

From the Director's Desk

India is one of the richest and most diversified countries as far as biodiversity, natural products and resources are concerned. Dissemination of information on various topics related to these subjects has acquired unprecedented prominence in the last two decades as every field, be it science, technology or engineering, look to natural resources as a safe source, both environmentally as well as technologically.

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Gangan Prathap
(Former Director)
CSIR-NISCAIR

NATURAL PRODUCTS AND RESOURCES REPOSITORY (NPARR)

(A Quarterly Electronic Repository of Current Information on Natural Products and Resources)

This repository is produced by systematic survey of research and review papers published in primary journals and providing abstracts/summaries and bibliographic details of applied research. It is covering information on all aspects of natural products and resources of plants and animals. The abstracts are presented in various categories viz. Beverages, Cosmetics, Dyes, Essential oils, Fats/Oils, Feed/Fodder, Fibre, Flavour/Fragrance, Food, Fruits, Fuel, Gum/Rubber, Insecticides /Fungicides/Nematicides, Oils/Fats, Poultry, Pulp/Paper, Spices/Condiments, Therapeutics, Vegetables, Wood, etc. Title, journal, author(s), address of corresponding author (Asterisk marked) of the original paper are provided for scientific reference and citation. NPARR inserts new products and technologies developed forthcoming conferences or educational event, book reviews, projects completed and theses awarded.

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NATURAL PRODUCTS AND RESOURCES REPOSITORY (NPARR)

(A Quarterly Electronic Repository of Current Information on Natural Products and Resources)

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NATURAL PRODUCTS AND RESOURCES REPOSITORY (NPARR)

BEVERAGES (incl. Juices, Tea/Coffee, Yoghurt and other natural soft drinks)

NPARR, 7(4), 2016-326 Developing a carob-based milk beverage using different varieties of carob pods and two roasting treatments and assessing their effect on quality characteristics

This work aimed at formulating a carob-based milk beverage and assessing its chemical and sensory properties. Six varieties of carob pods, each processed into roasted and unroasted powders, were used to develop 12 prototypes of the beverage. Chemical and physico-chemical analyses (moisture, ash, fibre, protein, sugars, total-phenolics, total-antioxidants, water activity and colour) and sensory tests were conducted. The variety of carob pod had a significant effect on all chemical variables in carob powders ($P < 0.01$), except for sugars, and when incorporated in the beverage, on moisture, total phenolics, total antioxidant activity and colour parameters (L, a, b; P -values < 0.001). Roasting treatment significantly increased fibre, total phenolics, total antioxidant activity (P -values < 0.001), fructose, glucose (P -values < 0.05), and a-value levels ($P < 0.01$), significantly lowered moisture ($P < 0.05$), water activity, L- and b-values (P -values < 0.001) in carob powders; and significantly increased the beverage's total phenolics, a-value (P -values < 0.001) and total antioxidant activity ($P < 0.01$). Roasting treatment significantly increased the beverage's acceptability ratings. Beverages formulated with roasted carob powder had higher ratings for level of residue, colour, caramel odour, mocha odour and flavour, roasted coffee odour and flavour, viscosity mouthfeel and bitter aftertaste. Principal component analysis was conducted; PC1 and PC2 separated attributes

according to roasting treatment and variety of carob pods, respectively. The use of Akkari roasted and Baladi Ikleem el Kharoob roasted to formulate a carob-based milk beverage is recommended [N. Srour, H. Daroub, I. Toufeili, A. Olabi*, (Nutrition and Food Sciences Department, Faculty of Agricultural and Food Sciences, American University of Beirut, Riad El Solh, Beirut, Lebanon) *Journal of the Science of Food and Agriculture*, 2016, **96**(9), 3047-3057].

NPARR, 7(4), 2016-327 Improving the sweet aftertaste of green tea infusion with tannase

The present study aims to improve the sweet aftertaste and overall acceptability of green tea infusion by hydrolyzing (-)-epigallocatechin gallate (EGCG) and (-)-epicatechin gallate (ECG) with tannase. The results showed that the intensity of the sweet aftertaste and the score of overall acceptability of the green tea infusion significantly increased with the extension of the hydrolyzing treatment. (-)-Epigallocatechin (EGC) and (-)-epicatechin (EC) were found to be the main contributors for the sweet aftertaste, based on a trial compatibility with EGCG, ECG, EGC, and EC monomers, and a synergistic action between EGC and EC to sweet aftertaste was observed. A 2.5:1 (EGC/EC) ratio with a total concentration of 3.5 mmol/L gave the most satisfying sweet aftertaste, and the astringency significantly inhibited the development of the sweet aftertaste. These results can help us to produce a tea beverage with excellent sweet aftertaste by hydrolyzing the green tea infusion with tannase [Y. N. Zhang, J. F. Yin, J. X. Chen, F. Wang, Q. Z. Du*, Y. W. Jiang, Y. Q. Xu (Institute of Food Chemistry, Zhejiang Gongshang University, 149 Jiaogong Road, Hangzhou, Zhejiang, China) *Food Chemistry*, 2016, **192**, 470-476].

NPARR, 7(4), 2016-328 Strawberry-flavored yogurts and whey beverages: What is the sensory profile of the ideal product?

This study aimed to evaluate the sensory profile and Brazilian consumers' liking of strawberry-flavored yogurts and whey beverages (fermented or nonfermented) with different fat contents that were sweetened with sugar or nonsugar sweeteners. We also determined the influence of sensory attributes on consumer preferences and the profile of the ideal product. Nonfermented whey beverages (NFWB) and "light" yogurt were less liked. The NFWB were less acidic, less viscous, and with lower smoothness of mouthcoating, sweeter and with a more intense artificial strawberry aroma (ASA) than the fermented products. Low-fat yogurts were more liked, more viscous, and had higher smoothness of mouthcoating than nonfat yogurts. Fermented-whey beverages were as liked as yogurts. Viscosity and smoothness of mouthcoating positively influenced consumer liking. The ideal product had higher levels of brightness, artificial strawberry taste, artificial strawberry aroma, and sweet taste; intermediate smoothness of mouthcoating, color, and viscosity; and low particles, acid taste, and aroma [D. R. Janiaski, T. C. Pimentel, A. G. Cruz, S. H. Prudencio*, (Universidade Estadual de Londrina (UEL), Departamento de Ciência e Tecnologia de Alimentos (DCTA), Londrina, Paraná, Brazil) *Journal of Dairy Science*, 2016, 99(7), 5273-5283].

