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News and Information

International Advanced Research Workshop 'Agricultural Activities and Food Safety Issues'

Co-organized by Agricultural Research Organization (Israel)-Suleyman Demirel University (Turkey)

May 25-May 30, 2003

Suleyman Demirel University
Isparta/TURKEY
(www.sdu.edu.tr/fp6workshop)



Organizing Committee

Dr. Natan Gollop (ARO, ISRAEL)
Dr. Pervin Basaran (SDU, TURKEY)
Dr. Birol Kilic (SDU, TURKEY)

Summary

The major goal of this International Advanced Research Workshop was to provide the opportunity for applying joint research projects to the EU's Sixth Framework Programme, whose one of the seven priorities is food safety and quality. The main theme for the meeting was 'Food Safety Issues and EU 6th Framework Priority'. And the international opportunities for co-operation in policy and research development and about improvement of information and communication systems were discussed. The technical program for the workshop consisted of plenary seminars of invited speakers, roundtable discussions, and posters.

Program

Microbial contamination, food borne pathogens-food poisoning
Biotechnology applications and food safety and quality
Use of chemicals in agriculture and food safety concerns
Use of non-chemical treatment options for post harvest protection
Vulnerability of ground-water from agricultural diffuse
Water Security: Availability and Quality
Emerging Food Safety Issues
EU's 6th Framework Programme and why food safety as major priority

Abstract

LONG-TERM FIELD TRIALS AS A RESEARCH BASIS FOR SUSTAINABLE AGRICULTURE

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Today 800 million people worldwide suffer from hunger and 13 million die every year from the results of inadequate nutrition. At the same time the usable area of land will be reduced due to erosion, devastation and ground sealing at the rate of approximately 10 million hectares per year. More and more people must exist using a smaller agricultural area of land. It is obvious that the scenario presents new challenges for agricultural and environmental research. A principal question is how increasing crop production with a lower input of resources can be achieved while simultaneously preserving soil quality in the long run. Long-term investigations are required because modifications in the soil, especially carbon and nitrogen content, occur slowly and are to a large extent only quantifiable after decades. To understand adequately the concepts of sustainable crop production and soil protection which ensure lasting preservation of soil fertility, long-term field trials under varying soil and environmental conditions are indispensable for usable quantitative data to be obtained. These studies would allow nutrient elements and the energy cycle and to be assessed and quantified. The effects of different uses of land also need to be determined. Long-term field trials are also very important to investigate the problems of sustainable land use, food security, climate changes and water quality. This is the only approach using analysis of long-term observation-type studies in connection with available data records and knowledge of small-scale sequences of events, to extrapolate the findings to large-scale global occurrences. This study will give an overview about the most important long-term trials in the world and some selected results about the long-term trials at the Humboldt-University of Berlin (Germany). On the other hand, the information will be provided concerning the first long-term trial, which is planned to be established in Aegean region of Turkey.

THE USE OF RECLAIMED WASTE WATER IN AGRICULTURAL IRRIGATION- THE ROLE OF MEMBRANE BIOREACTORS

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Tertiary-treated reclaimed wastewaters have been increasingly used in agricultural irrigation in recent years due to efforts for saving the clean water sources especially in drought areas. The use of reclaimed wastewaters in agricultural irrigation includes water for farming, horticulture, and ranching (i.e., for irrigation, stock watering, or support of vegetation for range grazing). Membrane bioreactor systems (MBRs) have been increasingly employed in the last few years in producing reclaimed wastewaters to be used in such agricultural purposes since the produced waters are of high quality with relatively competitive unit costs. With advances in polymer industry and decreasing membrane costs, MBRs have been employed exponentially worldwide in the last few years especially for wastewater reclamation and reuse. There are many advantages associated with the use of MBRs compared to conventional activated sludge system as discussed below. Due to high MLSS concentrations in the MBRs, lower hydraulic retention times (HRTs), thus smaller aeration tank volumes are required. Biomass separation is independent of settling; separation is via microfiltration or ultrafiltration. There is no need for secondary clarification. High organic loadings may be allowed due to high MLSS in aeration tanks. Because of elevated solids retention time (SRT), MBRs provide a perfect physical disinfection since the separation of the treated water is accomplished through microfiltration or ultrafiltration. There is essentially complete removal of protozoa and bacteria. Since there is no escape of TSS as occasionally observed from secondary clarifiers, SRT control is better. MBRs are compact systems with much smaller plant footprints, as aeration and biomass separation, may occur within a single tank. Effluent quality is much superior. Values for effluent parameters typically observed with MBRs are as follow: BOD < 2.0 mg/L, TSS < 2.0 mg/L, NH₃-N < 1.0 mg/L (with nitrifying MBRs), Total phosphorus < 0.1 mg/L (with inclusion of anaerobic zone), total nitrogen < 3-10 mg/L (with inclusion of anoxic zone: denitrification), turbidity < 0.5 NTU. Because of these numerous advantages, MBRs may be considered a perfect treatment technology in producing reclaimed water. In this presentation, in addition to theoretical and practical discussions with respect to application of MBRs, case studies and real design experience from projects in the USA will also be provided.

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BACTERIOCINS USED IN FOOD PRESERVATION

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Microorganisms are the most serious hazard in world food supply. With increasing consumer demands for fresh, natural, convenient and preservative-free foods, and increasing variety of minimally processed refrigerated foods have enhanced attention to bacteriocins from GRAS lactic acid bacteria. The use of bacteriocins or the use of bacteriocin-producing lactic acid bacteria associated with foods may provide a novel means of preserving foods and beverages from detrimental effects of spoilage and/or pathogenic bacteria. They are naturally occurring and can be used in microbiological control of food pathogens to eliminate or reduce use of traditional chemical preservatives. Bacteriocins are active against key pathogenic organisms such as clostridia, staphylococci, bacilli, listeria in processed meats, and dairy products. Although a number of bacteriocins produced by lactic acid bacteria have been described, the mechanisms by which bacteriocins inhibit or kill sensitive organisms are not fully understood. The dairy propionibacteria are "food-grade" organisms that naturally occur in some fermented foods and are intentionally added to others. They are consumed in foods and their actions result in desirable food characteristics. The application of jensenin G, a bacteriocin produced by *Propionibacterium thoenii* (formerly *P. jensenii*) P126, in controlling over-acidification of yogurt and other fermented products has been reported. It is bacteriostatic to *P. acidopropionici* P5 and bactericidal to *L. delbrueckii ssp. lactis* ATCC 4797. Because it inhibits *L. delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus*, it has a potential role in preventing over-acidification of yogurt. The antibotulinal activity of jensenin G and its heat and pH stability suggest its usefulness as a biological food preservative. However, the mode of action of jensenin G against sensitive organism is not known. Addition of jensenin G to cells of *L. delbrueckii* subsp. *lactis* ATCC 4797 caused rapid loss of cellular K⁺, depolarization of cytoplasmic membranes, efflux of inorganic phosphate and hydrolysis of internal ATP. Maximum losses of intracellular K⁺ and P_i were 393 and 48.11 nmol mg⁻¹ cell dry weight (CDW), respectively. Intracellular ATP decreased from 4.76 to 0.04 nmol mg⁻¹ CDW within 5 min representing 99.3% loss. Extracellular concentrations of ATP and UV-absorbing molecules did not concomitantly increase. Jensenin G permeabilized cell membranes allowing for efflux of K⁺ ions and phosphate but without efflux of larger compounds. Like other peptide bacteriocins, the inhibitory action of jensenin G against *L. delbrueckii* subsp. *lactis* appears to be directed to the cytoplasmic membrane and may be caused by pore formation.

