

**FACULTY OF AGRICULTURAL
AND FOOD SCIENCES**



**ANNUAL REPORT OF SPONSORED RESEARCH
PROJECTS AND SERVICE CONTRACTS**

October 1, 2002 – September 30, 2003

PREPARED BY

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Chairman of Research Committee

EXECUTIVE SUMMARY

Research funds and income from service contracts amounted to 3,253,123 US\$. Research funds from the Lebanese National Council for Scientific Research (LNCSR), University Research Board (URB)/Initiative for Biodiversity Studies in Arid Regions (IBSAR) at AUB, Service Contracts and International Agencies accounted for 1, 4, 18 and 77 %, respectively.

During the academic year 2002-2003, the Faculty of Agricultural and Food Sciences hosted 10 international-, 7 LNCSR-, and 17 URB/IBSAR-funded projects and 6 service contracts. Research areas funded by International Agencies included biotechnology, biodiversity, animal nutrition, crop production, natural resources, plant pathology, sustainable agriculture, and integrated pest management. Research domains funded by the LNCSR and URB/IBSAR were more varied and included agricultural engineering, crop production, medicinal plants, animal and plant diseases, genetically modified organisms, fertigation, human nutrition and obesity, community nutrition, animal and poultry nutrition, landscape design, sensory evaluation and cereal science. Service contracts involved crop production, dairy stock improvement, agricultural extension, rural development and vegetable seed trials.

The number of research projects was 34. Of these, 12 were in the Department of Plant Science, 8 in the Department of Animal Science, 8 in the Department of Land and Water Resources, 5 in the Department of Nutrition and Food Science and 1 in the Agricultural Research and Education Center.

The number of service contracts was 6. Of these, 2 were coordinated by the Department of Land and Water Resources, 2 by the Department of Animal Science and 2 by the Agricultural Research and Education Center.

Introduction

The Faculty of Agricultural and Food Sciences at the American University of Beirut is at the forefront of internationally-recognized basic and applied research geared towards serving the needs of Lebanon and the region and is actively involved in providing extension/training services to the community.

In addition to addressing a broad spectrum of research needs in the agricultural, food, landscape and nutritional sciences, the Faculty is particularly active in community service and development. Since 1997, the Faculty has assumed the leading role in the Dairy Stock Improvement Project, aimed at upgrading the productivity of Lebanese dairy farms, through supervising import of genetically-improved heifers from the US and providing training to recipient farmers on management practices. The Yammouneh Economic and Agricultural Sustainability and Yammouneh Technology Transfer and Extension projects identified a potentially viable cropping pattern for the Yammouneh region and provided training to farmers to upgrade agricultural productivity and profitability to alleviate the negative economic consequences precipitated by the eradication of illicit crops. In addition, the Faculty hosted three major projects funded by Mercy Corps International. The Project Bioprospection: An Alternative for Sustainable Agricultural Development in Lebanon aims at identifying medicinal plants that are indigenous to Lebanon and investigating their biological activities. The two other projects: Growing Sustainability, an Integrated Village Development Project, El Qaraaoun Pilot Village, and Sustainable Forage Development aim at improving the sustainability of rural livelihoods and enhancing the capabilities of dairy farmers, who received cows through the US Dairy Stock Improvement Program, to produce forage crops.

The Faculty has been participating in collaborative efforts to establish standardized virus detection methods for the Middle East. The project, Development of a Regional Viral Indexing and Certification Program for Plant Propagation Materials in The Middle East, aims at developing detection methods for major viruses infecting selected crops and establishing a plant pathogen detection laboratory in Lebanon through collaborative research among countries in the Middle East under the leadership of the University of Wisconsin, Madison, in the US.

The Faculty operates an Environmental and Sustainable Development Unit that aims to promote collaboration on sustainable development initiatives among departments at AUB and other institutions and organizations undertaking related activities. The Unit draws on the vast experience of the Faculty in natural resource management and environmental issues of relevance to the region. The Unit focuses on research and development activities linked to community development and operates in close cooperation with the Interfaculty Graduate Environmental Science program.

