide a source of genetic diversity for researchers to mitigate problems of salinity in agricultural production systems.

In line with the new strategy to include other marginal quality waters such as wastewater, ICBA is acquiring, conserving and distributing germplasm of high value species such as vegetables and ornamentals. Over 9400 accessions of 220 proven or potentially salt-tolerant species, originating from 134 countries, are conserved in the ICBA genebank (at controlled environment of 5-7°C and 30-40% RH). A majority of the accessions are forage grasses and legumes. However, crops such as sunflower, mustard, guar, quinoa, asparagus, canola, pigeonpea, sesbania, cowpea, tomato, hot pepper and okra are recent acquisitions. Among the newly acquired crops, quinoa, asparagus, pigeonpea, guar, mustard and cowpea showed good adaptation and excellent potential for crop diversification in the Arabian Peninsula.

Following preliminary evaluation, using low quality water irrigation (salinity, 3 dS m-1; 2,100 ppm) on the research station, several cultivars with high yield potential were identified for further testing and possible introduction as promissing alternative crops in the region. Seed multiplication is underway in over 100 salt-tolerant germplasm accessions of forage crops including, pearl millet, sorghum, buffel grass, sesbania and triticale. About 320 newly acquired accessions of tomato, hot pepper, okra, eggplant and ornamental species are also being grown for seed increase and to evaluate their

performance under field conditions. In the United Arab Emirates, ICBA undertook 14 germplasm exploration trips and collected 220 samples of 70 economically important species for conservation and sustainable use. Many of these species have great potential for economic exploitation and because of their natural adaptation, they are more appropriate for use in landscaping and habitat restoration programs. Seed multiplication is underway to ensure their continued availability for research and other uses. Showed high potential for biomass and seed production. Promissing accessions produced high dry matter and seed yield.

Evaluation of native and introduced genotypes under local conditions

The process of domesticating wild species into the agricultural production system has been one approach to using wastelands, and poor quality water for irrigation. The approach involves the evaluation, selection and introduction of species to provide the necessary information about their salt tolerance, productivity and uses. Subsequently the potential species can be subjected to different management practices including irrigation, fertilizer, pre-and post-harvest methods to optimize productivity and increase the quality of the material. Results indicate that native plant species are more adaptable to the local environments as compared to the introduced plant species. ICBA leads in the testing and evaluation of both native and introduced genotypes under local conditions.

The major objectives and milestones are:

(i) Identification of salt tolerant genotypes

(ii) Management systems related to soil, water and plants

(iii) Uses and economics of the tested production systems

Propagation and multiplication of halophytes and salt tolerant plants for fodder, bio-energy and landscaping

There are two groups of plants that are salt tolerant and have potential to be used for fodder, bio-energy and landscaping: (i) the conventional and cultivated genotypes; and (ii) the wild plant species/accessions. In many cases, seeds are not available through commercial seed suppliers. Since these plants differ from conventional plant species, their mode of propagation and multiplication also differ. ICBA has started an extensive program for propagation and multiplication of these germplasms, both in greenhouses and under field conditions.

The main purpose is to have sufficient material (seeds and/or vegetative cover) of halophytes and salt tolerant plants for the trials at ICBA and for dissemination with partners through collaborative projects. Many of these germplasms may require specific methods and/or treatments for germination, after which they are subjected

to gradual increase in salinity treatment - a process referred to as <hardening>. Some of the material are genetically highly salt tolerant and may establish even without any hardening process. In cases of grasses, they may show highly salt tolerance in vegetative stage, but either develop very poor embryo and seeds, or do not develop at all. In such cases, vegetative propagation is much better and rapid as well.