PURIFICATION, CLONING AND CHARACTERIZATION OF BACTERIOCIN PRODUCT BY *PROPIONIBACTERIA THEONII* P-127

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The bacteriocin GZB-1 with molecular weight of 3000 Dalton, was purified from the growth media of *Propionibacteria theonii* P-127, a strain which is known to produce, under specific growth conditions, the bacteriocin PLG-1 with molecular weight of 9,500. The N-terminal of GZB-1 was microsequenced, the gene was cloned and the DNA sequence was determined. GZB-1 is highly homologous to PAMP (Faye et al, J. Bacteriol. (2002) 184, 3649-3656), but in contrast to PAMP it was purified in its active form and no protease digestion was needed. The survival curve of indicator bacteria *Lactobacillus delbruckii* with 100 units per ml of GZB-1 showed two phases. The fast phase of 20 minutes was followed by a slow phase. During the fast phase bacterial survival was reduced by two logs and during the slow phase bacterial survivals was reduced by 3 additional logs in 200 minutes. GZB-1 activity is affected by magnesium and its activity is completely abolished at 50 mM magnesium chloride. Other divalent cations had no effect on GZB-1 activity. This is the first report, to our knowledge that bacteria may produce two different bacteriocins under different growth conditions.

THE EFFECT OF OUTDOOR FLORA ON FUNGUS CONTAMINATION IN PACKED AND UNPACKED TEA

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The aim of this study carried out in May 2002 was to determine quantitatively the contamination by the airborne fungi of packed and unpacked tea sold in markets. Twelve unpacked, 21 packed tea samples and 12 Potato Dextrose agar (PDA) plates exposed to the air flora from different regions of Rize were investigated for fungal containment. Average fungal load in one gram tea was 86 cfu in unpacked and 458 cfu in packed tea samples. Approximately, 485 fungus colonies per plates were isolated from the outdoor flora. The amount of fungus containment of unpacked tea samples was quantitatively close to the outdoor flora, although, it was quite less in packed tea samples. There has been a significant difference between packed and unpacked tea samples regarding fungus contamination (Mann Whitney U test, p<0.01). After 45 examinations, 128 fungus species were isolated from both tea samples and air flora. Eleven fungus genera were identified. *Penicillium* spp. and *Aspergillus* spp. were the most dominant. Fungal containment rates of the unpacked and packed tea samples and the outdoor flora ranged between 38-50%, 28.9-31.6%, and 14.1-26.5%, respectively.

POSSIBILITIES FOR BIOLOGICAL CONTROL OF BLUE MOLD DURING THE POSTHARVEST STORAGE OF APPLE FRUIT

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Blue mold (*P. expansum*) is the major disease causing significant losses during the post-harvest fruit storage. As far as the active substances of the major fungicides used for post-harvest treatment are considered potentially cancerogenic, the aim of the present study was to find out alternatives such as the biological control. Here its essence means discovering microorganisms of strongly expressed antagonism to the pathogen. Using standard phytopathological methods, the potential antagonists were isolated in the pre-harvest period. Apple leaves and fruits, collected from untreated in the last 3 years single trees or orchards, were used as a material for isolation. The screening for antagonism was conducted on wounded and inoculated fruits of Golden Delicious. The infection had been achieved with a suspension containing 6x10⁴ CFU/ml. The antagonist concentration was of density 31-33% (E=0.5) at 430 nm wavelength by the scale of the spectrophotometer. In four of the isolates (3 yeasts and 1 bacterium) a high degree of pathogen suppression was detected when reporting the results (7 days later at 22°C). Their antagonistic effect was confirmed by a bio-test on fruits of cv. Starkrimson at a pathogen concentration of 1x10⁵ CFU/ml.

METHYLBROMIDE ALTERNATIVES FOR DRIED FRUITS IN TURKEY

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Turkey is the leading exporter of dried fruits & edible nuts such as raisins, figs, apricots and hazelnuts with an annual export of more than 500,000 tons with a value of ca. \$ 1 billion US. Until now, post harvest fumigation with Methyl bromide (MBr) has been the major method used for the control of storage pests including *Ephesia cautella* Walk., *Plodia interpunctella* Hbn. (Pyralidae:Lep.) *Carpophilus* spp. (Nitidulidae:Col.) *Oryzaephilus surinamensis* L. (Silvanidae:Col.) *Carpoglyphus lactis* (L.) (Carpoglyphidae:Acari). Although, phosphine, modified atmospheres, high pressure carbon dioxide, deep freezing, cold storage, micro-waves, and radiation applications can be mentioned among the alternatives, modified atmospheres and phosphine applications remain the most attractive ones in terms of applicability and economy. Recent studies carried out in some organic dried fruits handling facilities has shown that gas hermetic fumigation (G-HF), using CO₂ gas (Karbogaz) in the flexible PVC envelopes known as Volcani Cubes, resulted in complete mortality, in five days or less, for all life stages of *E. cautella* and *C. lactis*, the main pests of the dried fruits under field conditions. The cost of CO₂ application is similar to that of MBr, which is approximately 1 €/ton dried fig. Carbon dioxide application under high pressure is another method for application of modified atmosphere but is regarded as still expensive for Turkish dried fruit sector in comparing with other methods, which is up to 10 €/ton of dried figs. Magnesium phosphide (Fumi-Cel Degesch) applications as an alternative to MBr for conventional dried fruits processing companies showed that complete mortality of all stages of *E. cautella* and *C. lactis* had been found at 800 ppm of phosphine fumigation for 3 days of exposure in the field. The cost of magnesium phosphide for stack applications are calculated around ~0,25 Euro/ton dried fig which is 4 times cheaper than that of MBr application in field conditions. It can be concluded that high carbon dioxide and phosphine applications are currently most applicable alternatives as conventional and organic fumigation procedures, respectively.