NPARR, 7(4), 2016-329 Effect of high pressure processing on dispersive and aggregative properties of almond milk

A study was conducted to investigate the impact of high pressure (450 and 600 MPa at 30 degrees C) and thermal (72, 85 and 99 °C at 0.1 MPa) treatments on dispersive and aggregative characteristics of almond milk. Experiments were conducted using a kinetic pressure testing

unit and water bath. Particle size distribution, microstructure, UV absorption spectra, pH and color changes of processed and unprocessed samples were analyzed. Raw almond milk represented the mono model particle size distribution with average particle diameters of 2 to 3 μ m. Thermal or pressure treatment of almond milk shifted the particle size distribution towards right and increased particle size by five- to six-fold. Micrographs confirmed that both the treatments increased particle size due to aggregation of macromolecules. Pressure treatment produced relatively more and larger aggregates than those produced by heat treated samples. The apparent aggregation rate constant for 450 MPa and 600 MPa processed samples were $k_{450\text{MPa}, 30^\circ\text{C}}=0.0058\text{s}^{-1}$ and $k_{600\text{MPa}, 30^\circ\text{C}}=0.0095^{-1}$ respectively. This study showed that dispersive and aggregative properties of high pressure and heat-treated almond milk were different due to differences in protein denaturation, particles coagulation and aggregates morphological characteristics. Knowledge gained from the study will help food processors to formulate novel plant-based beverages treated with high pressure [S Dhakal, M. M. Giusti, V. M. Balasubramaniam* (Ohio State Univ, Dept Food Sci & Technol, 333 Parker Food Sci & Technol Bldg, 2015 Fyffe Rd, Columbus, OH 43210 USA) *Journal of the Science of Food and Agriculture*, 2016, 96(11), 3821-3830].

NPARR, 7(4), 2016-330 Physicochemical and sensory quality of several commercial Brazilian chocolate milk beverages

Five brands of Brazilian chocolate milk were subjected to physicochemical and acceptability analysis. The moisture content, fat content, pH and soluble solids content varied between 78.35 and 84.27 g/100 mL, 1.68 and 3.08 g/100 mL, 7.11 and 7.44, 14.0 and 19.0 °Brix, respectively, while the ash contents and % lactic acid equivalents were similar. Four of the tested brands had acceptable scores

in all attributes; however, one had lower acceptability scores and lower values for luminosity, chromaticity, b^* and hue angle, which are potential indicators of the sensory quality. Strong chocolate aroma, strong chocolate flavour, strong brown colour, brightness and sandiness may be used as indicators of low acceptability for chocolate milk

[F. Della Lucia*, J. R. Do Carmo, C. S. N. Morais, C. A. Nunes, A. C. M. Pinheiro, E. B. Ferreira, S. M. Pinto, L. R. de Abreu, E. V. D. B. Vilas Boas (Nutrition Faculty, Federal University of Alfenas, Rua Gabriel Monteiro da Silva 700, Alfenas, MG, Brazil) *International Journal of Dairy Technology*, 2016, 69(3), 364-371].

COSMETICS/COSMECEUTICALS

NPARR, 7(4), 2016-331 Safety assessment of microbial polysaccharide gums as used in cosmetics

The Cosmetic Ingredient Review Expert Panel assessed the safety of 34 microbial polysaccharide gums for use in cosmetics, finding that these ingredients are safe in cosmetic formulations in the present practices of use and concentration. The microbial polysaccharide gums named in this report have a variety of reported functions in cosmetics, including emulsion stabilizer, film former, binder, viscosity-increasing agent, and skin-conditioning agent. The Panel reviewed available animal and clinical data in making its determination of safety [M. M. Fiume*, B. Heldreth, W. F. Bergfeld, D. V. Belsito, R. A. Hill, C. D. Klaassen, D. C. Liebler, J. G. Marks, R. C. Shank, T. J. Slaga (Care of Gill LJ, Cosmet Ingredient Review, 1620L St NW, Suite 1200, Washington, DC 20036 USA) *International Journal of Toxicology*, 2016, **35**(1), 5S-49S].

NPARR, 7(4), 2016-332 Impact of eye cosmetics on the eye, adnexa, and ocular surface

Despite the fact that cosmetic products undergo rigorous testing to ensure they are safe for human use, some users report mild discomfort following their application. The cutaneous changes, such as allergic dermatitis, are well reported, but the ocular changes associated with eye cosmetic use are less so. Some pigmented cosmetic products may accumulate within the lacrimal system and conjunctivae over many years of use, but immediate reports of eye discomfort after application are most common. Changes to the tear film and its stability may occur shortly after application, and contact lens wearers can also be affected by lens spooliation from cosmetic products. Additionally, creams used in the prevention of skin aging are often applied

around the eyes, and retinoids present in these formulations can have negative effects on meibomian gland function and may be a contributing factor to dry eye disease. The aim of this review is to summarize current knowledge regarding the impact of cosmetic products on the eye, ocular surface, and tear film [A. Ng*, K. Evans, R. V. North, L. Jones, C. Purslow (Univ Waterloo, Sch Optometry & Vis Sci, Ctr Contact Lens Res, 200 Univ Ave West, Waterloo, ON N2L 3G1, Canada) *Eye & Contact Lens-Science and Clinical Practice*, 2016, **42**(4), 211-220].

NPARR, 7(4), 2016-333 Optimized method of dispersion of titanium dioxide nanoparticles for evaluation of safety aspects in cosmetics

Nanoparticles agglomerate when in contact with biological solutions, depending on the solutions' nature. The agglomeration state will directly influence cellular response, since free nanoparticles are prone to interact with cells and get absorbed into them. In sunscreens, titanium dioxide nanoparticles (TiO₂-NPs) form mainly aggregates between 30 and 150 nm. Until now, no toxicological study with skin cells has reached this range of size distribution. Therefore, in order to reliably evaluate their safety, it is essential to prepare suspensions with reproducibility, irrespective of the biological solution used, representing the above particle size distribution range of NPs (30-150 nm) found on sunscreens. Thus, the aim of this study was to develop a unique protocol of TiO₂ dispersion, combining these features after dilution in different skin cell culture media, for in vitro tests. This new protocol was based on physicochemical characteristics of TiO₂, which led to the choice of the optimal pH condition for ultrasonication. The next step consisted of stabilization of protein capping with acidified bovine serum albumin, followed by an adjustment of pH to 7.0. At each step, the solutions were analyzed by dynamic light scattering and transmission electron microscopy. The final concentration of NPs was

determined by inductively coupled plasma-optical emission spectroscopy. Finally, when diluted in dulbecco's modified eagle medium, melanocytes growth medium, or keratinocytes growth medium, TiO₂-NPs displayed a highly reproducible size distribution, within the desired size range and without significant differences among the media. Together, these results demonstrate the consistency achieved by this new methodology and its suitability for in vitro tests involving skin cell cultures [K. P. Carvalho*, N. B. Martins, A. R. L. P. Ribeiro, T. S. Lopes, R. C. de Sena, P. Sommer, J. M. Granjeiro (Natl Inst Metrol Qual & Technol INMETRO, Lab Tissue Bioengn, Div Mat Appl Life Sci, BR-25250020 Duque De Caxias, Brazil) *Journal of Nanoparticle Research*, 2016, **18**(8), DOI: 10.1007/s11051-016-3542-7].