Biosaline agroforestry: Remediation of saline wastelands through production of renewable energy, biomaterials and fodder

Growing trees on saline wastelands provides an unique opportunity to produce timber, biomaterials and biomass for energy on land that is of little economic value for food production, thus avoiding competition for food resources. The BIOSAFOR (Biosaline Forestry) research investigates the productive potential of biosaline agroforesty systems in the saline environment from the selection of trees to an optimized management and the development of economically feasible value chains. The BIOSAFOR project integrates different disciplines based on case studies, experimental trials and modeling studies. A number of salt tolerant genotypes are screened through an extensive process to determine the salinity threshold and the slope of growth (and biomass) reduction.

The data are then related to case area studies in different arid regions, where same or similar genotypes occur. This data is combined with climatic, groundwater (and other water resources) and soil data to prepare digitized maps identifying where suitable genotypes could be grown for producing biomass - bioenergy. animals, is also a source for bio-energy. The plant provides a favourable environment conducive for under-storeyed plants. ICBA initiated a trial using A. ampliceps with two other salt-tolerant grass species, Sporobolus arabicus and Paspalum vaginatum to evaluate the responses of salinity treatments and fertilizers, on growth and productivity of the test plants.

The average of four years results shows that the difference in biomass percentages between non-fertilizer and fertilizer treatments (at all salinity levels) were minimal for both the grasses. In case of S. arabicus, the increase in dry biomass were 11.9, 9.4 and 5.06% for 10, 15 and 30 dS m-1 salinity levels respectively, for fertilized plots as compared to non-fertilized treatments. For P. vaginatum, the differences were 11.5, 8.5 and -2.3% for same salinity levels and fertilizer treatments.

Central Analytical Laboratory (CAL)

Analytical laboratories are the backbone of any applied agriculture institute supporting research, extension, soil resource management and environmental protection. ICBA houses a Central Analytical Laboratory at its headquarters to provide independent services for in-house projects and external agencies. To date CAL has analyzed a number of soil and water samples, and provided services to external organizations such as the Environment Agency - Abu Dhabi (EAD); Tourism Development and Investment Company (TDIC) of Abu Dhabi; GRM International Australia; and Shell International.

1.3.6. APRP/ICARDA

The Arabian Peninsula Regional Program (APRP) of ICARDA serves the seven countries of the Arabian Peninsula, namely, Bahrain, Kuwait, Qatar, Saudi Arabia, the Sultanate of Oman, the United Arab Emirates, and the Republic of Yemen. The Program addresses three priority themes (i) rangelands, forage and livestock; (ii) protected agriculture; and (iii) water resources management.

These themes are supported by research in agroecological characterization and stress physiology. Emphasis is also placed on institutional strengthening and capacity building, human resource development, and promotion of the use of information technology. APRP is financially supported by the Arab Fund for Economic and Social Development (AFESD), the International Fund for Agricultural Development (IFAD), and, more recently, the OPEC Fund for International Development.

Goal:

The development of more productive and sustainable rangeland and irrigated production systems, including protected agriculture, through the more efficient use of the natural resources of the Arabian Peninsula, in particular water, energy and indigenous plant species.

Objectives:

- Improved targeting of research and technology transfer, land use planning, and environmental management based on the characterization of the specific potentials and constraints of the diverse agroecologies and associated land use systems of the Arabian Peninsula.
- Improved water use efficiency and optimal utilization of available water resources in open field irrigated production systems.
- Development of integrated range, forage and livestock production systems and management practices for rangeland rehabilitation.

- Development of a protected agriculture industry for the region that meets the national demand for more efficient and sustainable production systems and techniques.
- Strengthened national institutional, human resource capacity and enhanced technology transfer

1.3.7. Advanced Biotechnology Center (ABC), Dubai

The advanced Biotechnology Center is a private laboratory facility based in Dubai. Its main mandate is to run and execute routine analysis of biological materials as well as quality control of water and various measures for food safety.

Recently, ABC has engaged in routine fingerprinting of Date palm produced via tissue culture and micropropagation techniques using state of the art molecular biological techniques such as PCR, AFLP, RAPD etc. Although the facility is not very large, but the quality of services rendered are of high standards.