THE POTENTIAL USE OF HOT WATER RINSING AND BRUSHING TECHNOLOGY IN FOOD INDUSTRY

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Minimal or fresh-cut processing of vegetables provides convenience to food service and retail consumers, but may result in severely limited shelf life postcutting because of undesirable pathological and physiological changes. In recent years, as a consequence of the increasing number of produce-related outbreaks of food-borne illness, greater attention has been given to interventions that kill or remove human pathogens on fresh produce. A key goal of washing and sanitizing treatments, therefore, is removal or inactivation of such pathogens. However, conventional washing and sanitizing methods are not capable of reducing microbial populations by more than 90 to 99%, which is less than that required by food safety laws. Chlorination is usually considered a means to maintain sanitary process waters rather than a means to disinfect the product. However, chlorinated wash water typically reduces microbial populations by less than 100-fold. A prestorage technology of a very short hot water rinsing and brushing (HWRB) is widely used today in Israel on fresh harvested commodities. The potential use of HWRB technology on fresh produce designated for the fresh cut industry was evaluated on melon fruits treated at 75°C for 20 s. HWRB significantly reduced the total microbial colony forming units (CFU) of the epiphytic microorganism population by a 3-4 log reduction, compared to untreated fruit, or fruit that were rinsed and brushed with tap water (TWRB). This treatment, although damaged the fruit skin after 7 days storage, did not affect melon fresh-cut internal quality as evaluated by total soluble solids, flesh firmness and general taste of the fresh-cut fruit after 7 days storage at 7°C. In the near future, a better understanding of the physiology, pathology, biochemistry and molecular biology of hot water-treated produce will enable the development of more precise and effective HWRB techniques. This simple technology, which should be also explored on a broader range of minimally processed products, may successfully reduce our current extensive reliance on chemical treatments implemented on produce designated for the fresh-cut industry.

SAFETY EVALUATION OF STARTER CULTURES

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A starter culture may be defined as one or more strains of one or more species of desirable bacteria used to inoculate a raw and pasteurized product to start fermentation. At least five functions of starter cultures may be recognized in fermented food production. There are (1) to initiate the fermentation; (2) to destroy disease producing bacteria; (3) to enhance the keeping quality of the product (4) contribute to flavor and aroma (5) concentrate and stabilize the raw material (e.g. cheese from milk). They also enhance human health with their probiotic functions. Lactic acid bacteria (LAB) are used as starter cultures in the production of lactic fermented foods. Members of genera *Lactococcus* and *Lactobacillus* are most commonly given generally-recognized-as-safe (GRAS) status whilst members of genera *Streptococcus*, *Enterococcus* and some other genera of LAB contain some opportunistic pathogens. Despite of acceptance of being GRAS, some LAB strains produce the metabolic products such as biogenic amines adversely affecting the human health. LAB have low amino acid decarboxylating activity, however, their contributions to biogenic amine contents of fermented foods have not ignored during long storage periods. Non-starter culture of lactic acid bacteria have been accepted to be responsible for biogenic amine formation, some starter cultures were also determined to produce high level biogenic amines in fermented foods. Biogenic amines have been reported to cause physiological effects such as hypertensive crisis, fever, urticar, ulcers of stomach and colon. In this proceeding, biogenic amine production capability of commercial starter cultures was emphasized. The safety of probiotic strains is of prime importance. Several approaches are possible in the assessment of the probiotic safety: (a) studies on the intrinsic properties of the probiotic strains; (b) studies on the pharmacokinetics of the probiotic strain; and (c) studies on interactions between the probiotic strain and the host. The contents of probiotic preparations currently on the market are based on lactic acid bacteria (LAB). When safety assessment of a commercial probiotic formula should be taken consideration to those strains genetically modified or derived from animals. All probiotic foods should be safe and have good sensory properties.

RECENT DEVELOPMENTS IN FOOD SAFETY

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Food safety is becoming more important in food markets due to several structural changes in the world food system. These changes include advancements in the science of public health, changes in how consumers obtain and prepare food, and increased international trade in food products. These changes, which are apparent in both industrialized and developing nations, are creating enhanced market incentives for producers to improve food safety and enhanced political incentives for public intervention in food markets. Frequently, partnerships between the public and private sectors are needed to respond to incentives for improved safety. Foodborne diseases are some of the most widespread health problems in the world and they have implications both on the health of individuals and the development of societies. Developing food safety measures will be a significant challenge for us. Advances in biotechnology and computer applications, in the US, Centers for Disease Control and Prevention (CDC) has implemented two programs in the past several years. One of these is FoodNet, a surveillance system that tracks foodborne illnesses. The other is PulseNet, an electronic system that stores the 'DNA fingerprints' of pathogens. These fingerprints are obtained by pulsed field gel electrophoresis (PFGE). This PulseNet technology is quickly revolutionizing epidemiology. In the past, outbreaks of foodborne illnesses were usually not detected unless a very large number of people were affected, or unless the individual illness cases were geographically clustered, so that the outbreak could be confirmed by conventional epidemiological procedures. The advent of PFGE now makes it possible to detect outbreaks that are very small or are geographically widespread.

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PRESENCE OF ACRYLAMIDE IN FOODS

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Acrylamide is more commonly known as an industrial chemical used to prepare the polymeric material known as polyacrylamide, which is used as a flocculant for treating industrial wastewater and, to a lesser extent, drinking water. The European Union has a limit of 0-1 mg/L of water. In 1993, the US Environmental Protection Agency classified acrylamide as a probable human carcinogen of medium hazard. Acrylamide is carcinogenic in mice due to its genotoxic transformation product, glycidamide. Those findings alarmed many countries in last year and studies have been concentrated especially on the mechanisms of occurrence of acrylamide in foods, and the effects of consumption of foods containing acrylamide to human health. The health consequences of exposure to the low levels found in foods have not been clear, yet. There are two areas of concern: (1) potential toxicity to the nervous system, and (2) potential genetic damage that may lead to cancer. Acrylamide occurs as a byproduct of high-temperature (greater than 120°C) cooking processes. Studies showed that acrylamide formation occurs in carbohydrate-rich foods. However, tests on carbohydrate-rich foods cooked at lower temperatures by boiling have shown much lower acrylamide levels. Acrylamide can be generated from food components during heat treatment as a result of the Maillard reaction between amino acids and reducing sugars. Asparagine, a major amino acid in potatoes and cereals, is an important participant in the formation of acrylamide. It has been found that other carbonyl sources such as glyoxal, glyceraldehyde and 2-deoxyglucose, are also produced significant amounts of acrylamide in the model system with asparagine. FDA also concluded that the presence of acrylamide in food is a major concern, and recommended more research on mechanisms of formation and toxicity. Both the WHO/FAO and the FDA have recommended that people continue to eat a balanced diet rich in fruits and vegetables.