NPARR, 7(4), 2016-334 **Role of fatty acid composites in the toxicity of titanium dioxide nanoparticles used in cosmetic products**

It has been recognized that the use of nanoparticles (NPs) in the cosmetic industry results in products with better efficacy and functionality. However, recent advances in molecular toxicology have revealed that NP exposure can promote cytotoxicity and oxidative damage, which has raised health concerns in the use of NPs in personal care products. Nevertheless, the mechanistic basis for the toxicity and safety of cosmetic NPs is poorly understood. The goal of the study was to determine the cytotoxicity and intracellular distribution of titanium dioxide (TiO₂) NPs containing fatty acid composites (palmitoleic acid, palmitic acid, stearic acid and oleic acid) commonly used in cosmetic products. Two types of cells, human fibroblast skin cells and adenocarcinoma lung cells, were exposed to either bare TiO₂ NPs or TiO₂ NPs mixed with fatty acids for up to 48 hr. NMR analysis confirmed that the fatty acid composites remained in the NPs after wash. The cytotoxicity

of TiO₂ NPs was determined by cell viability measurement using quantitative confocal microscopy, and the localization of two different forms of TiO₂ NPs were assessed using electron spectroscopic imaging with transmission electron microscopy. TiO₂ NPs containing fatty acids posed significantly reduced cytotoxicity (80-88% decreases) than bare NPs in both cell types. Furthermore, there was less intracellular penetration of the NPs containing fatty acid composites compared with bare NPs. These results provide important insights into the role of fatty acids in protecting the cells from possible toxicity caused by NPs used in the production of cosmetic products [J. Chang, C. W. Lee, H. H. Alsulimani, J. E. Choi, J. K. Lee, A. Kim, B. H. Park, J. Kim, H. Lee* (Northeastern Univ, Dept Pharmaceut Sci, Boston, MA 02115 USA) *Journal of Toxicological Sciences*, 2016, **41**(4), 533-542].

NPARR, 7(4), 2016-335 **Effect of cosmetic matrices on the release and odour profiles of the supercritical CO₂ extract of *Origanum majorana* L.**

In this study, the effect of different cosmetic matrices on the release profile and odour intensity of the fragrance *O. majorana* was investigated for the first time. The fragrance compounds of *O. majorana* were extracted by supercritical fluid extraction using carbon dioxide (SFE-CO₂) at 40 °C and two operating pressures (8.5 and 10 MPa), and their chemical profiles were assessed by gas chromatography with flame ionization detector coupled with mass spectrometry (GC-FID/MS). Lastly, the fragrance compounds were incorporated into three cosmetic matrices (glycerine, dipropylene glycol and skin lotion) to assess their release and odour profiles over time using dynamic headspace (DHS)/GC-FID/MS and Odour Value concept, respectively. The SFE-CO₂ enabled recovering extracts with the pleasant scent of the living plant, and the increment of pressure induced an increase on the

extraction yield. GC-FID/MS analyses revealed that oxygen-containing monoterpenes was the principal group of components identified in both SFE-CO₂ extracts. The fragrance compounds were more retained in dipropylene glycol, and the major deviations from the original odour intensity (control) were observed in the presence of dipropylene glycol and skin lotion. The hydrophilic character of the

cosmetic matrices strongly influenced the release of the fragrance compounds, thus affecting the odour profile of the studied mixtures [P. Costa*, C. V. Velasco, J. M. Loureiro, A. E. Rodrigues (Univ Porto, Fac Engn, Lab Associado LSRE LCM, Rua Dr Roberto Frias S-N, P-4200465 Oporto, Portugal) *International Journal of Cosmetic Science*, 2016, **38**(4), 364-374].

DYES (incl. Food colorants)

NPARR, 7(4), 2016-336 Highly selective adsorption of organic dyes containing sulphonic groups using $\text{Cu}_2(\text{OH})_3\text{NO}_3$ nanosheets

In this study, we report a facile approach to synthesize $\text{Cu}_2(\text{OH})_3\text{NO}_3$ nanosheets via simply sono-chemical method, which showed high efficiency and selectivity towards the adsorption of organic dyes containing sulphonic groups. The structure and morphology of the nanosheets were characterized by X-ray diffraction, scanning electron microscopy, transmission electron microscopy, Fourier transform infrared spectroscopy, N_2 adsorption-desorption isotherms, particle size and zeta potential analysis. The adsorption results indicated that the equilibrium data coincide very well with Langmuir isotherm, and the maximum adsorption capacities for Congo red, methyl blue and methyl orange were 1864, 1270 and 959 mg/g, respectively. The kinetic data can be explained by pseudo-second-order model. The $\text{Cu}_2(\text{OH})_3\text{NO}_3$ nanosheets also demonstrated high selectivity towards the adsorption of dyes containing sulphonic groups from mixed dye solutions. The rational mechanism of adsorption was attributed to hydrogen bonding, electrostatic attractions and ion exchanges between the dye molecules and $\text{Cu}_2(\text{OH})_3\text{NO}_3$ in the adsorption process [J. C. Jia, H. H. Wang, H. L. Niu*, J. S. Chen, J. M. Song, C. J. Mao, S. Y. Zhang, Y. H. Gao, C. L. Chen (Anhui Univ, Coll Chem & Chem Engr, Hefei 230039, Peoples R China) *Journal of Nanoparticle Research*, 2016, **18**(9), DOI: 10.1007/s11051-016-3567-y].

