



ECONOMIC AND SOCIAL COMMISSION FOR WESTERN ASIA

DRAFT REPORT

**E-FORUM ON MODERN BIOTECHNOLOGY; TECHNICAL AND POLICY IMPLICATIONS IN
THE NEAR EAST AND NORTH AFRICA REGION**

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Summary

The e-Forum on Modern Biotechnology; Technical and Policy Implications in the Near East and North Africa (NENA) Region was held from 1 September to 10 October 2005. The e-Forum, which is the first electronic forum to be held by ESCWA, gave participants the opportunity to exchange views on the agricultural applications of modern biotechnology and their environmental, social and economic implications. Participants from different countries and scientific backgrounds, as well as representatives of concerned international and regional organizations, were able to discuss issues of prime importance to the region and to convey their concerns and ambitions to policy and decision makers. Furthermore, the e-Forum aimed at exploring means for capacity building in applying modern agricultural biotechnology, with a view to achieving salient socioeconomic development objectives. The e-Forum helped in setting the stage for possible future cooperation between science and technology institutions and experts in the NENA region, including the ESCWA member countries.

Discussions in the e-Forum fell under the following four broad topics: a) Biotechnology and food security; b) Policy focus and priority issues; c) Biosafety recent trends and future prospects; and d) Capacity building in biotechnology.

The e-Forum resulted in a number of recommendations, and stressed the need for regional cooperation in areas such as biotechnology capacity-building, public awareness and biosafety laws. In addition, a number of specific project proposals were set forward based on discussions. These proposals will be circulated among concerned experts and institutions with the aim of building partnerships for implementing the projects.

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INTRODUCTION

1. The e-Forum on Modern Biotechnology; Technical and Policy Implications in the Near East and North Africa (NENA) Region was held from 1 September to 10 October 2005. The e-Forum, which is the first electronic forum to be held by ESCWA, gave participants the opportunity to exchange views on the agricultural applications of modern biotechnology and their environmental, social and economic implications. Participants from different countries and scientific backgrounds, as well as representatives of concerned international and regional organizations, were able to discuss issues of prime importance to the region and to convey their concerns and ambitions to policy and decision makers. Furthermore, the e-Forum aimed at exploring means for capacity building in applying modern agricultural biotechnology, with a view to achieving salient socioeconomic development objectives. The e-Forum helped in setting the stage for possible future cooperation between science and technology institutions and experts in the NENA region, including the ESCWA member countries.

I. ORGANIZATION OF THE E-FORUM

2. Discussions in the e-Forum fell under the following four broad topic areas:

- a) Biotechnology and food security;
- b) Policy focus and priority issues;
- c) Biosafety recent trends and future prospects;
- d) Capacity building in biotechnology.

3. Discussions were followed by a special session dedicated for conclusions and recommendations. The outcomes of this session are summarized in section IV of this report. Based on these conclusions and recommendations, a number of specific project proposals in biotechnology were put forward by participants (see section V for a list of these projects and their main objectives).

4. One hundred and three (103) experts from 25 countries and different scientific backgrounds participated in the e-Forum, in addition to representatives of concerned United Nations agencies. See Annex I for a list of participants and Annex II for the distribution of participants by country.

II. E-FORUM PAPERS

5. A section of the e-Forum's website was devoted for posting papers and project proposals presented by participants to the meeting. See Annex III for the list of papers presented.

6. Papers presented included two documents prepared by ESCWA on biotechnology research activities in selected Arab countries, and the status and future prospects of agricultural biotechnology. Three other papers that were prepared for ESCWA by experts in the field were titled: 1) Dissemination of Biotechnologies for Employment Creation and Poverty Alleviation in Impoverished ESCWA Communities: Plant Tissue Culture; 2) Biotechnology Policies, Capability Building and Development Strategies in Kuwait, Saudi Arabia, Egypt and Morocco; 3) Biotechnology Policies, Capacity Building and Development Strategies in Lebanon.

III. DISCUSSIONS

7. The following is a summary of discussions under the four topics of the e-Forum.

A. BIOTECHNOLOGY AND FOOD SECURITY

8. Deliberations under this theme focused on the capability of biotechnology and genetic engineering (BTGE) to improve food security, achieve economic growth and alleviate poverty in the NENA countries. In addition, participants explored the true costs/benefits of planting genetically engineered crops in countries of the region and the possibility of achieving comparable benefits at lower costs using other approaches.

9. Participants emphasized the potential of modern biotechnology applications in upgrading agricultural practices and improving farmers' income and thus paving the way to a more sustainable agriculture in the NENA region.

10. The considerable advances achieved in some modern biotechnology applications, including tissue culture, DNA fingerprinting (mapping, molecular breeding) and biocontrol, and the benefits of adopting such techniques instead of relying on genetic modification, were highlighted. However, it was agreed, that the adoption of these techniques needed a proper infrastructure and the presence of highly trained personnel.

11. Many saw that countries in the region needed strong breeding programmes to take full advantage of biotechnology tools. However, it is important that these programmes be associated with biotechnology labs and connected with end users (farmers) if biotechnology is to be translated into varieties that are more productive.

12. Proponents of GM technologies argued that developing countries needed genetically modified (GM) crops for sustainable agriculture. Genetically engineered drought- and salt-tolerant crops could provide an avenue to using degraded and unproductive lands. While genetically modified breeds designed to fight diseases and pests could provide a solution to the excessive reliance on pesticides and herbicides. This would in turn help farmers cut down on production costs and safeguard the environment. Furthermore, genetic modification targeting the nutritional and storage quality of agricultural products may improve their market competitiveness.

13. GM proponents further argued that while the NENA region harbors a great genotypic diversity of a number of crops such as olive, fig and grape trees, genotypic variability does not ensure finding resistance to diseases or any other phenotypic trait of interest. When a gene for resistance to a disease in a certain crop can be identified, simple breeding techniques will allow the transfer of the trait into the commonly used crop variety (the level of ease/difficulty depending on a number of variables). However, the problem arises when genetic resistance cannot be found in the crop of interest, or in a closely related species. That is where genetic engineering becomes necessary in order to incorporate a gene from a totally different species.

14. Opponents of GM technologies, on the other hand, suggested the adoption of non-GM biotechnologies, such as organic farming and integrated pest management (IPM) strategies. Organic farming allows for the reduction in pesticide use and thus the reduction of agricultural pollution and facilitates the marketing of local produce abroad. IPM on the other hand, improves farmers' capability to forecast disease and pest epidemics and enhance their crop management strategies, thereby providing them with means and tools to increase productivity.

15. In addition to that, participants discussed the issue of GMO acceptance by the public and the need for awareness campaigns and transparent research to determine the benefits and risks of GM crops for developing countries. Participants recommended food labeling to better inform consumers and to give them the right to choose.

16. Other related topics that were discussed under this topic included:

- a) Selecting and cultivating genotypes that are most suited for planting locations in the NENA countries;

- b) Securing necessary funds for research and development in the region to fight the privatization of this technology by developed countries and large companies;
- c) Potential risks of GMOs to human health, which may include toxic reactions, cancer risk, food allergies, and antibiotic resistance;
- d) Terminator gene technology that is being developed as means of intellectual property protection and that works on controlling the action of some genes in the plant rendering the seed sterile and not fit for planting. If the technology gets implemented, small farmers in poor countries, who rely on saving seeds will be adversely affected and in case the terminator gene escapes into wild populations, it may result in devastating environmental consequences.