RESEARCH FACILITIES

Research facilities available in the Faculty of Agricultural and Food Sciences include the following:

Department of Animal Sciences

- Animal Rooms
- Feed Analysis Laboratory
- In Vitro Digestibility Apparatus
- Culturing and Enumeration of Microorganisms
- Tissue Culture Compartment
- Serology and Molecular Biology Research
- Histology and Immunofluorescence
- Conventional and Environmentally Controlled Poultry Houses
- Small Ruminant Digestibility Units

Department of Land and Water Resources

- GIS Facilities
- Atomic Absorption Spectrophotometer (Micro and Macro Nutrient Analysis)
- Flame Photometer (Cations Measurement)
- Digestion Block and Microwave Digestion System
- Measurement of Soil Physical Properties
- Water Quality Measurement (Salinity, pH, Cations, Anions)
- Wind Tunnel for Pesticide Drift Measurement
- Computer Facilities to Perform Required Analyses

Department of Nutrition and Food Science

- Caloric Value Determination of Foods
- Dietary Fiber Determination Unit
- High Pressure Liquid Chromatography Apparatus
- Gas Chromatography Apparatus
- Human Metabolic Unit
- Dual Energy X-Ray Absorptiometry Unit
- Body Composition Analyzer Apparatus
- Mixograph
- Sensory Evaluation Laboratory
- UV-Vis Spectrophotometer
- Food Processing Pilot Plant with Facilities for Canning, Evaporation, Dehydration, Bread Making, and Chilled and Frozen Storage, of Foods

Department of Plant Sciences

- Greenhouses for Plant Propagation and Pot Experiment
- Growth Chambers and Incubators for Microorganisms, Insects and Plants
- Extraction Equipment

- DNA and Protein Analysis (Electrophoresis and PCR)
- Tissue Culture Setup and Equipment
- Plant Tissue Analysis and Composition Equipment
- Light Microscopy Equipment for Research and Teaching
- Gas-chromatography and Mass Spectrometry

Agricultural Research and Education Center (AREC)

The Agricultural Research and Education Center, located in the Beqaa, has 600 dunums that can be subdivided into 5 dunums plots, and allocated for research on rain-fed and irrigated agronomic crops using several types of up to date agricultural machinery and implements in the fields of mechanization, irrigation, and soil fertility. In addition, three greenhouses and an orchard of several fruit species are available. Facilities in the poultry sector allow for conducting nutritional trials on broilers in floor pens, battery brooders and cages. Trials on laying hens can be conducted in groups using floor pens, or individually in cages placed in environmentally controlled rooms. A new environmentally controlled layer house is equipped with colony cages for research trials on laying hens and parent breeders. A dairy herd and flocks of Awassi sheep and Shami goats with milking parlors are available for research activities. Research trials on small ruminants can be conducted in individual and collective pens. Crates for conducting digestibility trials on small ruminants are also available.

Research Interests

Research themes/interests that are being pursued by faculty members include the following:

Department of Animal Sciences

- Identification and Control of Animal Diseases
- Identification of Major Contaminants of Milk
- Utilization of Food By-products in Animal Nutrition
- Restricted Feeding and Fat/Fat-Soluble Vitamin Supplemented Diets in Animal Nutrition
- Pasture Utilization and Grazing Intensity
- Livestock-Environment Interactions
- Bioeconomic Sustainability of Small Ruminant Systems
- Optimization Strategies for Small Ruminant Production
- Barley and Low-Protein Diets in Poultry Nutrition
- Molting of Laying Hens
- Nutrient Requirements of Poultry at High Temperatures
- Utilization of Prebiotics and other Feed Additives in Poultry Diets

Department of Land and Water Resources

- Environmental/Rural and Dry land Hydrologic Modeling
- Water Harvesting/Storing

- Nutrient Management in Agricultural Systems
- Agrochemical Toxicity and Residual Effects in Soils
- Development of Suitable Fertilization Programs for Major Crops in Lebanon
- Fertigation
- Design and Analysis of Agricultural Machinery
- Pesticide Application Technology and Drift Reduction Techniques
- Modeling the Dynamics and Transport of Pesticide Sprays
- Water Requirements of Crops and Deficit Irrigation
- Water Resources Management
- Agricultural and Environmental Sustainability
- Application of GIS Methodologies in Desertification Monitoring
- Phytoremediation and Pollutant Dynamics in Soil-plant Systems
- Economics of Water and Natural Resources
- Wastewater utilization
- Economics of Biodiversity