NPARR, 7(4), 2016-337 Color and electrical resistance evaluation of cotton fabrics composed of stainless steel yarns treated with direct and reactive dyes

The aim of this work was to investigate the color change of cotton fabrics with stainless steel yarns incorporated. In order to establish the

impact of conductive yarns' composition properties in the fabric, concentrations and two different dyeing profiles based on direct and reactive dyes chemistry were applied. The success of this novel e-textile design was evaluated colorimetrically with two different dye concentrations as well through various linear electrical resistances to obtain solid statistical conclusions. The dyed samples were colorimetrically evaluated and the electrical resistances of conductive yarns inside the fabric structure were compared and discussed statistically before and after dyeing. The results provided evidence that dyeing has great influence on electrical resistances of conductive yarns used as transmission lines for electro-textile applications. The greatest changes in electrical resistances were observed with samples including thin conductive yarns and untwisted conductive yarn after dyeing processes. Additionally, it can be concluded that the presence of stainless steel conductive threads significantly retards the dyeing processes depending on the dyestuff concentration and weave type, resulting in major color differences, especially when plain weave type is used or the dyestuff concentration is less than 1% for twill and sateen weaves [S. K. Bahadir*, S. Jevsnik, D. Fakin, U. K. Sahin (Istanbul Tech Univ, ITU Tekstil Teknol & Tasarimi Fak, Inonu Cd 65, TR-34437 Istanbul, Turkey) *Textile Research Journal*, 2016, **86**(13), 1356-1371].

NPARR, 7(4), 2016-338 The potential application of tomato seeds as low-cost industrial waste in the adsorption of organic dye molecules from colored effluents

The objective of current study is to investigate the tomato seeds (TSs) as a low-cost industrial waste material to be employed in the adsorption of two acid dyes (C.I. Acid Red 14 (AR14) and C.I. Acid Blue 92 (AB92)). In this regard, field emission scanning electron microscope images, Fourier transform infrared

analysis, and determination of isoelectric pH were used to characterize the surface morphology, functional groups, and surface charge of TS, respectively. Initial dye concentration, pH, and adsorbent dosage were studied as the key parameters that affect the adsorption performance. The isotherm, kinetic, and thermodynamic parameters of removal process were determined. It was found that the experimental data had followed the Langmuir isotherm model. The pseudo-second-order kinetic model described the rate of adsorption process properly. Temperature variation of adsorption process indicated that the removal of AR14 and AB92 by TS was an exothermic and spontaneous procedure. Finally, the cost analysis demonstrated that TS can be suggested as an effective and eco-friendly biosorbent for the removal of organic dyes from colored textile wastewaters [H. Najafi, E. Pajootan*, A. Ebrahimi, M. Arami (Amirkabir Univ Technol, Dept Text Engn, 424 Hafez Ave, Tehran 158754413, Iran) *Desalination and Water Treatment*, 2016, **57**(32), 15026-15036].

NPARR, 7(4), 2016-339 **Competitive removal of malachite green and rhodamine b using clinoptilolite in a two-dye system**

Surface and groundwaters become contaminated with dyes due to discharge into the environment, which increases the risk of a number of human diseases. Many methods of dye removal from discharge waters at the source have been developed, but few are effective and the

most effective method (activated carbon) is very expensive. The purpose of the present study was to test a natural zeolite (clinoptilolite type) as a potentially effective and inexpensive method to remediate dye discharge into the environment. In the removal experiments, malachite green (MG) and rhodamine B (RB) cationic dyes were used. The effects of various experimental conditions such as initial dye concentration, pH, and temperature on dye removal were investigated in a single-dye system. The degree of removal of MG and RB increased with increasing initial concentration and temperature of the dye in a single-dye system. An increase in pH decreased RB removal, but increased MG removal. In a two-dye system, MG and RB adsorption decreased by ~41.74 and 21.51%, respectively, due to competitive adsorption of the two dyes. Adsorption reflected a pseudo-second order kinetics model with high correlation coefficients ($r^2 = 0.996-1.000$) in single-dye and two-dye systems. Adsorption was most consistent with the Langmuir-1 and the Redlich-Peterson isotherm models with high correlation coefficients ($r^2 = 0.987-0.999$) in both systems. The Langmuir-1 adsorption capacities were determined as 43.86 and 44.25 mg/g for the removal of MG and RB in single dye systems, respectively. In a two-dye system, the Langmuir-1 capacities were 20.62 and 31.54 mg/g for the removal of MG and RB, respectively [E. Baran, B. Acemioglu* (Department of Chemistry, Faculty of Science and Arts, University of Kilis 7 Aralik, Kilis, Turkey) *Clays and Clay Minerals*, 2016, **64**(3), 299-313].

ESSENTIAL OILS (incl. Flavour and Fragrance)

NPARR, 7(4), 2016-340 Alternative preservation method against *Sclerotium* tuber rot of Jerusalem artichoke using natural essential oils

The *Sclerotium* tuber rot fungus (*Sclerotium rolfsii* Sacc.) represents a serious problem for Jerusalem artichoke (JA) tubers during storage periods. The aim of this study was to investigate an alternative preservation method using a natural essential oil to inhibit the fungal growth, increase storability, and keep nutritive value of JA tubers under storage conditions. In vitro antifungal activity was assessed using two essential oils; caraway and spearmint at concentrations of 2, 3, 4 and 5%. Among the tested treatments, caraway oil at 2% resulted in complete inhibition of the fungal growth. In the storage experiment, two preservation methods were applied using caraway oil. In the first method, JA tubers were treated with caraway oil at 2%, kept in perforated polyethylene bags and stored at 4°C and 90% relative humidity (RH). In the second method, JA tubers were treated with caraway oil at 2%, kept between peat moss layers and stored at room temperature (25/10°C, day /night) and 70% RH. Comparing with the infected-untreated control, tubers infected with *S. rolfsii* and treated with caraway oil which kept in peat moss exhibited lower severity of *Sclerotium* tuber rot, sprouting percentage and weight loss. On the other hand, this treatment led to the highest dry matter and contents of carbohydrates, protein, inulin and total phenols as well as the activity of peroxidase and polyphenol oxidase enzymes. Based on the obtained results we recommend the use of caraway oil and peat moss when storing JA tubers at room temperature due to its eco-safety and saving of the cooling energy [K. M. Ghoneem, W. I. A. Saber, A. A. El-Awady, Y. M. Rashad*, A. A. Al-Askar (Plant Protection and Biomolecular Diagnosis Department, Arid Lands

Cultivation Research Institute, City of Scientific Research and Technological Applications, Egypt) *Phytoparasitica*, 2016, **44**(3), 341-352].