B. POLICY FOCUS AND PRIORITY ISSUES

17. Discussions under this topic focused on identifying principal policy issues regarding the adoption of modern biotechnologies, including genetic engineering, in the NENA countries and strategies designed for the implementation of such policies. Discussions went into assessing efforts by NENA countries to set relevant policy/strategy bodies, and institute, in any other manner, policies and strategies to effectively deal with the full range of issues presented by modern biotechnologies, including genetic engineering. It was found that NENA countries were in need of more focused efforts in this regard to accelerate policy formulation and strategic planning.

18. It was noted that the majority of developing countries did not have regulatory systems for GMOs. Many, however, were in the process of establishing such systems, often with the technical assistance of UN and non-UN organizations.

19. The importance of the Cartagena Protocol on Biosafety, an international agreement concerning viable GMOs, was emphasized. This international protocol catalyzed the drafting/implementation of national laws regulating the release and handling of GMOs. So far, 123 countries have drafted their national biosafety frameworks (NBF). The protocol requires signatory countries to regulate GMOs nationally through labeling and traceability, an issue which is important to protect parties as well as non-parties to the protocol. Participants stressed the importance of coordination within the ESCWA region when drafting national GM laws.

20. Policy issues of principal concern that were pointed out include:

- a) Possible risks of GMOs to human health;
- b) Release of GM crops into the environment and the possible adverse effects on biodiversity, knowing that the NENA region is a center of origin for many important crops;
- c) Ethical issues stemming from the local culture;
- d) Capacity-building in biotechnology research and development;
- e) Adoption and implementation of biotechnology frameworks and strategies;
- f) Regulating the import and export of GM products.

21. The issue of regional cooperation in GMO monitoring was also raised. Many saw the need for establishing a reliable and comprehensive regional monitoring system in the NENA region to control the quality of produced and imported GM food and safeguard the environment against possible GMO risks. It was pointed out that this would require new, advanced laboratories and appropriately trained technical staff, both of which are currently absent in most NENA countries.

22. Participants saw that the present lack of capabilities in the NENA countries to detect GMOs increases the need to apply regulations, such as the Code of Ethics for International Trade, that would safeguard them.

23. Finally, participants warned that mega producers of GM foods have been trying to delay countries from signing the Cartagena protocol and developing national biosafety frameworks, with the aim of sustaining the substantial profits they gain from selling GM products in these countries.

C. BIOSAFETY RECENT TRENDS AND FUTURE PROSPECTS

24. Discussions under this section revolved around the different aspects of biosafety and stressed the importance of its application to the NENA region, which is a center of origin for many important crops such as wheat and barley.

25. Emphasis was placed on the importance of controlling gene transmission from GM plants to indigenous ones, through the combined efforts of governments and farmers. Governments in the region must prevent growing open pollinated transgenic plants in areas of centers of origin and biodiversity. They must see to the implementation of a good monitoring and warning system for inspecting areas planted with crops of concern. In this respect it may be helpful to build a databank of GM use in the region. In addition, governments should warn farmers against buying seeds for planting or animal fodder from unreliable sources. Farmers, on the other hand, must adhere to strict biosafety guidelines, including proper containment and confinement procedures.

26. It was indicated that the practice of containment procedures in developed and developing countries has been successful where capacity building in biosafety either preceded or overlapped with the country's involvement in GM crop growing and/or trading. It is therefore of utmost urgency to start raising awareness, building capacity and training local farming communities to identify and respond to GM contamination needs. In this regard, joint efforts from all countries in the region are needed, especially those that have shared borders.

27. Related issues that were discussed under this topic include:

- a) Provisions of the Cartagena Protocol on Biosafety;
- b) The two processes of transgene movement from a GM to a non-GM recipient, which are gene flow and vegetative propagation;
- c) Studying the coexistence between GM and non-GM crops and its potential threat to the existence of wild strains;
- d) The ethical considerations of patenting genes and the possible economic implications on poor farmers;
- e) Efforts exerted by countries in the region to sign the Cartagena Protocol on Biosafety and develop their national biosafety frameworks (NBF) to implement the provisions of the protocol. These NBFs will help parties implement a research agenda that includes national biodiversity assessment, identification of hot biodiversity areas, genetic characterization and mapping of wild relative species and landraces, and identification and definition of species at risk of GM crops introduction.

28. Regional cooperation received special attention. It was proposed to establish a visionary network of research centers, scientists, academia, and stakeholders in the region to help develop specific and focused areas of research leading to the adoption and adaptation of GM technology. Such regional cooperation networks/centers would optimize use of already scarce human and physical resources and maximize research output. Participants also discussed potential areas for cooperation in biosafety in the region, including technical and policy-related issues, and the role that institutions, such as ESCWA, could play in promoting such cooperation.

D. CAPACITY BUILDING IN BIOTECHNOLOGY

29. Deliberations under this topic focused on the importance of educating the public on biotechnology and genetic engineering (BTGE) and the wisdom of democratizing the tools of modern biotechnology to create a wider range of beneficiaries.

30. It was stressed that simple terms must be used in BTGE public awareness campaigns and that continuous lines of communication must be established between the educators and the public. Special attention should be awarded to explaining the mechanisms responsible for the transfer of genetic material from genetically modified (GM) crops into the wild as new cases of crop-to-wild gene flow continue to be discovered. This fact mandates additional research, and possibly different approaches to assess gene flow risks, such as the use of computer simulated models.

31. Participants indicated that democratizing BTGE tools required creating public-private partnerships and extending this partnership to include academia. Care must be taken in this kind of partnership to avoid losing transparency, because partners often have conflicting objectives and agendas. Additionally, researchers would be required to learn how to commercialize the results of their work, which would be easier to realize if research is targeted towards national needs, therefore attracting the local market.

32. In assessing the state of international and regional collaboration in biotechnology research, participants found that a more effective way of building capacity and attracting regional and international collaborators is to develop an area of research excellence in our national institutions. Many developing countries have the potential to develop areas of research excellence, especially if researchers from national universities, governmental and non-governmental institutions agree on common research priorities and bring together a critical mass of experts from different backgrounds, and different faculties and universities, etc. into centers of excellence devoted to specific topics of priority to the region. Electronic platforms, like the one offered through this e-Forum, may help in sharing knowledge and experiences in this regard.

33. Additional means for building BTGE capacity in the region were pointed out, including licensing research materials, establishing postgraduate programmes in BTGE and launching training and follow-up programmes.

34. With respect to research and development priorities in BTGE, arid and saline agriculture were found to be of prime importance for the next few years. Participants suggested that there was no real need for insect resistant crops research in the next 5 to 10 years because most of the countries in the region put biological control methods high on their agenda. In addition, it would be difficult to enforce the refuge strategy to a very large number of small farms spread in the region. Phenotypic traits such as longer shelf life and improved nutritional quality are still in the research stage in most countries (even developed ones); however, they need to be on the NENA region's research agenda soon.