Department of Nutrition and Food Science

- Diet Composition in Obesity and Hyperinsulinemia
- Dietary Fats and Plasma Lipids
- Nutritional Status of Populations
- Vitamins in Health and Disease
- Macronutrient Metabolism
- Assessment of Bone Density and Percent Body Fat
- Processing, Nutritional Value and Sensory Properties of Traditional Foods
- Bread and Cereal Technology
- Nutritive Value of Foods
- Functional Foods
- Shelf-Life Determination of Foods
- Food Microbiology
- Sensory Evaluation of Foods

Department of Plant Sciences

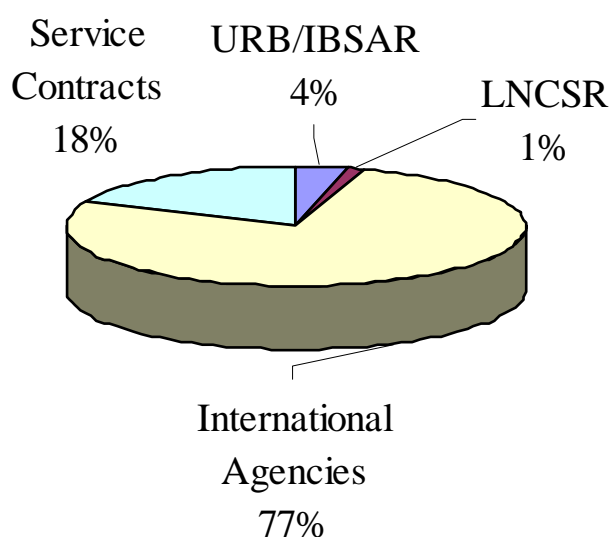
- Etiology and Epidemiology of Plant Diseases
- Integrated Pest Management
- Validation of Models for Disease Prediction and Forecasting
- Survey and Identification of the Wild Mushrooms of Lebanon
- Pesticides Residues, Metabolism and Fate in the Environment
- Biorational Pesticides
- Alternative Use of Herbicides, Fungicides and Insecticides
- Characterization of Plant Genetic Resources
- Plant Breeding
- Medicinal Properties of Wild and Cultivated Plants
- Phytoremediation

Faculty Research Funds and Service Contracts

2002 – 2003

**Faculty Research Funds and Service Contracts
(2002-2003)**

Source	Amount (\$)
Service Contracts	600,423
International Agencies	2,495,330
University Research Board (URB)/ Initiative for Biodiversity Studies in Arid Regions (IBSAR)	115,500
Lebanese National Council for Scientific Research (LNCSR)	41,870
Total	3,253,123



Service Contracts*

Coordinator(s)	Department ^a	Title	Funding Agency ^b	Area	Amount in \$
R. Zurayk	LWRS	Provision of technology transfer and extension to complement the irrigation rehabilitation project –Yammouneh	CDR	Agricultural Extension	187,426
N. Dagher	ANSC	Dairy stock improvement in Lebanon	US AID	Animal Science	292,025
I. Bashour	LWRS	Rural integrated development of the mountains of the northern region	FAO	Agricultural Development	3,230
S. Hamadeh	ANSC	Establishing a national training unit in Lebanon	IFAD	Agricultural Extension	100,000
M. Farran	AREC	Vegetables seeds trial at AREC	Unifert	Crop Production	4,377
M. Farran	AREC	Expansion of the existing pilot apple nursery	INDEVCO	Crop Production	13,365

*. Processed by Regional External Programs (REP) office.

a. ANSC: Animal Science; AREC: Agricultural Research and Extension Center; LWRS: Land and Water Resources; PLSC: Plant Science.

b. CDR: Lebanese Council for Development & Reconstruction; FAO: Food and Agricultural organization; IFAD: International Fund for Agricultural Development; US AID: United States Agency for International Development.