NPARR, 7(4), 2016-341 Foliar application of plant nutrients and kinetin modifies growth and essential oil profile in *Rosa damascena* under acidic conditions

Rosa damascena Mill. is cultivated for its high-value essential oil in different parts of the world. The flower yield and the composition of essential oil of *R. damascena* are strongly affected by a number of factors. Nevertheless, the interactive effects of foliar application of plant nutrients and kinetin and its time of application on yield and secondary metabolites profile of *R. damascena* under acidic conditions are still unclear. Thus, a field experiment comprising two different times of spray and five foliar spray treatments was conducted to test the hypothesis that flowering behavior and secondary metabolites profile can be modified through proper nutrient supply at right time. The foliar spray at flower bud appearance stage (S2) significantly ($P \leq 0.05$) increased flower yield by about 10.0% compared with the foliar application at axillary bud development stage (S1) during both years, regardless of plant nutrients. Among the foliar spray treatments, kinetin at 0.20 g/L registered about 23–39% higher flower yield compared with the water spray control; however, remained statistically at par ($P \leq 0.05$) with $\text{Ca}(\text{NO}_3)_2$ at 4.06 g/L. Moreover, the percentage of major fragrance-bearing compounds of essential oil (β -citronellol + nerol, linalool, E-geraniol, and Z-citral) was marginally increased with $\text{Ca}(\text{NO}_3)_2$ compared with kinetin treatment. However, the percentages of major hydrocarbons, nonadecane and heneicosane, were noticeably increased when kinetin was applied at S1. Foliar application of kinetin and $\text{Ca}(\text{NO}_3)_2$ might be done to improve flower yield and essential oil content in *R. damascena* flowers [P. K. Pal*, M. Mahajan, V. K. Agnihotri (Division of Agrotechnology

and Plant Improvement, Council of Scientific and Industrial Research-Institute of Himalayan Bioresource Technology (CSIR-IHBT), Post Box No. 6, India) *Acta Physiologiae Plantarum*, 2016, **38**(7), DOI: 10.1007/s11738-016-2187-6].

NPARR, 7(4), 2016-342 **Essential oil and phenolic compounds of *Artemisia herba-alba* (Asso.): Composition, antioxidant, antiacetylcholinesterase, and antibacterial activities**

Total phenols, flavonoids, flavonols, and flavanols of the methanolic extract of the aerial part of *Artemisia herba-alba* were determined. The extract was analyzed by liquid chromatography with photodiode array coupled with electrospray ionisation mass spectrometry and allowed to identify of 10 phenolic compounds. Apigenin-6-C-glycosyl flavonoids and caffeoylquinic acids were identified. Chlorogenic acid and 1,4 dicaffeoylquinic acid being the major constituents. The essential oil obtained by hydrodistillation was analyzed by gas chromatography-mass spectrometry. Twenty-three compounds, representing 97.8% of the total oil, were identified. The most abundant components were β -thujone (41.9%), α -thujone (18.4%), and camphor (13.2%). Methanolic extract and essential oil exhibited a considerable antioxidant activity as evaluated by 2,2-diphenylpicrylhydrazil hydrate scavenging activity, reducing power, β -carotene bleaching test, and chelating ability. The methanolic extract was found to be more efficient, while the essential oil exhibited the highest acetylcholinesterase inhibitory activity. Analysis of the antibacterial activity showed that *A. herba-alba* methanolic extract and essential oil are efficient against gram positive and gram negative bacteria [F. Younsi, R. Trimech, A. Boulila, O. Ezzine, S. Dhahri, M. Boussaid,

C. Messaoud* (National Institute of Applied Science and Technology, Laboratory of Plant Biotechnology, University of Carthage, Centre Urbain Nord, BP 676, Tunisia) *International Journal of Food Properties*, 2016, **19**(7), 1425-1438].

NPARR, 7(4), 2016-343 **Phytochemical diversity in essential oil of *Vitex negundo* L. populations from India**

Vitex negundo L., commonly known as the 'Nirgundi' has a long history of medicinal use in traditional and folk medicines for various diseases. To explore the diversity of the essential oil yield and composition of *V. negundo*, 23 populations were collected during spring season from the western Himalayan region. The essential oil yields varied from 0.06 to 0.10% in different populations of *V. negundo*. GC-FID, GC-MS, and statistical analysis of the leaf volatile oils showed significant phytochemical diversity. The volatiles of *V. negundo* were complex mixtures of 61 constituents, with sabinene (2.8-40.8%), viridiflorol (10.7-23.8%), β -caryophyllene (5.3-21.4%), terpinen-4-ol (0.1-7.2%), epi-laurenene (2.2-5.9%), humulene epoxide II (0.5-4.6%), and abietadiene (0.1%-4.3%) as major constituents. Based on the distribution of major constituents, four groups were noticed by the multidimensional scaling and hierarchical average linkage cluster analyses. In conclusion, the yield and composition of the essential oils isolated from *V. negundo* varied considerably, depending on the origin [R. C. Padalia*, R. S. Verma, A. Chauhan, C. S. Chanotiya, S. Thul (CSIR-Central Institute of Medicinal and Aromatic Plants (CIMAP), Research Center, India) *Records of Natural Products*, 2016, **10**(4), 452-464].

FEED/FODDER

NPARR, 7(4), 2016-344 Innovative technologies for the mitigation of mycotoxins in animal feed and ingredients-A review of recent patents

Mycotoxins are secondary metabolites produced by specific fungi that can be found throughout the dietary chain of animal feed. Among the agriculturally important mycotoxins are: aflatoxin B1 (AFB1), deoxynivalenol (DON), zearalenone (ZEA), nivalenol (NIV), fumonisin B1 (FUB1), ochratoxin A (OTA), citrinin (CIT) and patulin (PAT). Economic losses and health concerns caused by increased frequencies of mycotoxin contaminations have attracted research interests toward exploring new inactivation and detoxification methods. Suggested strategies of decontamination include eliminating mycotoxins from contaminated grains, decreasing the bioavailability of such mycotoxins in the gastrointestinal tracts of animals, or directly degrading mycotoxins in feeds. Based on these points of action, a number of approaches such as adsorption, chemical treatment, and bio-transformation by catabolizing microorganisms/ enzymes have been developed and optimized. This review summarizes the detoxification techniques and industrial applications (granted and pending patents) reported in the last five years (2010-2015). A clear understanding of such novel detoxification methods and development-trends can be beneficial to the feed and livestock industry and will contribute to assuring pre- and post-harvest management and processing practices are in place that maximizes the consumers' safety and profits of livestock and related industries [Y. Zhu, Y. I. Hassan, C. Watts, T. Zhou* (Guelph Food Research Centre, Agriculture and Agri-Food Canada, 93 Stone Road West, Guelph, ON, Canada) *Animal Feed Science and Technology*, 2016, **216**, 19-29].
NPARR, 7 (4), 2016-345

Effect of range legumes intercropping and weed management on weed control and fodder productivity of Guinea grass (*Panicum maximum* Jacq.)