1.3.8. DuBiotech

Dubai Biotechnology and Research Park (DuBiotech), a member of TECOM Investments was officially launched in February 2005 by His Highness Sheikh Mohammed bin Rashid Al Maktoum, as part of Dubai's 2010 vision to establish a knowledge-based economy. The Park is the world's first Free-Zone dedicated to Life Sciences.

DuBiotech accommodates the entire Life Sciences value chain by providing key facilities, investing in infrastructure and creating a unique free zone that incorporates industrial, academic, commercial and residential projects.

The park incorporates special tailored facilities that include the BIO Headquarter Towers, the Nucleotide Lab Complex and warehousing facilities to support the rigorous requirements of research and development, manufacturing, distribution and high added value services.

As part of its commitment to Corporate Social Responsibility (CSR), all DuBiotech buildings are classified as LEED certified 'green' buildings. This extends not only to the headquarters and laboratory complexes, but also to the manufacturing and community service buildings that will be part of the park. The BIO headquarter Towers, once fully complete, are expected to be one of the largest 'green' buildings globally.

In addition to the park's facilities and infrastructure, DuBiotech also offers services such as regulatory affairs management, partner development, registration & licensing, government services and leasing services; thus consolidating all services under one roof for the client's convenience.

DuBiotech is actively building affiliations and alliances with distinguished universities, specialist hospitals, world regulatory bodies and other research parks to link the DuBiotech community with the global Life Sciences industry.

In alignment with its philosophy to be the major life science hub in the Middle East, DuBiotech features a community of Biotechnology, Pharmaceutical & Research companies including global leaders like Pfizer, Amgen, Merck Serono and Genzyme. Many small and medium businesses are also part of the community.

DuBiotech offers a unique business environment through a mixture of incentives such as advanced infrastructure, support services, freedom of capital movement, tax-free income and easy access to different markets. All of these together position DuBiotech as the strategic and ideal location for life science companies.

Vision Statement

The Dubai Biotechnology and Research Park will be the premier Life Science Hub in the region, comprising Industry, Research and Education through national and international collaboration.

Mission Statement

Contribute to Dubai's knowledge based economy by creating, developing and advancing an integrated life science cluster within a specialized and regulated environment.

DuBiotech Research Park

Dubai Biotechnology and Research Park (DuBiotech)is the Middle East's first and foremost Science and Business Park dedicated to global Life Science, DuBiotech is a hub fostering collaborations and innovation through its commitment to Life Science research, education and industry nationally and internationally.

DuBiotech, upon completion, will cover 30 million square feet of built-up area. It is strategically located in a prime area of Dubai. The 22 million square feet Park is divided into zones that are dedicated to various initiatives and companies of all sizes from across the Life Science value chain with an emphasis on Research and Development.

DuBiotech's headquarter is a 22 stories twin towers stands forth as an icon for the Biotechnology and Research Park. It is designed to be efficient, cost-effective and to create best in-class facilities to host life science companies interested to grow their business in the Middle East region.

The 600,000 sq ft headquarters recently won the Design and Sustainability Honour Award from the American Institute of Architects (AIA) for the technologically complex headquarters and it's poised to be one of the world's largest green buildings.

Bio HQ's unique design reflects DNA movement in a gel electrophoresis, a technique commonly used in the life sciences industry. The two towers are flanked through a Jewel Case which accommodates retail facilities and a Business center.

Designed for multi-tenancy with flexible subdivision, the facility is located in the middle of the DuBiotech complex in a very convenient part of Dubai, that is easily accessible from the new airport and from the major attractions and residential areas.

Normal Office Space (core + shell)

It consists of a variety of occupancies including Tenant Offices, Government Support Services, and Tenant Support Services. Tenant Office space is available to a variety of prospective clients interested to be part of the major biotech cluster in the Middle East. The normal office space is modular, flexible, and can accommodate a variety of tenant sizes.

Business Center (Fitted-out)

It provides incubator offices for small and innovative life sciences companies. The Centre offers total office solutions (fully furnished) and a variety of space types from touch-down stations to office suites. All the startup companies incubated in the Business Center enjoy the same Partner Development Management services – PDM provided to all DuBiotech Business Partners.