International Agencies

Investigators	Dept. ^a	Title	Funding Agency ^b	Research Area	Amount in \$
Y. Abou-Jawdah	PLSC	Development of a regional viral indexing & certification program for plant propagation materials in the Middle East.	University of Wisconsin	Integrated Pest Management	119,662
Y. Abou-Jawdah	PLSC	Selection of cucumbers for resistance to cucurbit yellow stunting disorder virus	USDA	Plant Pathology	25,000
S. Talhouk	PLSC	Collaborative molecular biotechnology integrating network	MAICH	Biotechnology	19,834
S. Talhouk	PLSC	Bioprospection: An alternative for sustainable agricultural development in Lebanon	Mercy Corps International	Biotechnology	516,933
M. Farran	ANSC	MEA dehulled meal feeding trials	ASA	Animal Nutrition	10,000
S. Hamadeh R. Zurayk F. Awar R. Darwish R. Smith N. Hwalla S. Talhouk	ANSC	Sustainable improvement of marginal lands in Lebanon: Aarsal, a case study. Phase II	IDRC	Natural Resources	69,139
R. Zurayk	LWRS	Using GIS & remote sensing for assessment of dryland agrobiodiversity in Lebanon	UNDP	Biodiversity	3,617
R. Zurayk	LWRS	Sustainable livelihoods in drylands	World Bank /UNDP	Sustainable Agriculture	20,000
R. Zurayk	LWRS	Growing sustainability, an integrated village development project, El Qaraaoun pilot village.	Mercy Corps International	Sustainable Agriculture	411,145
M. Sidani	AREC	Sustainable forage development program	Mercy Corps International	Crop Production	1,300,000

a ANSC: Animal Science; AREC: Agricultural Research and Extension Center; LWRS: Land and Water Resources; PLSC: Plant Science.

b. ASA: American Soybean Association; EEC: European Community; IBSAR: Initiative for Biodiversity Studies in Arid Regions; IDRC: International Development Research Center; MAICH: Mediterranean Agronomic Institute of Chania; UNDP: United Nations Development Program; UNDP/GEF: United Nations Development Program/ Global Environmental Fund; USDA: United States Department of Agriculture.

**University Research Board (URB)/
Initiative for Biodiversity Studies in Arid Regions (IBSAR)**

Investigator	Dept *	Title	Research Area	Budget \$
E. Abou-Fakhr Hammad	PLSC	Biological Control of Insect pests: safflower pests as a case study	Crop protection	7,000
E. Barbour	ANSC	Evaluation of an emulsion delivering herbal extracts with immunomodulation and antimicrobial activities	Medicinal plants	5,500
I. Bashour	LWRS	Effect of N fertilization and supplemental irrigation on wheat and barley yields in Beqaa.	Fertigation	4,000
M. Batal	NFSC	Nutrition status Lebanese school children, aged 6-9 years, from different socioeconomic background	Community nutrition	7,000
N. Farajalla	LWRS	Temperature and perception trends in Beirut and the central Beqa'a.	Water resources	6,000
M. Farran	ANSC	Canavanine in ervil seeds may induce molting in laying hens by reducing feed intake.	Poultry science	7,000
S. Hamadeh	ANSC	The effect of water restriction feed restriction and shearing on some physiological and immunological indicators in Awassi sheep.	Animal science	7,000
N. Hwalla	NFSC	Effect of macronutrient composition of hypoenergetic diets on weight loss, body composition and blood parameters	Obesity	6,000
J. Makhzoumi	PLSC	A study of garden landscapes in Beirut: the designed and vernacular.	Landscape design	4,000
M. Nimah	LWRS	Olive yield as affected by supplemental irrigation split fertilization and pest management.	Fertigation	5,500
O. Obeid	NFSC	The effect of dietary manipulation on food intake and glycogen synthesis of glucocorticoid treated rats.	Nutrition	5,500
A. Saad	PLSC	Characteristics, host range and control of the fire blight disease of pome fruits in Lebanon	Crop protection	4,000
M. Sidahmed	LWRS	The design of a prototype lentil harvester for small farms.	Agricultural engineering	4,000
F. Sleiman	ANSC	The potential use of food by-products as feed for ruminants.	Animal nutrition	6,000
I. Toufeili	NFSC	Determination of sensory thresholds of selected calcium salts and formulation of calcium-fortified Arabic Bread	Sensory evaluation	5,500
S.K. Yau	PLSC	Agronomic studies on safflower. II. N. fertilization and supplementary irrigation	Fertigation	6,500
S. Talhouk	PLSC	Development of carbohydrate free bread**	Cereal science	25,000

* ANSC: Animal Science; LWRS: Land and Water Resources; NFSC: Nutrition and Food Science; PLSC: Plant Science.