A field experiment was conducted during 2007-2011 on sandy loam soil at Jhansi, Uttar Pradesh to find out the effect of range legumes intercropping and weed management practices on weed control and fodder productivity of Guinea grass (*Panicum maximum*). Results indicated that intercropping of *Stylosanthes seabrana* with Guinea grass produced significantly higher total dry forage yield (6.68 t/ha) than *Clitoria tematea* (5.41 t/ha) and *Macroptillium atropurpureum* (5.60 t/ha). In total dry forage yields, per cent contribution of *S. hamata*, *S. seabrana*, *Macroptillium atropurpureum* and *C. ternatea* were 30.52, 36.23; 23.39 and 20.15, respectively. In weed management practices, hand weeding 35 days after sowing in 1st year and 25 days after onset of monsoon rain from 2nd year onwards recorded significantly higher dry forage yields of both Guinea grass (5.02 t/ha) and legumes (2.00 t/ha) than weedy check, pre-emergence application of pendimethalin and weeding with weeder cum mulcher. Maximum net return (Rs 13733/ha) and net return per rupee invested (Re 1.48) were obtained by intercropping of Guinea grass with *S. seabrana*. Maximum net return (Rs 12746/ha) was also observed on hand weeding at 35 days after sowing. Intercropping of Guinea grass with *S. seabrana* and hand weeding showed maximum growth, productivity and monetary return from the system [S. N. Ram*, B. K. Trivedi (ICAR Indian Grassland & Fodder Res Inst, Jhansi 284003, Uttar Pradesh, India) *Range Management and Agroforestry*, 2016, **37**(1), 44-49].

NPARR, 7 (4), 2016-346 Evaluation of normal and specialty corn for fodder yield and quality traits

To evaluate fodder potentiality of different types of maize, five maize genotypes

grown under different use pattern such as baby corn (HM-4), sweet corn (HSC-1), forage type maize (J-1006), normal maize (DHM-117) and quality protein maize (HQPM-5) were analyzed for forage quality. Study indicated that forage maize exhibited highest crude protein (CP) with higher in-vitro dry matter digestibility (IVDMD) and lowest values of dry matter, ADF and ADL content. The baby corn hybrid (HM-4) was found almost at par to fodder maize in terms of forage quality parameters entailing its use as animal fodder. Forage quality of DHM-117 (normal maize) and HQPM-5 was also found comparable to fodder maize. Nutritional quality of silage made of sweet corn variety (HSC-1) was found to be better as compared to its green fodder. However, small loss of nutrients was observed in silage as compared to green forage, but it significantly improved its digestibility. The correlation data showed that CP was positively related to IVDMD but negatively associated with fiber components (CF, NDF and ADF). The study concluded that specialty maize possess the required characteristics of a nutritious fodder and its preservation as silage could significantly minimize the green fodder deficit in India [D. P. Chaudhary*, A. Kumar, R. Kumar, A. Singode, G. Mukri, R. P. Sah, U. S. Tiwana, B. Kumar (Indian Inst Maize Res, ICAR, Ludhiana 141004, Punjab, India) *Range Management and Agroforestry*, 2016, **37**(1), 79-83].

NPARR, 7 (4), 2016-347 Broiler chicken cecal microbiocenoses depending on mixed fodder

Molecular genetic techniques (NGS sequencing and quantitative PCR) were used to determine the composition of the cecal bacterial community of broiler chickens fed with different mixed fodder. The cecal microbiome exhibited taxonomic diversity, with both typical inhabitants of avian intestine belonging to the families Clostridiaceae, Eubacteriaceae, and Lactobacillaceae and to the phylum Bacteroidetes, and new unidentified taxa, as well as bacteria of the families Lachnospiraceae and Ruminococcaceae,

which were previously considered restricted to the rumen microbiota. Contrary to traditional concepts, enterococci and bifidobacteria were among the minor components of the community, lactate-fermenting species were absent, and typical avian pathogens of the genus *Staphylococcus* were detected but seldom. Members of the family Sutterellaceae and the genus *Gallibacterium*, which are responsible for avian respiratory infections, were also detected. Significant fluctuations of abundance and composition of microbial groups within the cecal community and of the parameters of broiler productivity were found to occur depending on the feed allowance. Cellulose content in the feed had the most pronounced effect on the composition and structure of bacterial communities. Decreased cellulose content resulted in a decrease of bacterial abundance by an order of magnitude and in increased ratios of members of the phylum Bacteroidetes and the family Clostridiaceae, which possess the enzymes degrading starch polysaccharides. Abundance of the normal inhabitants of avian intestine belonging to the genus *Lactobacillus* and the order Bacillales decreased, while the share of *Escherichia* and members of the family Sutterellaceae increased, including some species capable of causing dysbiotic changes in the avian intestine. No significant change in the abundance of cellulolytics of the families Ruminococcaceae, Lachnospiraceae, and Eubacteriaceae was observed [V. I. Fisinin, L. A. Il'ina, E. A*. Iyldyrym, I. N. Nikonov, V. A. Filippova, G. Y. Laptev, N. I. Novikova, A. A. Grozina, T. N. Lenkova, V. A. Manukyan (BIOTROF Ltd, St Petersburg, Russia) *Microbiology*, 2016, **85**(4), 493-499].