Retail Services (core + shell)

It is the vibrant, active centre in the HQ Complex, where people can get out, meet and mingle with each other. It's a great place to get to know your neighbors. The retail services include food and beverage outlets, general retail and convenience shops and fitness center.

Licensing & Activities

DuBiotech has identified a broad range of licensing categories and activities under which companies are allowed to perform within the Park.

- **Therapeutics** – Pharmaceutical, Biological and herbal products used to treat and/ or manage human or animal diseases, but not limited to, antibiotics, vaccines and gene therapy.
- **Diagnostics and Analysis** – Activities related to clinical testing, food, environment, forensic, agricultural, and/ or other biological/ chemical analysis.
- **Agricultural, Forestry, Horticulture, Food** – Novel crop varieties or animals, pesticides, trees, tissue culture products, fertilizers, food products, beverages, ingredients, etc.
- **Environment** – Including, but not limited to, waste treatment, bioremediation, energy production and environmental assessment.
- **Speciality Supplies** – Including, but not limited to, enzymes, DNA, RNA, oligonucleotides, amino acids, oligopeptides, polypeptides, proteins, cells, research animals, gases, etc.
- **Equipment** – Hardware, software, bioreactors, furniture, and/ or consumables utilized for research, education, training, production, and/ or manufacturing.

- **Life Science Consultancy** – Firms supporting or carrying out technical scientific, financial and economical studies pertaining to the life science industry in the areas of manpower, planning, advising, market research and analysis, performance analysis, due diligence, and in designing life science buildings such as laboratories, clinical trials and manufacturing facilities.
- **Life Science and Biomedical Associations (Non Profit)** – Non Profit International, regional and/ or national establishments comprised of scientific and/ or biomedical professionals that focus on enhancing best practices, quality, professionalism, standards, regulations, awards, exposure placement and creating business opportunities in their particular field.

The Nucleotide Lab Complex

The Nucleotide Complex, spanning an area of 256,000 sq. ft, comprises state-of-the-art laboratory buildings that are purpose-built for scientific and industrial R&D, diagnostics, analytical testing, equipment training activities and after sales services among others.

Features of the Nucleotide Complex The LEED certified Core and Shell Lab Space of the Complex, accommodates up to 160 laboratory units, which are designed to meet class III Bio-safety Standards/Guidelines. The laboratory units allow flexibility and ease in layout customisation and are equipped with a dedicated space for a Biological Safety Cabinet and an exhaust system to enable air filtering. The lab facilities are also fitted out with water systems, drainage systems, compressed gas systems and vacuum/air systems.

The air exhaust and ventilation system are specifically designed to prevent cross contamination from leaking/circulating between lab spaces. Additionally, acid resistant drainage along with pH neutralisation systems allows for safe discharge of chemicals/waste and sterilized high quality stainless steel mechanical equipments ensure high standards of hygiene.

1.4. Biotechnology constraints and challenges

There is no doubt that agricultural biotechnology has opened up new possibilities, particularly in crop and livestock development. However, there are major challenges that need to be addressed and tackled especially in the developing countries, in order for these countries to maximize their benefits from biotechnology in solving the urgent problems of food supply, protecting the environment, and reducing poverty. The main constraints and challenges that need consideration and actions are in the followings:

1.4.1. Clear biotechnology agenda and supporting policies

There is a need for Arab countries to develop clear and time-bound national agenda for biotechnology research and development (R&D) and commercialization. This could be achieved by linking science and technology with industry, and having both well tuned to market demands. Similarly, there is a need for policy initiatives to accelerate investments by technology holders and adoption by the farming communities.

These policies include the registration and approval of GM crops and funding and infrastructure support for public-private partnership programs in plant biotechnology, and other related areas. The supporting policies should also provide the framework for research and business institutions, and outline the trade and investment guidelines for the newly emerging biotech sector, which should be in agreement with the international guidelines, including the necessary biosafety measures and tests for new or introduced genetically modified crops.