OZONE APPLICATIONS IN FOOD SYSTEMS

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Ozone is a strong oxidant and potent disinfecting agent. Ozonation has been used for years to disinfect water for drinking purposes in Europe. A number of other commercial uses have been found for ozone including disinfection of bottled water, swimming pools, prevention of fouling of cooling towers, and wastewater treatment. There are potential numerous application areas of ozone in the food industry such as food surface hygiene, sanitation of food plant equipment, reuse of waste water, treatment and lowering biological oxygen demand (BOD) and chemical oxygen demand (COD) of food plant waste. The bacteriocidal effects of ozone have been documented on a wide variety of organisms, including Gram positive bacteria such as *Listeria monocytogenes*, *Staphylococcus aureus*, *Bacillus cereus*, *Enterococcus faecalis* and Gram negative bacteria such as *Pseudomonas aeruginosa*, and *Yersinia enterocolitica* as well as spores and vegetative cells. Two major mechanisms have been identified in ozone destruction of the target organisms: first mechanism is that ozone oxidizes sulfhydryl groups and amino acids of enzymes, peptides and proteins to shorter peptides. Ozone degradation of the cell envelope unsaturated lipids results in cell disruption and subsequent leakage of cellular contents. Although ozone has not been commonly used in the dairy and food industry, it has found limited applications in a few areas such as conversion of green tea to black tea, cleansing of shellfish, and disinfection of poultry carcasses and chill water in the poultry industry. Treatment of apples with ozone resulted in lower weight loss and spoilage. Fungal deterioration of blackberries and grapes was decreased by ozonation of the fruits. Mold and bacterial counts were greatly decreased and chemical composition and sensory quality of the vegetables were not changed. A number of patents have been issued for using ozone to treat fruits and vegetables. Although chlorination efficiently decreases the spread of food borne infectious disease, chlorine combines with many organic compounds to form toxic by-products.

PRESENTATION OF TUBITAK-MRC FOODSCIENCE TECHNOLOGY RESEARCH INSTITUTE (FSTRI)

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Food Science and Technology Research Institute (FSTRI) is conducting intensive R&D studies, food quality control analyses, training programs and consultancy services. Since its establishment, the Institute has rapidly developed its infrastructure and reached an important and dynamic position in Turkey. In parallel with national development targets, the mission of the Institute is to contribute to the technological development and increase the competitiveness of the Turkish food industry and to carry out applied R&D studies for the assurance of the food safety and healthy nutrition of society. FSTRI conducts its activities by four working groups: Food Processing Technologies and Nutrition, Food Microbiology and Biotechnology Food Preservation and Packaging Technologies, Food Analysis R&D Activities include the improvement of existing technologies and development of new ones for processing and preservation of foods, increasing quality and yield, formulation of new value-added products, examination of nutrition-health relationships and assurance of microbiological safety in foods. Contract-Research Projects (CRP) are among the priority activities of the institute. Companies provide financial support to CRPs and have the rights for commercial exploitation of the project outcome. Quality Control Analyses are performed routinely for the companies producing food. Especially these analyses are performed for food exporters. QC laboratories are accredited by DAR/DAP (Germany) according to ISO/IEC 17025 standard. Consultancy Services include a various issues, such as technological problem solving, establishing quality assurance systems (ISO 9000, GMP, HACCP), choosing proper equipment, setting up laboratories and techno-economic feasibility reports. FSTRI participated in 8 EU FP6 project proposal in 2003, under different sub-headings of the priority thematic area of Food Quality and Safety. Moreover, having a good experience in international projects with its high level of capacity and infrastructure, FSTRI is planning to participate in or coordinate new projects under the EU FP6 Programme or other international programmes.

THE PINK COLOR DEFECT IN COOKED POULTRY MEAT

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Color of the product is one of the most important factors in acceptance and sale of meat products. When color is different than expected, consumers will choose not to purchase the meat product. Uncured poultry products do not contain added nitrite which is used for *Clostridium botulinum* control and traditional pink color development in cured products. Therefore, pink color development in traditionally white uncured poultry products is an undesirable characteristic. It has especially been a problem in turkey breast meat products. Even though it is a cosmetic problem, it causes product rejection as well as loss of consumer confidence in the quality of this food supply. A number of probable causes for the pink color defect have been suggested. A small amounts (e.g. 10 ppm.) of nitrite and nitrate contamination in drinking or chilling water and nitrite present in poultry meat may form and produce pink color problems in processed poultry meat. Nitrite in the feed is more of a concern than nitrite in drinking water with respect to muscle pinkness. Exhaust fumes during transportation of birds prior to slaughter, carbon monoxide, nitrogen dioxide (0.4 ppm.) and nitric oxide generated by oven fumes, poorly ventilated gas ovens, low end-point cooking temperatures, concentrations and oxidation states of pigments, microbial, and irradiation (dissociate water into oxidizing and reducing free radicals which may react with heme pigments) can produce pink color defect in poultry meat. The pink color due to refrigerated storage can fade quickly if meat is exposed to either light or oxygen. It has been suggested that several non-pink generating ligands such as diethylenetriamine pentaacetic acid, ethylenedinitrilo-tetraacetic acid disodium salt, trans 1,2-diaminocyclohexane-N,N',N'' tetraacetic acid monohydrate, and calcium reduced nonfat dried milk provided reduction in pink color development with presence of sodium nitrite and especially nicotinamidemight inhibit pink color development. As mentioned before, so many research has been done to understand and solve the pink color development in uncured cooked poultry products, and some of the suggestions such as controlling nitrate and nitrite contamination has provided some improvements, but because of the complicated nature of undesirable the industry-wide sporadic pink color defect in uncured cooked poultry meats is still exist as an economical problem for poultry industry. To solve this problem, all the factors reported (over and undercooking, nitrate and nitrite contamination, pH etc.) and suspected (packaging environments, cytochrome c, ORP, PSE and DFD muscle etc.) which might contribute pink color development should be identified, and than according to results, new processing and handling practices should be employed to poultry meat industry.