NPARR, 7(4), 2016-348 Vegetative propagation of twelve fodder tree species indigenous to the Sahel, West Africa

In the Sahel region, many woody species are used as fodder because of their high nitrogen content, especially during the dry season,

in contrast to grasses and crop residues. Unfortunately, this resource is being threatened by regular pruning, increasing livestock browsing and impeding their natural regeneration. Therefore, there is a need to find appropriate regeneration options to sustain fodder production. Thus, a series of vegetative propagation experiments were conducted to identify the most appropriate multiplication methods of some of the species used as fodder. This series included testing the effects of naphthalene acetic acid (NAA) and indole butyric acid (IBA) on rooting ability of stem cuttings of 12 species: *Azelia africana*, *Balanites aegyptiaca*, *Bauhinia rufescens*, *Commiphora africana*, *Faidherbia albida*, *Ficus gnaphalocarpa*, *Guiera senegalensis*, *Kigelia africana*, *Pterocarpus erinaceus*, *Pterocarpus lucens*, *Pterocarpus santalinoides* and *Terminalia avicennioides*. The series also evaluated the impacts of the size (*C. africana*) and the age (*P. erinaceus*) of the cuttings on their rooting success. *Pterocarpus santalinoides* was revealed to be an easy-to-root species, showing a high

percentage of rooted cuttings (up to 88 +/- 3%), followed by *P. erinaceus*, *P. lucens* and *B. aegyptiaca* (up to 37 +/- 4%, 31 +/- 5% and 26 +/- 6%, respectively), in contrast to *A. africana*, cuttings of which did not root at all. The application of NAA and IBA enhanced the number of roots and secondary roots per rooted cutting. Large-diameter cuttings (15-20mm) of deeply planted *C. africana* gave the highest percentage of rooted cuttings (78.3 +/- 4.4%). Tree pruning improved the rooting capacity of cuttings collected from *P. erinaceus* with one-month resprouts giving the highest percentage of rooted cuttings (50.0 +/- 6.7%). These results indicate that *P. santalinoides*, *C. africana*, *P. erinaceus*, *P. lucens* and *B. aegyptiaca* are amenable to vegetative propagation as an alternative to sexual propagation [C. Ky-Dembele*, J. Bayala, A. Kalinganire, F. T. Traore, B. Kone, A. Olivier (West Africa & Cent Reg Off Sahel Node, World Agroforestry Ctr, Bamako, Mali) *Southern Forests*, 2016, **78**(3), 185-192].

FIBRES (incl. Textile and other utility fibres)

NPARR, 7(4), 2016-349 Effect of waterlogging on carbohydrate metabolism and the quality of fiber in cotton (*Gossypium hirsutum* L.)

Transient waterlogging occurs frequently in the Yangtze River and adversely affects cotton fiber quality. However, the carbohydrate metabolic mechanism that affects fiber quality after waterlogging remains undescribed. Here, the effects of five waterlogging levels (0, 3, 6, 9, and 12 days) were assessed during flowering and boll formation to characterize the carbohydrates, enzymes and genes that affect the fiber quality of cotton after waterlogging. The cellulose and sucrose contents of cotton fibers were significantly decreased after waterlogging for 6 (WL6), 9 (WL9), and 12 d (WL12), although these properties were unaffected after 3 (WL3) and 6 days at the fruiting branch 14-15 (FB14-15). Sucrose phosphate synthase (SPS) was the most sensitive to waterlogging among the enzymes tested. SPS activity was decreased by waterlogging at FB6-7, whereas it was significantly enhanced under WL3-6 at FB10-15. Waterlogging down-regulated the expression of fiber invertase at 10 days post anthesis (DPA), whereas that of expansin, beta-1,4-glucanase and endoxyloglucan transferase (VET) was up-regulated with increasing waterlogging time. Increased mRNA levels and activities of fiber SuSy at each fruiting branch indicated that SuSy was the main enzyme responsible for sucrose degradation because it was markedly induced by waterlogging and was active even when waterlogging was discontinued. We therefore concluded that the reduction in fiber sucrose and down-regulation of invertase at 10 DPA led to a markedly shorter fiber length under conditions WL6-12. Significantly decreased fiber strength at FB6-11 for WL6-12 was the result of the inhibition of cellulose synthesis and the up-regulation of expansin, beta-1,4-glucanase and XET, whereas fiber strength increased under WL3-6 at FB14-15 due to the increased cellulose

content of the fibers. Most of the indicators tested revealed that WL6 resulted in the best compensatory performance, whereas exposure to waterlogged conditions for more than 6 days led to an irreversible limitation in fiber development [J. Kuai, Y. L. Chen, Y. H. Wang, Y. L. Meng, B. L. Chen, W. Q. Zhao, Z. G. Zhou* (Nanjing Agr Univ, Minist Agr, Key Lab Crop Physiol & Ecol, Nanjing, Jiangsu, Peoples R China) *Frontiers in Plant Science*, 2016, **7**, DOI: 10.3389/fpls.2016.00877].

NPARR, 7(4), 2016-350 Drought effects on cotton yield and fiber quality on different fruiting branches

Whole-plant-based measurements do not always accurately reflect the effect of drought on cotton because of its indeterminate growth habits. We conducted pot experiments with cotton and imposed three soil water levels (75 ± 5 , 60 ± 5 , and $45 \pm 5\%$ of field capacity [FC]) during boll development to determine influences of drought on yield distribution and fiber quality on different fruiting branches (FB). Drought not only reduced lint yield (decreased by 31 to 35 and 57 to 60% under $60 \pm 5\%$ FC and $45 \pm 5\%$ FC, respectively) but also altered yield distribution on different FB. Drought plants produced fewer and smaller bolls on higher FB than did the well-watered plants. Boll biomass distribution and seed number per boll on upper FB were also altered by drought. Fiber length and strength declined progressively with decreasing water availability, being more pronounced on higher FB. Micronaire value was greater on higher FB under the same water regime, while no consistent influences of drought on micronaire were obtained. Boll weight, seed index, and fiber length and strength declined linearly with decreasing mean midday leaf water potential (LWP) during fruit maturation period (FMP) in the range of about 0.7 g, 1.0 g, 2.4 mm, and 3.4 cN tex⁻¹ per MPa, respectively. Our findings showed that the bolls at various FB differed in drought response. The LWP was a suitable index for fiber properties under

production environment. These data will be valuable for designing better irrigation strategies and improving cotton simulation models [R. Wang, S. Ji, P. Zhang, Y. Meng, Y. Wang, B. Chen, Z. G. Zhou* (Nanjing Agr Univ, Minist Agr, Key Lab Crop Physiol Ecol & Prod Management, Nanjing 210095, Jiangsu, Peoples R China) *Crop Science*, 2016, **56**(3), 1265-1276].