1.4.2 Intellectual property rights (IPRs)

Patenting and IPR are promoting privatization of scientific research in agricultural biotechnology, and might increase the gap of biotechnology know-how and its applications between developing and industrial countries. Most Arab countries, especially those joined the Trade World organization (WTO) develop their IPR policies and regulation which suppose to cover those of the biotechnology products.

Significant achievements have been made on IPR protection for genetic engineering in general and for plant biotechnology particularly in the developed countries. However, problems and challenges are emerging with the implementation of IPR policies and regulations. Areas that need attention particularly in the developing countries include: Public awareness on IPR, capacity building on IPR protection, implementation on IPR protection, and enforcement of laws and regulations related to IPR.

1.4.3. Biosafety regulations

Increasingly tedious and expensive biosafety regulations are a major cause in slowing down the progress that is expected from biotechnology. In the United States, the cost of obtaining regulatory approval of a new transgenic crop variety can be as much as $30 million. Even the big companies are abandoning research programs if the size of the market does not warrant this level of investment. Small seed and biotechnology companies are essentially priced out of the market unless they partner with the multinationals, and the public sector may be left out as well. The situation in the developing countries is still not clear, because their biosafety regulations have not been developed in most countries.

Arab countries, however, face a number of challenges, including low levels of awareness about the Cartagena Protocol and a lack of necessary human, institutional and technological capacities. There is an urgent need for countries and organizations, in a position to do so, to provide additional financial and technical assistance and facilitate access and transfer of technology to enable Arab countries promote awareness and build their capacities.

There is a need in the Arab countries to Issue and approve national legislations regarding the GMOs and ways to handle them in terms of: their importations to the country, trading, GMOs variety release regulations at the national level and their monitoring and evaluation procedures, biosafety measures for health and environment for the crops and their products, and biosafety regulations for the importation and testing of transgenic crops, with regulations for field tests.

1.4.4. Public acceptance

Public acceptance of biotechnology products, especially transgenic crops and genetically modified (GM) food, is a major constraint to the adoption of plant biotechnology. Public awareness programs and campaigns should be organized to educate the public on the benefits of biotechnology products.

1.4.5. Capacity building

One of the most challenging matters for the biotechnology implementation is the human building capacity and qualified personnel capable of handling and carrying out biotechnology research and applications

2. Finding and Recommendations

During discussions it was evident that the Government of the United Arab Emirates (UAE) recognizes the importance of biotechnology, especially in regard to food trade. Special emphasis is placed on the cooperation with international organisations, such as FAO and WHO, and among the States of the Gulf Cooperation Council (GCC). The UAE, as well as other GCC countries, highlight their special situation as net food importers, and their need to be adequately equipped and prepared to test imported foods for their nature, quality and safety, indicating that current testing for GM foods in imported products is only sporadic and on a case by case basis. The use of analytical kits, particularly for the application of ELISA technique to GMO food detection is indeed well known, but further training on the proper application of these kits is needed. Furthermore, at least one laboratory should seek and obtain accreditation in GMO food analysis from an internationally recognized institution as this is important for international food trade.

It was also apparent that a monitoring and surveillance system should be put in place to check on the presence of GM foods in imported food shipments. In UAE capacity building is urgently needed to strengthen the ability to control and test GM foods and foster research in the area of biotechnology. There is also a need to strengthen capacities both at regulatory and institutional level and to improve partnerships and dialogue at the regional level through strengthened technical, institutional, international cooperation on biotechnology and biosafety.