PESTICIDE USE, RESIDUES, AND PHEROMONE MATING DISRUPTION IN MICHIGAN USA APPLE ORCHARDS

D.E. Waldstein

Southwest Missouri State University, Mountain Grove, Missouri, U.S.A.

A pesticide residue analysis was conducted in 1998-2001 as a part of the Michigan (U.S.A.) Apple Integrated Pest Management Implementation Project. Each year 1,200 to 2,000 apples were sampled within one week of harvest from randomly selected trees in six to ten commercial orchards. The insecticides azinphos-methyl and phosmet, and the fungicides captan and dithiocarbamates had maximum residues above 1 ppm. All other insecticides, fungicides, and acaricides had maximum residues below 1 ppm and some had zero detectable residues. Azinphos-methyl was the only pesticide with maximum residues above the U.S. Environmental Protection Agency established tolerance. Residues were consistently not correlated with the number of applications or total pesticide active ingredient. Use of selective insecticides and pheromone mating disruption reduced organophosphate use by up to 49% but did not correlate to a decrease in organophosphate residues on fruit. Choice of pesticide may be the most important factor influencing residues. Insect pest management in orchards with mating disruption was equal to or better than the grower standard programs. Mating disruption programs were less profitable than grower standard programs for fruit destined for processing markets. However, for fresh market fruit, the average Isomate® C+ pheromone dispenser and 3M LR MEC® programs were \$54.68/ha and \$65.31/ha more profitable than the grower standard programs. Pheromone mating disruption and selective insecticides offer an environmentally and economically sustainable means for decreasing broad-spectrum insecticide use.

PRELIMINARY RESULTS OF A NATIONAL SURVEY: CONSUMER ATTITUDES TO GENETICALLY MODIFIED FOOD IN TURKEY

P. Basaran

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Since the Genetically Modified Organisms (GMOs) first introduced to Food Systems in 1990s, GMOs have raised economic, ethical, moral, and environmental issues. The socioeconomic effect that GMOs have on agriculture in both developed and developing countries is great. In Europe strong opposition and resistance to GMOs resulted in 39% cancellation of GMO research project over the last 4 years as reported by a European Research Commissioner. Whereas in the USA, Genetically Modified Crop research and development form a great market. Many national surveys have been conducted in developed countries such as USA, Japan, EU etc. However, very few public surveys have been conducted on how the GMOs are perceived in developing countries. To provide an initial investigation into this issue, a national survey has been conducted. Within this survey, confidence in national governmental organization to regulate GM crops were also evaluated by the questions. The preliminary results of this survey will be discussed in this presentation.

NON-RESIDUAL INSECT CONTROL FOR POST HARVEST PROTECTION

S. Navarro

Agricultural Research Organization, Bet Dagan, ISRAEL

Conventional storage methods used in the food industry are susceptible to the ingress of insect pests, which damage and contaminate the stored commodities. Contamination by insects is unacceptable under today's widely prevailing stringent standards of sanitation. During processing, packaging, storage and distribution, food is often exposed to a variety of conditions that bring about insect infestation of the packaged food including penetration of insects through packaging material. Rather the actual damage they cause, insect presence in the food is an indication of poor sanitary conditions existing where the food had been processed. Insect pests of stored products consist of about 500 species that vary in size, survival strategy, life cycle, diet requirements and their food invasion behavior as exhibited by penetration into the food packages. The available synthetic insecticides used in agriculture and households do not meet the prerequisites that would allow them to be incorporated into food packages because of their harmful side effects on the environment and their toxic hazards to both man and wildlife. As a consequence, the search for non-chemical methods of controlling insect infestations in stored products has increased in intensity, as public awareness has risen with respect to pesticide residues in food and their harmful influence on the environment. Several non-residual insect control approaches were thoroughly investigated and documented some 30 to 40 years ago and then stagnated or were abandoned because chemical control methods were cheaper and more convenient. However, many research groups are now in a "rethink" mode as a direct result of pressure from national and international legislative bodies that are fast reducing the range of existing chemical options, while the development of new chemicals for the stored product market has become prohibitively expensive. Today, funding is available for the development of methyl bromide alternatives, where the major requirement is rapid kill. Tomorrow phosphine fumigation, which has long been the mainstay of the grain storage industry, may become restricted because of the fast developing resistance to this fumigant. Many of the non-residual control methods have "niche" potential such as the use of impact forces in the flour industry, the use of the two extreme ranges of the electro-magnetic spectrum (radio frequencies and ionizing radiation) for high-value commodities, or even biological control in situations where insect contamination is not a problem. In the developing world where climates are usually tropical and the prevalence of bag storage often precludes aeration for insect prevention and control, the application of modified atmospheres, and most particularly the special case of sealed (hermetic) storage that makes use of bio-generated atmospheres, has a tremendous potential that is now being exploited. The manipulation of combined approaches such as controlled atmospheres at high temperatures or at high pressures, is also being studied as promising alternatives to conventional fumigation.

DETECTION OF CYANOBACTERIAL SPECIES AND TOXICOLOGICAL STUDIES IN THE LAKE DISTRICT IN TURKEY

F. Gurbuz¹ A.G. Karahan²

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Water blooms of cyanobacteria represent an increasing environmental hazard, in fresh water through a rising eutrophication is placing greater pressures on the uses of water for both drinking and recreational purposes. Many cyanobacteria such as *Microcystis*, *Oscillatoria*, *Anabaena* and *Nodularia* are known to their ability to produce potent toxins which are cyclic peptides and neurotoxic alkaloids. Their presence in water bodies has caused the death of wild and domestic animals worldwide and more recently they have been implicated in human fatalities. The presence of cyanobacterial toxins in drinking water supplies poses a serious health risk to human. It is thus important to monitor cyanobacterial densities and toxin levels in water reservoirs. This will be the first attempt to determine the toxicity of potentially toxic cyanobacteria in some lakes in this region used as sources for drinking water, for fisheries and recreation. Therefore domestic water supplies and reservoir such Egirdir lake will be searched and cyanobacterial bloom samples and water samples will be collected. Toxic strains will be separated from non-toxic strains and toxins will be extracted and purified Toxin separation will be conveyed by chromatographic techniques such as RP-HPLC. The effects of environmental conditions on toxin production will be studied as well.