35. Since post harvest losses have tremendous impact on food availability and security, another R and D priority in BTGE is identifying pathogen resistance genes. Fungal and viral disease resistant traits are desired and regional collaboration in this area is needed especially that crops grown throughout the region share the same diseases.

IV. CONCLUSIONS AND RECOMMENDATIONS

36. The following are the conclusions and recommendations resulting from discussions under the four topics of the e-Forum.

A. BIOTECHNOLOGY AND FOOD SECURITY

37. Regarding biotechnology and food security, it was recommended to:

- a) Acquire information on transgenic varieties developed by non-NENA countries and adopt what is suitable.
- b) Develop jointly transgenic varieties that would fit local environmental and socio-economic conditions and cater to the NENA region's specific agricultural problems and needs such as resistance to salt, drought and high temperature, resistance to insects and microbial pathogens.
- c) Award attention to the problems of economically important crops, since the development of transgenic varieties requires a lot of expertise, funds and takes a long time to complete and be ready to place on the market.
- d) Translate foreign biotechnology publications into Arabic.
- e) Put in place adequate and effective control mechanisms before adopting any GM technology or introducing a GM product.
- f) Secure both public and private funds to support specific biotechnology research projects, and explore possibilities of acquiring funds from regional and international biotechnology development organizations and multinational companies that have interest in the NENA region. This can be done by developing concept papers and establishing a dialogue among the different stakeholders including ESCWA, FAO, ICARDA, AOAD, and UNDP.
- g) Establish a dialogue with pan Arab companies involved in the agriculture sector and whose activities have proved to be profitable, with the aim of initiating scientific activities in biotechnology as joint ventures with private sector in the region. Foreign companies may be involved as well.
- h) Implement a set of regulations following a study that examines the benefits of both the technology-producing firms and technology users (farmers) so as to reach a fair balance of interests.

B. POLICY FOCUS AND PRIORITY ISSUES

38. Regarding biotechnology policy focus and priority issues, it was recommended to:

- a) Consider as priority when developing biotechnology policies, issues related to national economy improvement, sustainable development, food security, environmental and public health protection.
- b) Involve the public in the decision-making process regarding biotechnology through well informed representatives.
- c) Benefit from previous experiences in biotechnology policy formulation in different parts of the developing world, such as in Europe and the United States and seek the technical assistance of international organizations such as FAO, ICGEB, UNEP in this endeavor.
- d) Conduct impartial awareness campaigns, in a regular and comprehensive fashion, to clarify and explain basic facts about BTGE products and their importance to the future of agriculture and food security in the NENA countries. The language used should be simple to understand.
- e) Conduct a public survey in the NENA region regarding knowledge of GM food and views on consuming it.
- f) Organize discussion groups on GM crops relevant to the NENA region at different levels i.e. research institutions, agricultural universities and state governments. Discussions/campaigns should be independent of regulatory authorities (if they exist) without withholding the right of these authorities to learn about them.
- g) Set priorities for adopting modern biotechnology in the NENA region. In this regard, participants were asked to give their views on these priorities according from a citizen and a decision maker's perspectives. The following table summarizes the responses received.

Table 1. Priorities for adopting modern biotechnology in the NENA region

Ranking	Citizen	Decision maker
1	Regulations	Research Funding
2	Public Awareness	Regulations
3	Research Funding	Public Awareness
4	Import of Technology	Import of Technology
5	Use	Use

C. BIOSAFETY RECENT TRENDS AND FUTURE PROSPECTS

39. With respect to biosafety trends and future prospects, it was recommended to:

- a) Ensure the protection of biodiversity in the NENA region and maintain its status as a center of origin for certain crops. Governments should play a primary role in this regard.
- b) Develop national biosafety frameworks (NBFs) in accordance with the Cartagena Protocol on Biosafety, with the involvement of various ministries and agencies especially that of environment, agriculture, health, and the national biosafety committee.
- c) Include the following elements in the NBF:
 - A governmental policy on biosafety: this can be part of policies on biotechnology and policies on agricultural production, health care or environmental protection;
 - A regulatory regime for biosafety, which is a combination of enabling legislation, implementing regulations and complementing guidelines;
 - A system to handle notifications or requests for authorizations for activities such as GM release into the environment;
 - Systems for enforcement, monitoring and evaluation of impacts on human health and the environment;
 - Approaches for public information and participation in the development and implementation of the NBF as well as international exchange of information.
- d) Safeguard indigenous plants by restraining farmers from introducing open pollinated transgenic crops in areas that contain wild relatives of these plants. Furthermore, national and regional biodiversity conservation strategies should include in-situ and ex-situ conservation programs. International organizations could also assist governments in this task.
- e) Hold awareness campaigns for community-based organizations about the benefits of indigenous crops and the importance of preserving biodiversity. In that sense, efforts should be exerted towards seeking innovative approaches for marketing natural produce. Local governments can assist in this regard by providing access to official mass media and by setting up markets specialized in selling indigenous produce.
- f) Ensure effective networking and exchange of information and experience among researchers and workers in the field, and undertake collaborative programs between the member countries in biosafety-related issues. This may be achieved for example by holding workshops to explain the Cartagena Protocol to the different stakeholders, establishing a biosafety center in the NENA region with a focal point in every country, cooperating in capacity-building efforts, and exchanging of experts. Existing networks and programmes in the region must be tapped, such as FAO's programme on genetic erosion.

D. CAPACITY BUILDING IN BIOTECHNOLOGY

40. On biotechnology capacity-building issues, it was recommended to:

- a) Establish partnerships between the private sector, government and academia in decisions regarding the adoption of GM technology. Partners must set together a plan of action where the role of every organism is clearly identified, while taking into consideration socio-economic and scientific matters.
- b) Establish a NENA biotechnology forum with the participation of regional and international organizations, donors and national programs interested in developing biotechnology in the region. Membership can be made available to academic and research institutions.
- c) Organize regional workshops in order to define national needs and address constraints in the introduction/implementation of GMO programs.
- d) Establish a national committee to assist in decisions regarding GMOs. There might be a need to hold a meeting through the regional committee of the Codex Alimentarius.
- e) Set up a joint working plan in the region to avoid redundancy in activities. This may be done in coordination with regional and international organizations such as FAO and WHO, in order to benefit from their technical assistance in executing model projects.
- f) Establish an independent, transparent and accountable monitoring and consumer protection agency.
- g) Develop an excellency of research and development in priority and target areas, both at national and regional levels. Existing centers of excellence in the region and strengths available must be utilized as much as possible.
- h) Undertake focused research programmes that are relevant to the region to get a biotechnology product that is useful to the community.
- i) Support existing national laboratories that have good scientific potential and have shown interest in advancing biotechnology, by offering the means and facilities to do so.
- j) Secure essential funds for implementing the above-mentioned recommendations.

V. SUMMARIES OF SUBSTANTIVE INPUTS

41. In the following sections, brief abstracts of the papers submitted by participants in the e-Forum are provided, arranged by topic. Please refer to Annex 3 for information on the authors of these papers.