Moreover, the United Arab Emirates which are not signatory to the CPB so far, lack these specific skills within its regulatory system. Indeed, currently, countries as single entities and the region as a whole cannot fully address the problems deriving from uncontrolled movements of GMOs in the area which could produce unpredictable effects on the regional biodiversity and human health. This is mainly due to the:

- Lack of full technical expertise in GMO detection and the evolving methodologies and practices;
- Lack of standardized procedures for the management of GMOs at various ports of entry;
- Lack of trained staff in GMOs detection and monitoring;
- Lack of equipment and containment facilities; and
- Lack of technical information or access to information in Arabic as a preferred language

Accordingly, there was a consensus that there is a need to:

- Develop a critical mass in terms of human resources and laboratory facilities
- Strengthen biosafety research capabilities
- Strengthen collaboration with international, North-South and South-South collaboration

- Establish a regional mechanism for sharing experiences, expertise and know-how
- Harmonise laboratory procedures, standards, and techniques of GMO detection
- Train relevant officers and technicians at national level in the subject, and develop a platform for information sharing and networking amongst technical staff in GMOs detection laboratories.

3. Conclusions

Plant biotechnology offers an unprecedented opportunity to address some of the world's most serious issues, including hunger, poverty and disease. This is because biotechnology can circumvent the species barriers that prevent useful traits being introduced into plants by conventional breeding. By transferring genes from bacteria, fungi, animals and sexually-incompatible plants into our food crops and medicinal plants, it is possible to improve their agronomic traits and provide them with additional metabolic abilities.

Genetic engineering and biotechnology provide good opportunities for the investment and improvement of food security and food production in the Arab countries, however, it has it is own challenges that need to be considered by the Center.

The following questions are relevant to be asked not only as related to Arab countries, but also for the developing countries in general:

What opportunities exist for biotechnology to contribute toward improving agricultural productivity, expanding markets, and stimulating employment and income generation in Arab countries, and what are the constraints that limit capturing these opportunities and in using biotechnologies approaches?

What challenges do these countries face in realizing these opportunities and in mitigating the risks associated with the use of biotechnology?

Considering the important challenges that encounter the agricultural sector and its sustainability in the Arab countries, it seems that the new biotech crops applications offers enormous potential benefits in the second decade of commercialization, 2006 –2015, in terms of meeting increased food, feed and fiber demands in the Arab World and contributing to more prosperity for both producers and consumers. Of particular importance are the genes for drought tolerance that are under development in both the private and public sector. The genes for drought tolerance are genes that very few farmers in the world can afford to be without and this is particularly true for

the rainfed dryland areas that typify much of the land in the Arab countries for which ICARDA (International Center for Research in the Dry Areas) has a regional mandate, and where biotech research is undertaken on drought tolerance. The first commercial variety with drought tolerance is expected to be drought tolerant maize in the US in 2011. The drought genes have already been introduced into several crops and early field tests are underway; for example, drought tolerant wheat is being field-tested in Australia.

In this regards it is evident that the decision to invest in agricultural biotechnology is timely and appropriate and is of great strategic importance at a time when the new technologies can contribute to:

- an increased sustainable supply of the most affordable and nutritious supply of food, feed and fibre, which is critical for facilitating prosperity for both producers and consumers in the Arab States;
- sustainable crop production in the dry-land areas to alleviate poverty of the rural poor who are farmers and the rural landless who are dependent on agriculture for their lively hoods
- Speeding the crop breeding that will mitigate the new challenges associated with climate change when droughts will become more severe and prevalent, temperature changes will be more variable, and when agriculture which produces up to 30% of greenhouse gases, must be part of solution rather than part of the problem

On the another hand, investment opportunities in biotechnology in the region are highly needed and required a strong partnership and alliance between the public and private sectors which have a visible and potential strategy to boost the adoption, investment and industrialization of biotechnology and their products for better sustainable agriculture and economy, healthy, safe, and sufficient food and feed, and safe environment.

In order for the region to be able to invest in biotechnology, certain requirements are needed:

- Outstanding centers which are run by good scientific personnel and very well equipped with all necessary facilities and instruments.
- Identification of the important products and their needs and demands with availability of investment environment.
- Developing a strategic research platform.
- Strong collaboration between public and private sectors.
- Good marketing strategy.
- An enabling policy and investment environment that will enhance and encourage the investment in this field.