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DETECTION METHODS OF GMOS

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The use of recombinant DNA technology to produce genetically modified organisms is one of the most important scientific advances of the 20th century. Recent developments have opened many more possibilities for the use of gene technology. The next generation of bacterial cultures will probably contain strains with properties modified by gene technology, for example with new properties created by changing the expression level of one or a few genes. Consumers have a right to expect that all foods on the market are safe to eat-whether those foods are produced through traditional or conventional agriculture or the use of genetically modified product. Currently, there is no single, rapid or inexpensive test to verify whether a crop or processed food product sample is free of GMO or not. However, the methods that are using detection of GMO products can be grouped as DNA-based (PCR-based) techniques and protein-based techniques. DNA-based detection methods in use today are PCR, ligase chain reaction, nucleic acid sequence-based amplification, fingerprinting techniques (RFLP, AFLP, RAPD, etc.), probe hybridization and southern blot analysis. Protein-based testing most commonly use today are western blotting, measuring enzymatic activities of transgenes that represent enzymes (ELISA or immobilized antibody detection test) or the comparison of protein patterns (e.g. one- or two-dimensional gel electrophoresis). Knowledge of the genetics and molecular biology has advanced rapidly during the last decade.

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Scientific material

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(ISBN:951-45-7742-6; 120 pages; price 60 euro)

2-Effect of preharvest calcium treatments on postharvest quality of apples grown in Finland

(ISBN:951-45-8381-7; 112 pages; 9 coloured photos; price 60 euro).

3-Leaf macronutrient composition in relation to growth and yield potential of currants

(ISBN:951-45-9670-6; 124 pages; price 60 euro)

4-Hedelmän-ja marjanviljelyyn soveltuvan sijoituslannoitusmenetelmän kehittäminen

(ISBN:951-45-8914-9; 110 pages; price 50 euro)

5-Efterskörds kvalitet hos äpplen odlade på Åland 1993-1995 efter kalciumbehandling före skörd

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A book based on research report of a project on outdoor vegetables including white cabbage, Savoy cabbage, broccoli, cauliflower, Chinese cabbage, lettuce, cucumber, squash, onion, leek, red beetroot, rutabaga, carrot, celeriac and potato. Nutritional status and calcium uptake in outdoor vegetable stands during the growing season and effect on quality and storability was studied.

(ISBN : 952-5482-10-3; Book size:A4; Length: 300 pages, cost:120 euro)

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(1) Silicon in Food, Agriculture and Environment

Period: 2 - 5 August 2004

For more details please take contact with Prof. Vladimir Matichenkov: Institute Basic Biological Problems Russian Academy of Sciences, Pushchino, Moscow region, 142290, Russia .e-mail: vvmatichenkov@rambler.ru or vvmatichenkov@mail.ifas.ufl.edu
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-The Secretary of the meeting: Dr. Elena Bocharnikova: Institute Physico-Chemical and Biological Problems of Soil Science, Russian Academy of Sciences, Pushchino, Moscow region, 142290, Russia. Email: mswk@rambler.ru

(2) Plant Tissue Culture Association

Date: January 16-18, 2004 (India)

Convenor: Dr L D'Douza .For more details please contact: Sudhir K.Sopory: Professor, Senior Scientist and Group Leader, Plant Molecular Biology, International Centre for Genetic Engineering and Biotechnology, Aruna Asaf Ali Road, New Delhi-110067, India. Fax: 91-11-6162316 / Tel: 91-11-6192962 / sopory@hotmail.com or Isfae@isfae.org

(3) Food and Environment Interactions

Location: Akure, Nigeria.

For more details Contact: Dr. Victor N. Enujiugha: Department of Food Science and Technology, School of Agric. and Agric. Technology, Federal University of Technology, P. M. B. 704, Akure, Nigeria./ Email: venujiugha@yahoo.com or or Isfae@isfae.org

(4) Food and Health (Nutritional Problems and Children Disease)

Location: Argentina. For more details please contact : Annie Hubert, Directeur de Recherche CNRS, 239 rue Mandron, 33 000 Bordeaux, France. E-mail: anahubert@club-internet.fr or or Isfae@isfae.org

(5) International Conference on Bioprocess in Food Industry (ICBF-2004)

Date and Location: 24-27 october, 2004 in Clermont-Ferrand, France. The organizer is Blaise Pascal University, ISFAE being one of the co-organizers. Convenor : Prof. Christian Larroche, Co-convenor : Prof. Ashok Pandey.

For more details please contact: Christian Larroche, Head of Biochemical Engineering department, Chemical and Biochemical Engineering Laboratory CUST - Blaise Pascal University 24, avenue des Landais - BP 206 F-63174 Aubière cedex, France. Tel : (33) 473407429 / Fax : (33) 473407829. URL: <http://www.univ-bpclermont.fr/LABOS/lgcb> Member of ISFAE : <http://www.isfae.org>

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(6) International Symposium on Ecology of Biological Invasions

December 4-6, 2003 School of Environmental Studies, University of Delhi, India. Dr. Inderjit, Symposium Convener , Department of Botany, University of Delhi, Delhi – 110 007, INDIA. E-mail: allelopathy@satyam.net.in, Telephone: 0091-11-2766-2402

(7) Conference on Postharvest Technology & Quality Management in Arid Tropics

24-26 January 2005, Sultan Qaboos University, Sultanate of Oman. Contacts: Assoc Prof. Linus U. Opara & Assoc Prof. Shyam S. Sablani, Department of Bioresource and Agricultural Engineering College of Agricultural and Marine Sciences, Sultan Qaboos University, P.O. Box 34, Al-Khod, Sultanate of Oman. Emails: linus@squ.edu.om and shyam@squ.edu.om

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New Books

Crop Management and Postharvest Handling of Horticultural Crops Vol. 2. Postharvest Technology of Fruits and Vegetables

Editor

Ramdane Dris PhD.

World Food Ltd. Meri-Rastilantie 3 C, FIN-00980 Helsinki Finland , www.world-food.net

Raina Niskanen PhD.

World Food Ltd. Meri-Rastilantie 3 C, FIN-00980 Helsinki, Finland www.world-food.net

Shri Mohan Jain PhD.