A. BIOTECHNOLOGY AND FOOD SECURITY

42. **Notes on the Status and Future Prospects of Agricultural Biotechnology:** This ESCWA report gives an overview of the applications of modern biotechnology in agriculture. The report indicates that despite the controversy about GM crops, acreage dedicated to their cultivation has continued to grow and is expected to grow further. Growth is projected on the basis of increased areas allocated to GM crops, principally in the developed countries and to the introduction of new GM varieties. In addition, the number of countries growing GM crops has doubled during the past decade. Four main GM crops are currently planted: soybeans, corn, cotton and canola.

43. **Biotechnology and its applications in agriculture: research activities in selected Arab countries and indicators for national policies:** This ESCWA report provides information on the accomplishments of selected Arab countries in capacity building in Biotechnology and underlines the necessity of advancing research and development in order to reap the advantages this field has to offer.

44. **Dissemination of Selected Technologies for Employment Creation and Poverty Alleviation in Impoverished ESCWA communities: Plant Tissue Culture:** Adopting new technologies is essential to diversify the agricultural portfolio. Tissue culture revolutionized the horticultural industry and became the standard practical solution for the efficient propagation of plants, especially those that are difficult to propagate by conventional methods. The study proposes the establishment of an advanced propagation

facility that includes tissue culture laboratories and greenhouses to produce material that can be readily planted in the field. The tissue culture facility is projected to become a training focal point that aims at developing skilled human resources from within the target communities and will be extended to other institutions in the society. The basis for concept development and the concept approach are elaborated, and a case study applicable for Lebanon is detailed. Plants proposed for the project are the Lebanese orchids that hold a great environmental value since they are rare and threatened. It is hoped that the project will raise the profile of the target community not only as one producing commercially viable products but also as one that interfaces with nature reserves and environmental awareness highlighting its efforts to propagate and re-introduce these rare plants in the wild.

45. Utilization of Biotechnology in Crop Improvement in the Arab Countries; Priorities and Challenges: Arab countries need to adopt biotechnology in order to improve on the existing agricultural systems and to achieve food security. For a more successful adoption there should be better understanding of the sustainable development and implementation of biotechnology, capacity building (for better utilization of this technology), development of appropriate policies governing this technology, integrated Arab biotechnology projects to save resources, obtaining regional and international consultation, adopting less-costly techniques (tissue culture, DH, etc.), consideration of the sustainable use of local natural resources (land, water, plant genetic resources), and focusing applications on the most challenging problems in the region (drought, salinity, heat, frost diseases, etc.).

46. Application of Plant Biotechnology to Address Water and Salt Stress in Developing Countries: This study proposes genetic engineering as a venue to solve agriculture problems caused by salinity and drought stresses in Tunisia. Drought and salinity are major constraints for crop production and food security, and pose adverse socio-economic impacts in developing countries. A major constraint to improved tolerance is a lack of understanding of its complex genetic basis and the difficulty in combining favorable alleles into an optimal genotype. Genetic engineering has the potential to create new plant varieties that not only deliver higher yields but also provide solutions to biotic and abiotic challenges. Genetically engineered drought- and salt-tolerant plants could provide an avenue to the reclamation of farmlands in Tunisia lost to agriculture because of salinity and a lack of rainfall. The production of local GMOs would further benefit agriculture in Tunisia by developing transgenic crops that the public would perceive as benefiting citizens.

B. BIOSAFETY RECENT TRENDS AND FUTURE PROSPECTS

47. The Biosafety Regulatory System in Syria; Current status, Perspective and Challenges: Genetically modified Organisms (GMOs) can play a significant role in solving some persistent health and agriculture problems in the Arab countries, including Syria. However, being a center of origin and biodiversity for many plant species, Syria has to proceed cautiously with the introduction of genetically modified plants (GMPs) into the environment. For that reason, and other potential risks of GMPs, Syria has been working for several years to establish a Biosafety Regulatory System in order to avoid such potential risks. The Syrian National Biosafety Committee (SNBC) was established by the Atomic Energy Commission of Syria in 1999. The committee is represented by members from various academic and research institutes. The Syrian biosafety guidelines have been established and approved in the year 2001. They contain guidelines for laboratories, glasshouse containment, small-scale field testing, and release into the environment. The ministry of agriculture is responsible of issuing certificates for the importation and release of GMO into the environment. The SNBC is responsible for studying biosafety issues regarding the release. Institutional Biosafety Committees have been established in many institutes including ICARDA, AECS, College of Medicine, GCSAR, and Ministry of Health. The ministry of environment is responsible for implementing the Cartagena Protocol on Biosafety which Syria ratified in April 2004. Syria is also a member of the ICGEB biosafety group. Syria is currently working on building biosafety frameworks in cooperation with UNEP – GEF. The program will focus on building government policy on biosafety, a regulatory regime for biosafety, a system to handle notifications or requests for authorizations, a system for monitoring environmental effects, and approaches for public information and public participation.

48. The Need for Effective Biosafety Regulations in the Arab Region: In order to face production problems in the Arab region, new cropping and livestock systems need to be introduced. Biotechnology holds a potential for delivering sustainable food production. However, the lack of Biosafety capacity remains a major constraint to the transfer of this technology. This article presents safety concerns in the Arab region such as human health issues that include increased allergenicity and toxicity and environmental risks that include non-target adverse effects and gene flow to wild relatives. The article also presents the challenges that face implementing the appropriate biosafety measures. Those challenges include developing and implementing new models for biosafety regulations that promote science-based decision-making, policy development, regional cooperation, funding new research that can help improve the science based biosafety regulations, providing guidance to partner country institutes on incorporating biosafety concerns into product development strategies, and setting up regional mechanisms for biosafety risk analysis of biotechnology and its products.

49. Biosafety in the Islamic Republic of Iran: This report portrays the history of biosafety in the Islamic Republic of Iran. Iran joined the Convention on Biological Diversity in 1996 and signed the Cartagena Protocol on Biosafety in 2001 and ratified it in 2003. The national biosafety committee (NBC) was formed in 2000, as part of the ministry of science, research and technology and it was decided that the secretariat of the NBC be located in the National Research Centre for Genetic Engineering and Biotechnology. Activities of the NBC include translating articles of the Cartagena Protocol to Farsi, preparation of a draft of national biosafety law, creating a biosafety clearing house and publishing a seasonal biosafety bulletin.

50. Effect of Biotechnology on Biodiversity: Herbicide-Tolerant and Insect-Resistant GM Crops: This article discusses the threats facing biodiversity as a result of agricultural practices in general and traditional agriculture in particular. It suggests that knowledge based agriculture, including GM crops, can reduce this threat. The introduction of no-tillage practices, which are beneficial to soil fertility, has been encouraged by the rapid spread of herbicide-tolerant soybeans in the USA. The replacement of pesticides through Bt crops is advantageous for the non-target insect fauna in test-fields. The results of the British Farm Scale experiment are discussed. The article concludes that biodiversity differences can mainly be referred to as differences in herbicide application management.