** IBSAR.

Lebanese National Council for Scientific Research (LNCSR)

Investigator	Dept*	Title	Research Area	Budget \$
Y. Abou Jawdeh	PLSC	Selected Lebanese plant flora as sources of natural products to control plant pests	Medicinal plants	6,670
R. Baalbaki	PLSC	Detection of some genetically modified foods and crops in Lebanon	GMO	6,000
M. Farran	ANSC	Utilization of locally produced barley and oil seeds meals and feed additives in poultry	Poultry nutrition	6,670
A. Saad	PLSC	Disease forecasting for management of epidemic diseases on apple and potato in Lebanon	Crop protection	5,330
E. Barbour	ANSC	Relationship of water deprivation-stress to immunity in Awassi ewes of Lebanon	Animal science	5,330
N. Hwalla	NFSC	National nutritional micronutrient survey: Assessment of anemia and antioxidant micronutrient status of females in Lebanon	Human nutrition	6,000
M. Nimah	LWRS	Introduction of saffron to the Bekaa I. Selection and agronomic Studies	Crop production	5,870

*ANSC: Animal Science; LWRS: Land and Water Resources; NFSC: Nutrition and Food Science; PLSC: Plant Science.

Publications

During the academic year, 2002-2003, the Faculty generated 23 refereed articles, 9 abstracts, 5 proceedings, 3 reports, 2 books and 8 chapters in books. Details of publications are as follows:

Department of Animal Sciences

Barbour, E. K., M. T. Farran, S. K. Hamadeh, M. Bouljihad, O. Faroon, and S. Kreydiyyeh. 2002. Comparative impact of live chicken infectious anemia virus vaccine versus natural exposure in meat chicken breeders on immunity to infectivity by CIA and inclusion body hepatitis viruses in their offspring. *Veterinary Research Communication*, **26**:397-405.

Daghir, N. J., M. T. Farran, G. W. Barbour, and M. M. Beck. 2003. Nutritive value of high oil corn grown under semiarid conditions and its impact on broiler performance and carcass composition. *Poultry Science*, **82**:267-271.

Farran, M. T., E. K. Barbour, and V.M. Ashkarian. 2003. Excess leucine in low protein diet fails to induce ketosis in 3-week-old male broiler chicks fed different levels of isoleucine and valine. *Journal of Animal Feed Science and Technology*, **103**:171-176.

Barbour, E.K., and Mathew, T. 2003. Contribution of Disease Free Pets to Human Health. New Jersey Press. USA.

Hamadeh, S.K.; Haidar, M., Zurayk, R. The Cactus Flower: Research for Development in the Dry Arab World. 2003. IDRC publication.

Sleiman, F.T., R.A. Sarkis, M.G. Uwayjan, E.K. Barbour, M.T. Farran and M.N. Nimah. Silage characteristics, apparent digestibility, and performance of lambs fed apple pomace ensiled with different levels of wheat straw. Annual meeting of the American Dairy Science Association, Phoenix, Arizona, U.S.A., June 22-26, 2003.

Department of Land and Water Resources

Bashour, I., S. Dagher, G. Chammas and N. Kawar. 2003. Comparison of gas chromatography and immunoassay methods for analysis of total DDT in calcareous soils. *Journal of Environmental Science and Health. Part B*, **B38**:111-119.

Sidahmed M.M. and R.B. Brown. 2002. Computer simulation of factors affecting drift from a forestry airblast sprayer. *Canadian Biosystems Engineering*, **44**:27-35.

N.J. Kabengi, R. A. Zurayk , R. Z. Baalbaki, and J. Ryan. 2003. Phosphorus dynamics and characterization under a long-term rotation trial. *Communications in Soil Science and Plant Analysis*, **34**:375-392.

Zurayk, R., B. Sukkariyah, R. Baalbaki and D. Abi Ghanem. 2002. Ni phytoaccumulation in *Mentha aquatica* L. and *Mentha sylvestris* L. *Water, Air and Soil Pollution*, **139**:355-364.

Bashour, I., G. Hannoush and N. Kawar. (2003). Trace metal content of commercial fertilizers marketed in Lebanon. American Chemical Society publication.

Bashour, I. 2003. Fertilizer types available in the Near East markets and the potential for their use. FAO, Rome.

Bashour, I. 2003. Efficient use of fertilizers under sandy desert farming conditions. FAO, Rome.

Sayegh A. and Bashour I. 2003. Fertilization of calcareous and gypsiferous soils in the Near East. The Fertilizer Manual for the Near East Region. FAO, Rome.

Bashour, I., and A. Sayegh. 2003. Methods of Analysis For Soils in Arid and Semi-Arid Regions. FAO, Rome (Book:135 pages in English and 123 pages in Arabic language).

Haddad, J. and Nimah, M. N. 2002. Water quality Monitoring of a watershed. River Basin Management 2003, Wessex Institute of Technology.