Plant Breeding and Genetics Section Join FAO/IAEA, Division of Nuclear Techniques in Food and Agriculture

Department of Nuclear Sciences and Applications, International Atomic Energy Agency, Vienna, Austria

This book volume focuses on the influence of postharvest practices on the quality of horticultural commodities in order to enhance preservation of fresh fruits and vegetables (including root and tuber crops) grown under different climatic conditions, worldwide. We have provided information by highlighting the achievements related to minimizing the postharvest losses, postharvest technology, physiological changes, storage problems and processing aspects. Fifteen chapters are included in this book volume, which are: The Cool Chain and Transport: An Integrated Temperature Management System For Fresh Produce; Techniques of Modified and Controlled Atmosphere Storage for Fresh Fruits and Vegetables; Quality, Handling and Storage of White Asparagus; Food Safety on Vegetables; Postharvest Technology of Onions; Mechanics and Texture of Fruits and Vegetables; Modified and Controlled Atmospheres to Reduce Quality Loss of Fresh Fruits and Vegetables at Postharvest; Physiology and Postharvest Quality of Date Palm Fruits; Citrus: Post-Harvest Cold Chain; Non-destructive Harvest Time Decision of Horticultural Crops; Development, Physiology and Postharvest Technology of Mango Fruit; Postharvest Biology and Technology of Longan Fruit; Postharvest Physiology and Quality Changes of Loquat Fruit; Postharvest Physiology and Handling of Litchi Fruit; Postharvest Technology of Root and Tuber Crops. For more information kindly visit the website www.world-food.net or take contact with the Ramdane Dris , World Food Ltd. Meri-Rastilantie 3 C, Fin-00980 Helsinki Finland. Tel/Fax: 00 358 9 75 92 775, Email: Info@world-food.net or Dris.uh@alnetti.com

Publisher: Science Publisher; ISBN:1-57808-216-1; Year: 2002

Crop Management and Postharvest Handling of Horticultural Crops Vol. 3. Crop Fertilisation, Nutrition and Growth

Editor

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Department of Nuclear Sciences and Applications, International Atomic Energy Agency, Vienna, Austria

This book has compiled information on management tools, and also to review factors affecting the plant mineral nutrition and growth. We have highlighted the importance of fertilizers and mineral nutrition to improve agricultural production, yield, and amelioration of soil fertility. This book also highlights growth, production, yield and quality which can be limited by suboptimal conditions such as soil, salinity, poor drainage, water supply, fertilization programs, physical conditions affecting root growth and function or handling operations. The production of good quality food can not be achieved without the strict control of the use of fertilizers and other pesticide sprays. Thirteen chapters are included in the present book volume and they are as follows:

Environmental Effects of Fertilizers; Crop Quality as Affected by Adverse Conditions: Importance of the Knowledge of Nutritional Status; The Importance of Boron in Apple Production Under Polish Conditions; Integrated nutrient management in Indian soils for sustainable crop production; Role of Phosphorus on Carbon Uptake and Fruit Quality of Strawberry; Nutrition of Tropical Horticulture and Quality Product; Soil Fertility Management with Wood Ash; Role of the Grafting in the Horticultural Plants; Domestication of Jujube Fruit Trees, Behaviour and Yields of The Olive Tree (*Olea europaea L.*) in Rain Fed Arid Area; Evaluation of Dairy Sludge as a Grassland Fertilizer; Factors Affecting Content And Composition Of Essential Oils In Aromatic Plants, Edible Mushroom Cultivation and Production of Human Food by Utilization of Agricultural Waste. For more information kindly visit the website www.world-food.net or take contact with the Ramdane Dris , World Food Ltd. Meri-Rastilantie 3 C, Fin-00980 Helsinki Finland. Tel/Fax: 00 358 9 75 92 775, Email: Info@world-food.net or Dris.uh@alnetti.com

Publisher: Science Publisher; ISBN:1-57808-278-1; Year :2003

Plant Physiology - Characteristics-Breeding-Genetics -

Editor

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Catherine Barry-Rayan PhD.

Food Science Research Center, University of Limerick, Ireland

This book contains a compilation of articles with a great number of information dealing with different issues related to plant physiology, genetics and breeding. This book includes recent information on scientific research, worldwide. The main focus of this book is to review factors affecting physiological changes occurring during the growth and development and view on breeding of crops. Actually, there is still a lack of fresh information on the impact of physiological changes on the activity of some metabolisms and similar changes. The breeding is also considered as an approach to improve the quality traits of some crops. The book can be useful for scientists, researchers, students or experts dealing with plant physiology, plant biotechnology, plant pathology breeding and genetics. For more information kindly visit the website www.world-food.net or take contact with the Ramdane Dris, World Food Ltd. Meri Rastilantie 3 C, Fin-00980 Helsinki Finland. Tel/Fax: 00 358 9 75 92 775, Email: Info@world-food.net or Dris.uh@alnetti.com

Publisher: Science Publisher; ISBN:1-57808-240-4; Year : 2002

Food Technology and Quality Evaluation

Editor

Ramdane Dris PhD.

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Arun Sharma PhD.

Food Science & Safety Section Food Technology Division, Bhabha Atomic Research Centre, Mumbai 400 085, India

The book contains a great number of information dealing with different issues related to crop science and technology with its broad aspect. The attempts to prolong and preserve the freshlike attributes of horticultural food crops date back to historic times. This fact has been very interestingly brought forward in this book in an article authored by the Chinese scientists. The book also contains a number of articles with valuable information on the application of recent techniques and development of methodologies. The present book describe the impact of environmental factors on food crop quality, including handling parameters, quality evaluation, CA and MAP storage conditions, worldwide. A few articles contain frontline research and development in this area. Though only a few horticultural commodities have been included, the book covers the entire spectrum of activities in the area of fruit and vegetable and few other plant products such as medicinal plants, production, yield, and quality assessment. The book should equally interest both the researchers and lay persons. For more information kindly visit the website www.world-food.net or take contact with the Ramdane Dris, World Food Ltd. Meri-Rastilantie 3 C, Fin-00980 Helsinki Finland. Tel/Fax: 00 358 9 75 92 775, Email: Info@world-food.net or Dris.uh@alnetti.com

Publisher: Science Publisher; ISBN:1-57808-235-8; Year : 2002

Influence of Environment on Crop Production, Growth and Disease

Editor

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Iqrar Khan PhD.