C. CAPACITY BUILDING IN BIOTECHNOLOGY

51. Biotechnology Policies, Capacity Building, and Development Strategies in Lebanon: The impact of biotechnology on world economy is becoming apparent and developing countries are realizing the need to build national competence in this field. Developing countries need to adopt this technology and become contributors to this field if they wish to avoid serving as markets for biotech products developed in industrialized countries. This entails that developing countries establish a research-based infrastructure, develop biotech-related policies, build national capacity and develop strategies to enable it to embrace biotechnology in the 21st century. This report describes plans that developing countries could undertake to design national biotech-related policies, and build national capacity in human and technical resources in addition to establishing a legal framework. The report addresses specifically the case of Lebanon and suggests a development strategy with case studies, one based on an ongoing local experience, while the other discusses the successes and downfalls of the genetically modified Indian cotton. In brief, the report realizes that Lebanon is a country with unique characteristics in the Middle East that possess the capacity to develop biotechnology-based industry with long term planning and commitment from the government and the private sector.

52. Application of New Biotechnologies in the Production of Ornamental Plants: A practical example: The paper discusses the production of ornamental plants using new biotechnologies. The paper opened with the evolution of the floriculture market and precursors for market competitiveness, then proceeded to discuss the Floramiata SPA, the largest floricultural company in Italy. The Floramiata's research Centre was founded historically as a structure dedicated to the production of in vitro plants and to the analysis of soil and phytosanitary state. Moreover, in the last few years, the Centre has become a real Biotechnological pole, equipped with the most modern instrumentation in order to work in the fields of molecular biology,

biochemistry, tissue and cell cultivation and genetic engineering. The research centre is divided in two main divisions: Plant Tissue Culture and Research and Development.

53. Biotechnology and Biosafety at the Atomic Energy Commission of Syria: The paper offers a briefing on the mission and objectives of the Atomic Energy Commission of Syria (AECS). Current activities of the commission govern agricultural, environmental and medical biotechnology. In 1999 AECS established the Syrian National Biosafety Committee (SNBC), which is in charge of all Biosafety issues in Syria such as establishing biosafety regulations for genetic engineering research, collecting and disseminating updated biosafety information to the designated agencies, providing consultation to designated agencies regarding biosafety issues, and assessing the risk of releasing genetically modified organisms or their products into the environment and advising on whether they should or should not be released.

54. Activities of the Lebanese Agricultural Research Center (LARI) - Department of Plant Biotechnology- Tel Amara: This briefing about the department of plant biotechnology at LARI states its mission, achievements, publications and perspectives. It further describes the four ongoing projects of the department which are characterization of the diversity of figs cultivated in Lebanon, sanitation of *Prunus* infected by viruses, development of the culture of caper in Lebanon as a promising crop for the semi-arid regions and micropropagation of different fruit species. These projects fall under the two main objectives of the department, which are to produce certified plant material and characterize the Lebanese patrimony of fruit species.

55. Biotechnology Development in the Islamic Republic of Iran: The paper presents the progressive growth of biotechnology in Iran and gives a briefing about the centers that conduct traditional biotechnology such as Razi Vaccine and Serum Research Institute and the Pasteur Institute of Iran and those that deal with modern biotechnology such as the National Institute for Genetic Engineering and Biotechnology (NIGEB) and the Agricultural Biotechnology Research Institute in Iran (ABRII). Iran is exerting a lot of effort in order to meet the goals of the "National Biotechnology Strategy" that was ratified in 2004. The goals include education, research, production, private sector participation and the application of biotechnology in various fields. Laws for bio-security, bioethics, intellectual ownership and national biotechnology related research and product and facility standards are also being prepared.

56. Capacity Building in Biotechnology: Regional and International Cooperation and Networking Arrangements: The paper introduces the research program of the Center of Biotechnology in Sfax, which aims at studying and developing microbial and plant biopesticides, biofungicides and antibiotics that are useful in biological agriculture. The paper calls for the development of a network of laboratories in the NENA region, which could form the basis for collaborative research projects.

57. Capacity building activities in GMO Biosafety at the International Center for Genetic Engineering and Biotechnology (ICGEB): This paper summarizes the capacity building activities initiated by the International Center for Genetic Engineering and Biotechnology (ICGEB) in Italy, which has a long-standing engagement in capacity building. These activities include a Biosafety Unit and a Biosafety Outstation. Both the Unit and the Outstation work closely in the following sectors: information dissemination; the establishment of a biosafety clearing-house; scientific training in risk assessment for the environmental release of GMOs; and international cooperation with other international agencies involved in biosafety.

58. Biotechnology Applications in Oman: The paper offers an overview of the current status of biotechnology in Oman. Biotechnology was first introduced to Oman through establishing a tissue culture lab in 1992. Subsequent years witnessed an increase in the number of educational and advanced research labs. The problems and constraints facing biotechnology applications in agriculture such as high cost, lack of experts, and maintenance of equipment were presented. A set of recommendations was put forward in order to strengthen biotechnology research in Oman and the rest of the Arab world. These include bringing foreign experts to lecture and extending expertise to locals, proper training of local scientists, establishing a biotechnology fund, encouraging the exchange of scientists and expertise, holding periodical meetings and setting a prize for distinguished work in the field of biotechnology.

59. **Biotechnology in the Islamic Republic of Iran:** This presentation gives an overview of the different facets of biotechnology in the Islamic Republic of Iran. It included a list of the main Iranian institutes and NGOs involved in Biotechnology such as Pasteur Institute of Iran, Razi Institute for Vaccine development, Sharif University, Tarbiat Modarres University, Iranian Society for Biotechnology, Iranian Genetic Society and others. The presentation also included a detailed description of some of the listed institutes, their activities and products. Biotechnology products produced in Iran include herbal medicinal, medical therapeutic sera, biological (such as Rabbit Serum and Plasma), recombinant (such as Hepatitis B vaccine) products.

D. POLICY FOCUS AND PRIORITY ISSUES

60. **Bio-economy....a new force for development in the Islamic countries:** This paper indicates the significance of biotechnology to economic development and outlines its applications and achievements. Islamic countries, especially the Arabian Gulf countries, are taking important steps towards producing a new generation of biotechnologists and entrepreneurs. Those will help promote commercial biotechnology development in the Middle Eastern region. Jeddah biocity in the Kingdom of Saudi Arabia, Qatar Foundation's Science & Technology Park in Qatar and, Dubiotech in the United Arab Emirates are good examples of such steps. The paper further compares bio-economy in Europe versus the Islamic world.

61. **Biotechnology and Biosafety; Priorities Setting in Yemen:** Food security in Yemen could be addressed through Biotechnology. As described in this paper, Yemen currently lacks even the simplest biotechnologies, such as tissue culture, and policies that govern them. Constraints hindering the introduction of biotechnology include lack of professional technicians, equipment, awareness of its importance and financial support. Yemen needs support in building capacities in traditional and modern biotechnology and in biosafety. There is also a need for establishing a national center for biotechnology, formulating national guidelines on biosafety, collecting genetic resources and characterizing them, establishing a biosafety regulatory system, and rehabilitation research and development institutes.

62. **Plant Genetic Engineering: Perspectives for the Arab World:** Plant genetic engineering offers developing countries the needed technology to produce crops with higher yields, insect and pathogen-resistant plants and foods that are more nutritious. According to this abstract the Arab world will only benefit from this technology if sound policies are adopted and modern laboratories are established.