Bsaibis A., Nimah M. N. AlKhal, F. Darwish, M.R. and Bashour, I. 2002. Optimizing cropping pattern to maximize water productivity. River Basin Management 2003, Wessex Institute of Technology.

Zurayk, R. 2002. Farmers and funders priorities for biodiversity conservation in Lebanon. In: *Promoting Best Practices for Conservation and Sustainable Use of Biodiversity of Global Significance in Arid and Semiarid Zones of the Developing World*. UNEP, GEF, TWNSO. Trieste, Italy.

Nimah, M.N., A. Bsaibes, F. Alkal, M.R. Darwish, and I. Bashour. 2003. Optimizing cropping pattern to maximize water productivity. In River Basin Management 2003. Edited by C, A. Brebbia. Published by Wessex Institute of Technology, U.K., pp 187-199.

Nimah, M.N. 2002. Water resources management in the Near East and North Africa Region. FAO Current Emerging Issues for Economic Analysis and Policy Research; CUREMIS II NENA.

Bashour, I. 2003. Fertilizer consumption in the Near East: Low potassium rates? Proceedings of the International Potash Institute meeting in Jordan, Amman.

Bashour, I. and Lteif, A. 2002. Selenium levels in Lebanese soils and forages. Annual Meeting of American Chemical Society, Boston, Aug. 18-22.

Nimah, M.N., Bsaibis, A., and Hamed-Jawahari, M. 2002. Models for improving irrigation scheme water productivity. Conference on: Integrated Water Management, Agricultural Research Institute; Nicosia, Cyprus, June 18-22.

Department of Nutrition and Food Sciences

Sibai, A.M., Zard, C., Adra, N., Baydoun, M., and Hwalla (Baba), N. 2003. Variations in nutritional status of elderly men and women according to place of residence. *Gerontology* **49**:215-24.

Bouclaous, C., Torbay, N., Nassar, C., and Hwalla (Baba), N. 2003. Modification of glucocorticoid effects on body weight gain, plasma lipids, feed efficiency by changes in diet composition. *Nutrition Research* **23**:1105 – 1115.

Al-Kadamany, E., Khattar, M. Haddad, T., and Toufeili, I. 2003. Estimation of shelf life of concentrated yogurt by monitoring selected microbiological and physicochemical changes during storage. *Lebensmittel – Wissenschaft und – Technologie* **36**: 407 – 414.

Haladjian, N., Fayad, R., Toufeili, I., Shadarevian, S., Sidahmed, M., Baydoun, E., and Karwe, M. 2003. pH, temperature and hydration kinetics of faba beans (*Vicia faba* L.). *Journal of Food Processing and Preservation* **27**: 9 – 20.

Harakeh, S., Batal, M., and Barbour, E. 2003. Nutritional consequences related to “Mad Cow Disease” among homemakers and medical care practitioners in Lebanon. *Ecology of Food and Nutrition* **42**:241 – 254.

Bitar, S.T., N. Hwalla, N. Torbey, P.W. Emery and O.A. Obeid. The effect of diet supplementation with glutamine, dihydroxyacetone and leucine on the *in vivo* rate of postprandial glycogen synthesis. Presented at Nutrition Society meeting, 7-10 July 2003, Kings College London, London. UK. *Proc Nutr Soc*: 2003; **62**, 44A.

Boukarim, L., N. Hwalla, N. Torbey and O.A. Obeid. The *in vivo* rate of postprandial glycogen synthesis in glucocorticoid-treated rats maintained on different high protein diets. Presented at Nutrition Society meeting, 7-10 July 2003, Kings College London, London. UK. *Proc Nutr Soc*: 2003; **62**, 44A.

Department of Plant Sciences

Abi Harb, K., W. Khoury, E. Choueiri, L. Hanna and A.T. Saad. 2003. Management of apple blossom blight by chemical treatments, 2001. *Fungicide and Nematocide Tests*, **58**: PF013.