Sultan Qaboos University College of Agriculture P.O. Box 34, PC-123 Muscat, Sultanate of Oman

The book contains a compilation of articles with a great number of information dealing with different issues related to environment, crop cultivation, growth, physiology and disease incidence. The main focus of this book is to review environment factors influencing the physiological changes and quality of food crops and plant. Actually, there is still a lack of recent information on the physiological changes and quality control strategies of various crop. The book can be useful for scientists, researchers, students or experts dealing with various fields such as agriculture, horticulture, plant physiology, plant pathology, plant nutrition, agriculture, food technology, food science and biotechnology. For more information kindly visit the website www.world-food.net or take contact with the Ramdane Dris, World Food Ltd. Meri-Rastilantie 3 C, Fin-00980 Helsinki Finland. Tel/Fax: 00 358 9 75 92 775, Email: Info@world-food.net

Publisher: Science Publisher; ISBN:1-57808-257-9; Year : 2002

Plant Nutrition - Growth and Diagnosis

Current Status and Future Prospects

Editor

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International Atomic Energy Agency, Plant Breeding and Genetics Section, Division Of Nuclear Sciences and Applications,
Wagramer Strasse 5, P.O. Box 200, A-1400 Vienne Austria

The main focus of this book is also to deliver knowledge-based management tools. The use of recent methods or advanced techniques should make the information more meaningful to scientists and other readers and allow them to apply techniques to a wider range of crops. The manuscripts of this book interactions between growth, mineral nutrition and quality performance for a wide variety of crops. For more information kindly visit the website www.world-food.net or take contact with the Ramdane Dris , World Food Ltd. Meri-Rastilantie 3 C, Fin-00980 Helsinki Finland. Tel/Fax: 00 358 9 75 92 775, Email: Info@world-food.net or Dris.uh@alnetti.com.

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Volume 1: Preharvest Practice

Worldwide climatic changes have been raising concerns about potential changes to crop yields and production systems. Such concerns include the ability to accommodate these uncertain effects in order to ensure an adequate food supply for an ever increasing human population. To increase food security and alleviate poverty there is a need to introduce improved crop-production technologies to farmers or growers and by promoting appropriate policies that help them to adopt new technologies. Responsible agriculture must be viable yet sustainable - economically, environmentally and socially. This book focuses on the preharvest practices on the production and quality of food crops. Nine chapters are included in this book, which are: Effect of Preharvest Factors on the Quality of Vegetables Produced in the Tropics - Vegetables: Growing Environment and the Quality of Produce; Effects of Agronomic Practices and Processing Conditions on Tomato Ingredients; Modelling Fruit Quality: Ecophysiological, Agronomical and Ecological Perspectives; Sprays Technology in Perennial Tree Crops; Chestnut, an Ancient Crop With Future; Improvement of Grain Legume Production in Semi-Arid Kenya Through Biological Nitrogen Fixation: The Experience With Tepary Bean (*Phaseolus Acutifolius* a Gray var. *Latifolius*); Impact of Ozone on Crops; Saffron Quality: Effect of Agricultural Practices, Processing and Storage; Fruit and vegetables Harvesting Systems. It will stimulate readers thinking on key constraints in agriculture and horticulture. Readers will get acquainted with a wide range of information, technologies and methodologies. This book will be especially useful to researchers engaged in post harvest research. Also, it will be valuable for the graduate and post-graduate students majoring in food sciences and researchers.

Publisher: Kluwer, Hardbound ISBN: 1-4020-1698-0, Price: EUR 125.00 / USD 138.00 / GBP 86.00

Volume 2: Plant Mineral Nutrition and Pesticide Management

Nutrients are essential for plant growth, development and completion of their life cycle. Mineral fertilizers are keys to the world food supplies. However, there is a growing concern about the safety and quality of food due to over fertilization. Their excessive use is a cause of serious concern on food quality and human health. This book covers various aspects on mineral nutrition, fertilizers and pesticide management to improve agricultural production, yield and to amelioration of soil fertility. It contains nine chapters on Environmental and Biological Monitoring of Exposure to Pesticides in

occupationally Exposed Subjects; Crop Quality Under Adverse Conditions: Importance of determining the Nutritional Status; Phosphorus Management in French Bean (*Phaseolus vulgaris* L.); Nutrition and Calcium Fertilization of Apple Trees Diagnosis, Prediction and Control of Boron Deficiency in Olive Trees; Boron-Calcium Relationship in Biological Nitrogen Fixation Under Physiological and Salt-Stressing Conditions; Lime-Induced Iron Chlorosis in Fruit Trees; Si in Horticultural Industry; Biological Monitoring of Exposure to pesticides in the General Population (Non-Occupationally Exposed to Pesticides). This book will be especially useful to researchers, the graduate and post-graduate students majoring in food sciences and researchers.

Publisher: Kluwer, Hardbound ISBN: 1-4020-1699-9, Price: EUR 120.00 / USD 132.00 / GBP 83.00

Volume 3: Quality Handling and Evaluation

An effective food quality assurance system is essential throughout during harvest and retail display to provide a consistently good quality supply of fresh food crops to the consumers and to protect the reputation of a given marketing label. This book covers various aspects of quality handling and assessment, including handling parameters, quality evaluation, CA and MAP storage conditions in a broad sense. It emphasises on developing better methods of monitoring quality and safety attributes of fresh produce as part of a quality assurance system and quality assessment and maintenance. To meet the changing demands for quality, availability, cost, appearance and service the actors in the supply chain need to cooperate. We have included eighteen chapters. They are: Enzymes and Quality Factors of Fruits and Vegetables; Volatile Flavours in Strawberries: A Description of The Components, and How to Analyse Them; Methods to Evaluate the Antioxidant Activity; Essential Oil Drugs-Terpene Composition of Aromatic Herbs; Fruit and Vegetables Harvesting Systems; Integral Handling of Banana; Economics and Organisation of Horticultural Postharvest; Production; Handling Machinery and Damage inflicted to the Product; Mechanical Damage During Fruit Post-Harvest Handling: Technical and Physiological Implications; Harvest and Postharvest Conditions for apples and Pears; Rapid quality evaluation techniques of horticultural crops; Table Grape Postharvest Management and Safety Issues ; Fruit Postharvest Technology: Instrumental Measurement of Ripeness and Quality; Developmental Changes During Strawberry Fruit Ripening and Physico-Chemical Changes During Postharvest Storage; Processing of horticultural Crops in the Tropics; Quality Dynamics and Quality Assurance of Fresh Fruits and Vegetables in Pre- and Postharvest; Modification of Fruit Ripening by Genetic Transformation; Quality of Equilibrium Modified Atmosphere Packaged (EMAP) Fresh-Cut Vegetables. This book will be especially useful to researchers engaged in post harvest research, the graduate and post-graduate students majoring in food sciences and researchers.

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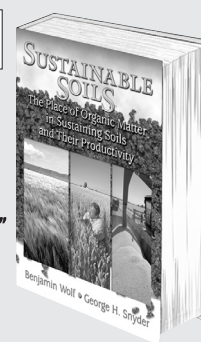
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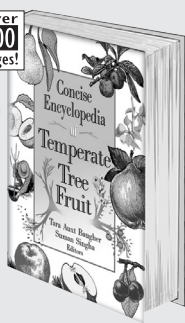
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