63. **The Secretariat for the National biotechnology Committee:** This document contains information about the "National Strategic Plan of Biotechnology- Islamic Republic of Iran" project and the "National Document of Biotechnology" which was compiled and prepared within the framework of the project. The "National Strategic Plan of Biotechnology- Islamic Republic of Iran" project was compiled over two years of continuous work and following the suggestion and supervision of the National Committee of Biotechnology. The project resulted in "The National Document of Biotechnology" which was made possible by the relentless activities of almost 200 experts.

64. **Biotechnology Policies, Capability Building and Development Strategies in Kuwait, Saudi Arabia, Egypt and Morocco:** Advances in biotechnology research and applications in agriculture, medicine, environment and industry are bypassing Arab countries at varied levels. This is largely due to the lack or inappropriate infrastructure, skilled work force, and commitment by governments. This report documents how some Arab countries like Kuwait, Egypt, Saudi Arabia and Morocco are on their way to catch-up with the developed nations in certain fields of biotechnology. Whether the economies of Arab countries are based on agricultural production (Egypt and Morocco) or oil mining (Kuwait and Saudi Arabia), biotechnology has immense potential for increased agricultural production and preservation of the environment. Gains from achieving goals summarized in this report will come from increased production efficiency for growers as well as protection and preservation of the environment and improved health status. Change in economic parameters such as markets, taxation schedules, environmental regulation of pollution, and input prices will

certainly affect the acceptability of these biotechnology products by the farming community in general, and by consumers in particular.

65. Consumer Decision-Making and Public Awareness of GMOs and their Products: The paper raises the issue of helping consumers make sound decisions regarding BTGE products through conducting appropriate awareness campaigns. Diverse means are suggested for raising awareness to suit each part of the society. Examples are given on awareness campaigns in developed countries.

E. TECHNICAL PAPERS

66. Genome Scrambling - Myth or Reality?: The report discusses induced mutations in transgenic crop plants, bringing together what is known about the mutagenic effects of the plant transformation process and its potential consequences for transgenic cultivars. The report shows that the current plant transformation methods are neither precise nor predictable and that the genomes of transformed plants typically contain many unintended mutations.

67. Analysis of the Unexpected Phenotypic Consequences Associated with Plant Transformation: The paper analyzes the unexpected phenotypic consequences associated with plant transformations. It demonstrates that the transformation of plants induces unintended genome-wide mutations. The paper includes a table that lists examples of transformations done in different crops, comparing intended effect with resulting change observed, and which is usually different.

68. Genetic Diversity Among Populations of Red Palm Weevil, *Rhynchophorus ferrugineus* Olivier (Coleoptera: Curculionidae), Determined by Random Amplified Polymorphic DNA-polymerase Chain Reaction (RAPD-PCR): This study reports the genetic variation between populations of the red palm weevil, *Rhynchophorus ferrugineus*, one of the most destructive pests of date palms in the UAE area. To test if the red palm weevil population in the UAE belongs to the same genetic group, the randomly amplified polymorphic DNA (RAPD) technique was used to assay seven populations of the insect from different locations. RAPD primer pairs detected a total 216 RAPD fragments in these populations and 111 of these showed polymorphism (51.4%).

69. Estimation of Genetic Variation and Relationships of Local Grape (*Vitis vinifera*) Varieties in the Palestinian Territories Through DNA-Molecular Markers for the Purpose of Assessing the Interaction 'Genotypes and Post-Harvest Keeping Quality': This study aimed at determining the susceptibility of different grape genotypes in the Palestinian territories to *Botrytis cinerea* which is a decay causing organism. The paper describes a DNA extraction experiment which uses amplified fragment length polymorphism (AFLP) analysis. The experiment was completed with the collaboration with Hohenheim University in Germany. Results of the experiment aren't included due to the lack of infrastructure to analyze them.

70. Identification of Plant Species Using Molecular Markers: The paper explains how taxonomic classification could be modernized through the use of molecular markers. Markers that could be employed for this purpose include: protein analysis, restriction fragment length polymorphism (RELP), Randomly amplified polymorphic DNA (RAPD) analysis, amplified fragment length polymorphism (AFLP), simple sequence repeat-PCR (SSR-PCR), detection of single nucleotide polymorphisms (SNPS) using sequencing and DNA-barcoding.

71. Cloning and Characterization of a Wheat Vacuolar Cation/Proton Antiporter and Pyrophosphatase Proton Pump: This study explains how the cloning and characterization of genes encoding for tonoplast transport proteins from crop plants would contribute to our understanding on how to enhance crop plant response to salinity stress. Salinity is a major constraint to crop productivity; reducing yield on saline soils and limiting expansion of agriculture onto previously uncultivated land. Two wheat genes that confer salt tolerance in yeast were identified. Employing these two genes to engineer salt tolerant plants can be a strategy to confer salinity tolerance to plants.

72. Plant Volatiles; Investing into an Organism's Own Defense Arsenal: This article discusses the identification, purification and cloning of a novel thiol methyltransferase (TMT) enzyme that accelerates the plant's defense process. Upon invasion by a foreign organism, a plant normally hydrolyzes glucosinolates into a variety of toxic compounds that eliminate the invading organism. The identified enzyme can transform these toxic compounds into volatiles that can travel faster in the plant, thereby accelerating the defense process. TMT can be used in biofumigation, which would provide an environmentally sound alternative to methyl bromide.

VI. PROPOSALS FOR BIOTECHNOLOGY RELATED PROJECTS IN THE NENA REGION

73. Based on discussions and substantive papers summarized above, a number of project proposals were put forward by participants¹ in the e-Forum to promote biotechnology in the NENA region. It is hoped that future collaboration will allow the implementation of these proposals.

74. The following is a list of these proposals and a brief summary of their objectives.

75. Establishment of Internet-Based "Islamic intelligence System for Bio-economy Development": The project aims to establish an Internet-based Islamic intelligence system for bio-economy development (IISBD). The aim of the IISBD is to provide an institutional set up for the promotion of biotechnology business activities for economic development in Islamic countries and to assist biotechnology industrial key players such as academic and bio-business communities, and to function as the Islamic Bioeconomy Brain Trust. The objectives of the IISBD are summarized as follows: 1) Serve as a consultative organization of the Muslim community and institutions of Members states of the Organization of the Islamic Conference (OIC), on matters related to biotechnology business; 2) Support the development of biotechnology industry in Islamic countries; 3) Increase industrial biotechnology awareness among Muslim investors; 4) Act as a forum for interactions and exchanging views among Muslim biotechnologists.

76. Establishment of a Center for Biotechnological Application: The project aims to establish a center for the diagnosis of pathogens and diseases in plants, animals and humans. This center would serve the agricultural, environmental, and medical sectors in the country. Palestine lacks the appropriate infrastructure to conduct this kind of diagnosis, and thus the urgent need for this center. The proposal contains a detailed description of the laboratories that the center needs to host. These include virology, bacteriology, mycology, entomology and nematology laboratories.