Abou-Jawdah, Y., A. Karakashian, H. Sobh, M. Martini and I.M. Lee. 2002. An epidemic of almond witches'-broom in Lebanon: classification and phylogenetic relationship of the associated phytoplasma. *Plant Disease*, **86**:477-484

Abou-Jawdah, Y., H Sobh, and A. Salameh. 2002. Antimycotic activities of selected plant flora, growing wild in Lebanon, against phytopathogenic fungi. *Journal of Agriculture and Food Chemistry*, **50**:3208-3213

Abou - Jwadah, Y, H. Dakhil, S. El-Mehtar, and I.M. Lee. 2003. Almond witches'-broom phytoplasma, a potential threat to almond, peach and nectarine. *Canadian Journal of Plant Pathology*: 28-32

Choueiri, E., S. El-Zammar, F. Jreijiri, A.T. Saad, M. A. Afram and C. Varreri. 2003. Records of Potatoes Viruses in Lebanon. *Journal of Plant Pathology* **84**:139-140.

Haidar M. A. 2003. Characterization of the interaction between cryptochromes and phytochromes in blue light-induced coiling and prehaustoria development of dodder (*Cuscuta campestris*) seedlings. *Annals of Applied Biology* **143**:57-62.

Haidar M.A., W. Bibi, and M.M. Sidahmad. 2003. Response of branched broomrape (*Orobancha ramosa*) growth and development to various soil amendments in potato. *Crop Protection* **22**:291-294.

Kabengi, N.J., R.A. Zurayk, R.Z. Baalbaki, and J. Ryan. 2003. Phosphorus dynamics and characterization under long-term rotation trial. *Communications in Soil Science and Plant Analysis*. **34**:375-392.

Makhzoumi, J. 2002. Landscape in the Middle East: an inquiry. *Landscape Research* **27**: 213-228.

Talhok, S. N., N. Sinno Saoud, and S. L. Jury. 2003. Work on the Post Herbarium at the American University of Beirut. *Bocconeia* **6**:289-291.

Yau, S.K. 2003. Yields of early-planted barley after clipping or grazing in a semi-arid area. *Agronomy Journal* **95**: 821-827.

Yau, S.K., M. Bounejmate, J. Ryan, A. Nassar, R. Baalbaki, and R. Maacaroun, 2003. Barley-legumes rotations for semi-arid areas of Lebanon. *European journal of Agronomy* **19**:599-610.

Abou-Fakhr Hammad, E.M. "*Melia azedarach* L., The Biopesticidal tree" and "Some Insect and Mite Pests and their Natural Enemies (Parasitoids and/or Predators) in the Middle East". Sections in *Encyclopaedia of Entomology*, USA.

Abou-Jawdah Y. (Editor) 2002. Integrated Production and Protection Management of Greenhouse Crops. Proceedings of the FAO/AUB first National Conference. Beirut Feb. 7, 2002 (pp. 187).

Abou-Jawdah Y. (Editor). 2002. Fourth coordinating meeting of the FAO regional working group on greenhouse production in the Mediterranean region. Beirut Feb. 2-7, 2002. (pp. 180).

Abou Jawdeh, Y., A. Karakashian, H. Dakhil, S. El-Mehtar, and I.M. Lee. 2003. Almond witches' s-broom phytoplasma, an epidemic disease in Lebanon. *The 2003 Annual Meeting of the American Phytopathological Society*, North Carolina, USA. August 9 -13, 2003.

Haidar M.A. 2003. Prospects for an Integrated Technology Transfer in the Middle East. *Proceedings Northeastern Weed Science Society of America*, Baltimore, Maryland, USA. p 135, Jan. 6-9, 2003.

Haidar M.A. 2003. Characterization of cryptochromes and phytochromes interaction in blue light-induced coiling and prehaustoria development of dodder (*Cuscuta campestris*) seedlings. *Proceedings Western Society of Weed Science of America*, Kauai, Hawaii, March 11-13, 2003.

Abi Harb, K., A. T. Saad, L. Hanna, and E. Choueiri. 2003. Efficacy of Plant extracts for the control of *Erwinia amylovora*. *The 2003 Annual Meeting of the American Phytopathological Society*, North Carolina, USA. August 9-13, 2003.

Yazbek, M. and S.K. Yau, 2002. Divergent selection of growth vigor on safflower yield. In abstracts of the *Annual Meeting of the American Society of Agronomy*, Crop Science Society of America, and Soil Science Society of America, Indianapolis, Indiana, USA, Nov. 10-14, 2002.

Yau, S.K., M. Bounejmate, J. Ryan, and A. Nassar, 2002. Sustainable barley-legume rotations for semi-arid areas of Lebanon. In abstracts of the *Annual Meeting of the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America*, Indianapolis, Indiana, USA, Nov. 10-14, 2002.