77. Establishment of a Regulatory Structure for the Development and Commercialization of New Plant Products Derived Through Biotechnology: Proposal to the United Arab Emirates: The project aims to establish a regulatory structure for the development and commercialization of new plant products derived through biotechnology in the United Arab Emirates. Having such a structure in place would attract international companies to invest in establishing local businesses. The regulatory structure needs to be scientifically sound, accepted by internal government councils, fits within existing laws, accepted by relevant international organizations and regulatory agencies and requires the presence of the right infrastructure for the uniform application of regulations. The proposal involves the following five phases: 1) Review existing laws, regulations and guidelines in the context of environmental safety, human safety and genetic engineering; 2) Evaluate existing infrastructure to understand where and how regulations can be implemented, managed, monitored and enforced; 3) Develop and write regulations and obtain internal approvals; 4) Let selected countries and international organizations review and comment on the regulations; 5) Finalize, publish and implement regulations.

¹ In alphabetical order: Raed Alkowni (Arab American University, Palestine); Jihad Attieh (University of Balamand, Lebanon); Wagdi Sawahel (National Research Center, Egypt); Khaled Sawalha (Al-Quds University, Palestine); Rabih Talhouk (American University of Beirut, Lebanon); Abdelouahab Zaid (UAE University, UAE).

78. **Biotechnology of Medicinal Plants:** The project aims to reactivate the biotechnology lab at the Al-Quds University in the Palestinian territories, an important lab, which could potentially serve various faculties such as Medicine, Pharmacy and dentistry as well as biochemical and medical centers. The lab will further help in building local capacities. Limited funds are currently hindering the realization of this project.

79. **Developing Arab Biosafety Strategy for Genetically Engineered Food:** To better equip Arab countries for dealing with genetically engineered (GE) food, the project proposes a strategy for effective implementation of biosafety regulations. This strategy includes developing the appropriate policies and regulations, seeking funds, gathering all information available on biotechnology and its different techniques, and establishing an Arab center for genetic engineering and biotechnology which is essential if the region is to meet the technology challenges of the century. The project also suggests a preventive strategy for biosafety which includes collecting information on the genetic make up of GE foods, setting standards for the analysis of the safety of these foods and revealing the possible benefits and risks of these foods.

80. **A Proposal for establishing a Biotechnology information Arab network on the internet:** The project aims to establish a biotechnology information Arab network on the internet. This network is important to introduce the Arab public to techniques, applications, achievements and risks of genetic engineering. In addition it will introduce them to the political, economical, legal, religious, health and environmental implications of genetic engineering. The network will provide research, educational and consultancy services and will contain a periodical newsletter, library, events agenda and a listing of Arab biotechnology research institutes.

81. **Determine the use and potential need of genetically engineered agricultural products in the NENA region:** This project proposes establishing centers to test imported goods for possible genetically engineered ingredients. Other aims of the project include assessing the state of use of genetically modified agricultural products in the region that are available on the market such as food, fodder, paramedical and ornaments and the extent to which farmers and vendors in the region need genetically modified products in order to improve their livelihoods.

82. **Investigate the potential of non-genetic engineering biotechnologies and their applications in the NENA region I: Organic farming:** The NENA region needs research and educational programs that would encourage the adoption of non-genetic engineering biotechnologies such as organic farming. This project is tailored for farmers interested in converting to organic production, and new organic farmers who need information on organic production. The project will help optimize the profitability of organic production in Arab countries for both domestic and foreign markets and to promote the utilization of organic farming systems as a means of enhancing the sustainability of Arab agricultural systems.

83. **Investigate the potential of non-genetic engineering biotechnologies and their applications in the NENA region II: Cultivation of Medicinal Plants and Production of Nutraceuticals:** This project targets farmers interested in converting to medicinal plant and nutraceuticals production. If implemented it will help optimize the profitability of this type of agricultural production in Arab countries, for both domestic and foreign markets, and promote the utilization of medicinal farming systems as a means of enhancing the sustainability of Arab agricultural systems. This technology holds promising avenues in the creation of sustainable businesses and improving the quality of life for a large population whose main income originates through agricultural products.

84. **Development of educational tools to increase awareness on the concept of genetic engineering and its applications in the NENA region:** Educating the population on the potential benefits and risks of genetic engineering, is of vital importance, if such practices are to be considered in the NENA region. This project proposes developing educational tools by local experts, such as seminars, computer programs, booklets, brochures, documentaries and launch education campaigns targeting all levels of the civil society, including schools, institutions of higher education, and public forums.

85. Training of stakeholders to manage and protect areas considered to be “bio-diversity” rich areas and “centers of origin” from potential harms of GMOs: This proposal suggests means for creating awareness among stakeholders of centers of origin and points to the urgency of preserving biodiversity in the wake of GMO trading and the importance of establishing skilled teams capable of training personnel involved in the different aspects of managing and preserving biodiversity rich regions/reserves. The above-mentioned objectives could be met by holding workshops and campaigns designed specifically for the purpose.

86. Establish a regional network of experts for risk assessment and risk management that will oversee the coordinated training of stakeholders in biosafety related issues: The major objective of this proposal is to create a network of biosafety experts that would enhance and harmonize the capacity of NENA countries in risk assessment and risk management procedures and biosafety practices overall, in order to reduce the risk of unwarranted trafficking of GMOs between countries in the region. All this needs to be done within the Cartagena Protocol framework.

87. Dissemination of selected biotechnologies (i.e. ornamental or medicinal plant tissue culture) for employment creation, community development and poverty alleviation: This document proposes a strategy for the sustainable introduction of plant tissue culture technology and its integration into the socio-economic fabric of poor communities of the NENA region. The study further proposes a pilot project aimed at using plant tissue culture for the production of selected ornamental and/or medicinal plants. This could formulate a basis for community development and employment creation, hence poverty reduction.

88. Raise awareness and coordinate efforts among stakeholders towards the establishment of conducive legal frameworks that will facilitate biotech business ventures in NENA region: The ESCWA countries are in need for region-wide efforts to modernize and update their legal regulatory framework to be in line with modern technologies in general and biotechnology in particular. This project proposes a mechanism for accomplishing these goals through a close coordination with legal bodies, policy and decision makers, government organizations (Ministries of industry, and Justice) and specialized partners such as lawyer syndicates and others. At the outcome of the project, a document with model directives for developing a set of recommended laws and regulatory frameworks related to the biotechnology industry will become available for member countries to adopt, and ESCWA can play a role in providing, on need-basis, advisory services to a country to adopt the proposed model directives.

Annex I

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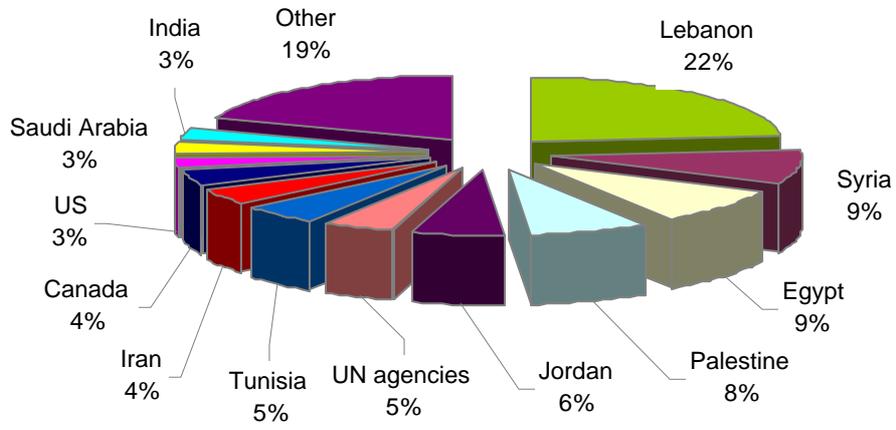
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¹ The Arab Group for the Protection of Nature does not agree with the general tone of the set recommendations in the report. APN provided the e conference with its position on GMOs through the recommendations of its GMO seminar that took place in Jordan.

Annex II

Distribution of participants in the e-Forum by country



Annex III

Papers presented to the e-Forum

Author	Paper title
فريق التكنولوجيا للتنمية المستدامة إدارة التنمية المستدامة والإنتاجية، الإسكوا	التكنولوجيا الحيوية وتطبيقاتها الزراعية: أنشطة البحث في دول عربية منتقاة ومؤشرات للسياسات الوطنية
Salma Talhouk American University of Beirut	Dissemination of Selected Technologies for Employment Creation and Poverty Alleviation in Impoverished ESCWA communities: Plant Tissue Culture
Khaled Masmoudi Plant Molecular Genetics Unit Centre of Biotechnology, Sfax	Application of plant biotechnology to address water and salt stress in developing countries
Team on Technology for Sustainable Development, Sustainable Development and Productivity Division, ESCWA	Notes on the Status and Future Prospects of Agricultural Biotechnology
M.Y. Sabbouh and Ayman Shehada AL-Ouda The Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD)	Economic & Social Impacts of Biotechnology & Genetic Engineering Products in the Arab World. Utilization of Biotechnology in Crop Improvement: "ACSAD perspectives for the Arab world"
M.Y. Sabbouh and Ayman Shehada AL-Ouda The Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD)	Utilization of Biotechnology in Crop Improvement in the Arab Countries "Priorities and Challenges"
Nader Al-Awadhi Kuwait Institute for Scientific Research	Biotechnology Policies, Capability Building and Development Strategies in Kuwait, Saudi Arabia, Egypt And Morocco
Arif Saeed Aqlan Alhammadi Department of biology, Faculty of Science, University of Sana'a, Republic of Yemen	Biotechnology and Biosafety: Priorities Setting in Yemen
National Institute for Genetic Engineering and Biotechnology, Iran	The Secretariat for the National Biotechnology Committee
Antonious Al-Daoude Department of Biotechnology and Molecular Biology, Atomic Energy Commission of Syria	Plant Genetic Engineering: Perspectives for the Arab World
Dana Jawdat Plant Physiology Division, Molecular Biology and Biotechnology Department, Atomic Energy Commission of Syria	Consumer Decision-Making and Public Awareness of GMOs and their Products
Wagdy A. Sawahel Microbial Genetics Department Genetic Engineering & Biotechnology Division National Research Center, Egypt	Bio-economy....A new force for development in the Islamic countries
Klaus Ammann Botanical Garden University of Bern	Effects of biotechnology on biodiversity: herbicide-tolerant and insect-resistant GM crops
National Institute for Genetic Engineering and Biotechnology, Iran	Biosafety in the Islamic Republic of Iran
Bassam Al-Safadi Department of Molecular Biology and Biotechnology, The Syrian National Biosafety Committee, Atomic Energy Commission of Syria	The Need for Effective Biosafety Regulations in the Arab Region
Bassam Al-Safadi Department of Molecular Biology and Biotechnology, The Syrian National Biosafety Committee, Atomic Energy Commission of Syria	The Biosafety Regulatory System in Syria: Current status, Perspective and Challenges
ابتهاج بنت جمعة الرئيسي وزارة الزراعة والثروة السمكية، سلطنة عُمان	استخدامات التكنولوجيا الحيوية في سلطنة عُمان

Rabih Talhouk Biology Department American University of Beirut	Biotechnology Policies, Capacity Building, and Development Strategies in Lebanon
Lamis Chalak Lebanese Agricultural Research Center	Activities of the Lebanese Agricultural Research Center (LARI)
Decio M. Ripandelli International Centre for Genetic Engineering and Biotechnology	Capacity building Activities in GMO biosafety at the International Center for Genetic Engineering and Biotechnology (ICGEB)
Mohammad Hossein Sanati National Institute for Genetic Engineering and Biotechnology, Iran	Biotechnology Development in the Islamic Republic of Iran
National Institute for Genetic Engineering and Biotechnology, Iran	Presentation on Biotechnology in Iran
Samir Jaoua Centre of Biotechnology of Sfax	Activities of the Centre of Biotechnology of Sfax
Atomic Energy Commission of Syria	Biotechnology and Biosafety at the Atomic Energy Commission of Syria
Maroun Atallah Department of Agrobiolgy and Agrochemistry, University of Tuscia, Italy	Application of New Biotechnologies in the Production of Ornamental Plants: A practical example
Jihad Attieh Department of Biology, University of Balamand	Plant Volatiles: Investing into an Organism's Own Defense Arsenal
Allison Wilson, Jonathan Latham and Ricarda Steinbrecher EcoNexus	Genome Scrambling - Myth or Reality?
Jonathan Latham, Allison Wilson and Ricarda Steinbrecher EcoNexus	Analysis of the unexpected phenotypic consequences associated with plant transformation
Faiçal Brini and Khaled Masmoudi (Plant Molecular Genetics Unit, Center of Biotechnology of Sfax), Roberto Gaxiola and Gerald Berkowitz (Department of Plant Science, Agricultural Biotechnology Laboratory, University of Connecticut)	Cloning and characterization of a wheat vacuolar cation/proton antiporter and pyrophosphatase proton pump
Jamil Harb Department of Biology and Biochemistry, Birzeit University	Estimation of genetic variation and relationships of local grape (<i>Vitis vinifera</i>) varieties in the Palestinian territories through DNA-molecular markers for the purpose of assessing the interaction 'Genotypes and postharvest keeping quality'
Nadia Haider Atomic Energy Commission of Syria (AECS) Damascus, Syria	Identification of Plant Species Using Molecular Markers
G.G. Gadelhak Department of Economic Entomology Faculty of Agriculture, Alexandria University M.R. Enan Agricultural Genetic Engineering Research Institute, Agricultural Research Center, Egypt	Genetic Diversity Among Populations of Red Palm Weevil, <i>Rhynchophorus ferrugineus</i> Olivier (Coleoptera: Curculionidae), Determined by Random Amplified Polymorphic DNA-Polymerase Chain Reaction (RAPD-PCR)
Abdul-Jalil hamdan, Ziad Fadda and Rezq Basheer-Salimia Faculty of Agriculture, Hebron University, Hebron Ministry of Agriculture, Ramallah, Palestine	Adopting biotechnology in Palestine

Annex IV

Evaluation results

An assessment form was sent by e-mail to participants after the closing date of the e-Forum, in order to assess its success in both organizational and substantive terms. The results of the questionnaire (43 completed forms) concerning the Forum's objectives, organization and the quality of outcomes and discussions, are presented in the figures below.

Figure 2. Results of the e-Forum Assessment