NPARR*, 7(4), 2016-351 *Epichloe endophytes affect the nutrient and fiber content of *Lolium perenne* regardless of plant genotype

Epichloe endophytes inhabit aerial grass tissues but they can modify belowground processes that might affect host nutrient balance. We aimed to determine the effects of endophyte status (E+=endophyte-infected; E-=non-infected) and three *EpichloA* << morphotypes (M1, M2, M3) on growth and nutrient content of a heterogeneous set of naturally infected asymptomatic plants of *Lolium perenne*. In addition, plant parameters were compared between asymptomatic E+ and plants with choke disease. A field experiment was conducted with 194 plants obtained from six natural populations (97E+, 97E-). For each E+ plant, the endophyte morphotype it hosted was known. Endophyte-infected plants had significantly lower P, Ca, S, B, neutral detergent fiber and lignin contents, and higher Mn and digestibility than E-, independently of plant origin. Biomass production was affected by plant origin but not by endophytes. No effect of *EpichloA* << morphotypes in any parameter was found. However, asymptomatic E+ and choke diseased plants differed in nutrients, fibers, and digestibility. An endophyte effect was detected in nutrient and fiber content, in spite of the heterogeneous constitution of the plant and fungal material used. The results obtained indicate that *EpichloA* << may affect above and possibly underground processes involved in nutrient absorption, as well as plant quality, what may potentially affect litter decomposition processes [M. C. Soto-Barajas, I. Zabalgoeazcoa,

J. Gomez-Fuertes, V. Gonzalez-Blanco, B. R. Vazquez-de-Aldana* (IRNASA CSIC, Inst Recursos Nat & Agrobiol Salamanca, Cordel Merinas 40-52, Salamanca 37008, Spain) *Plant and Soil*, 2016, **405**(1-2), 265-277].

NPARR*, 7(4), 2016-352 *Small interfering RNAs from bidirectional transcripts of GhMML3_A12 regulate cotton fiber development

Natural antisense transcripts (NATs) are commonly observed in eukaryotic genomes, but only a limited number of such genes have been identified as being involved in gene regulation in plants. In this research, we investigated the function of small RNA derived from a NAT in fiber cell development. Using a map-based cloning strategy for the first time in tetraploid cotton, we cloned a naked seed mutant gene (N-1) encoding a MYBMIXTA-like transcription factor 3 (MML3)/GhMYB25-like in chromosome A12, GhMML3_A12, that is associated with fuzz fiber development. The extremely low expression of GhMML3_A12 in N-1 is associated with NAT production, driven by its 3' antisense promoter, as indicated by the promoter-driven histochemical staining assay. In addition, small RNA deep sequencing analysis suggested that the bidirectional transcriptions of GhMML3_A12 form double-stranded RNAs and generate 21-22 nt small RNAs. Therefore, in a fiber-specific manner, small RNA derived from the GhMML3_A12 locus can mediate GhMML3_A12 mRNA self-cleavage and result in the production of naked seeds followed by lint fiber inhibition in N-1 plants. The present research reports the first observation of gene-mediated NATs and siRNA directly controlling fiber development in cotton [Q. Wan, X. Y. Guan, N. N. Yang, H. T. Wu, M. Q. Pan, B.L. Liu, L. Fang, S. P. Yang, Y. Hu, W. X. Ye, T. Z. Zhang* (Nanjing Agr Univ, Coll Agr, State Key Lab Crop Genet & Germplasm Enhancement, Cotton Hybrid R&D Engn Ctr, Minist Educ, Nanjing 210095, Jiangsu, Peoples R China) *New Phytologist*, 2016, **210**(4), 1298-1310].

FOOD (incl. Dairy, Fishery, Poultry and other Plant and Animal products)

NPARR, 7(4), 2016-353 Effect of black pepper essential oil on the quality of fresh pork during storage

The effect of different concentrations (0, 0.1 and 0.5%, v/v) of black pepper essential oil (BPEO) on thiobarbituric acid reactive substances (TBARS), meat color, the percentage of metmyoglobin (MetMb%), microbiological parameters and total volatile basic nitrogen (TVB-N) of pork loins stored at 4 °C for 9 days was evaluated. BPEO treatments showed lower TBARS, MetMb%, yellowness (b*) values, *Pseudomonas* spp. and Enterobacteriaceae count and TVB-N values and higher lightness (L*) and redness (a*) values than the control during storage the effectiveness of BPEO was dose-dependent. The retardation of the formation of MetMb by adding BPEO ensured higher L* and a* values and lower b* values than the control at 6 and 9 days; the MetMb content has a similar trend to the lipid oxidation. The lower TVB-N value of BPEO treatments than the control could be attributed to the inhibition of *Pseudomonas* spp. and Enterobacteriaceae. Gram-negative bacteria were more sensitive than Gram-positive bacteria to BPEO [J. Zhang, Y. Wang, D. D. Pan, J. X. Cao*, X. F. Shao, Y. J. Chen, Y. Y. Sun, C. R. Ou (Key Laboratory of Animal Protein Food Processing Technology of Zhejiang Province, Ningbo University, Ningbo, China) *Meat Science*, 2016, **117**, 130-136].

NPARR, 7(4), 2016-354 Quality characterization of processed cheese inoculated by *Bacillus coagulans* during cold storage: Compositional and sensorial attributes and probiotic microorganism viability

The effect of the addition of probiotic spores (10^7 and 10^8 colony-forming unit [cfu]/g) of *Bacillus coagulans* ATCC 7050 on the critical quality attributes of an Iranian processed cheese

including chemical composition, pH, titratable acidity (TA), survival rate and sensory features was studied during 60 days of cold storage. No significant difference was found in the chemical composition by the increasing spore count. A low pH value and a high TA quantity in the cheese inoculated by *Ba.coagulans* spores in comparison with the control sample were observed ($P < 0.05$). Results showed that the viability of probiotic cells was mentioned more than 10^6 cfu/g during the cold storage. The color, odor and texture sensory scores were insignificantly affected by the addition of probiotic spores during storage. However, a significant difference was found for the flavor and overall acceptability among different samples as these sensory attributes decreased with an increase in spore count. Incorporation of probiotic bacteria has been successfully performed in whey cheese matrices. However, probiotic-processed cheese inoculated by *Bacillus coagulans* spores have not been before made according to the data found in the literature. The use of this microbial source in producing processed cheese led to the improved critical quality attributes during 60 days of storage at refrigerator temperature. This study demonstrated that the processed functional cheese can be a potential carrier for the delivery of probiotic cells [S. Ehsannia, M. R. Sanjabi* (IROST, Dept Anim & Poultry Sci & Fisheries, Agr Res Inst, POB 3353-5111, Tehran, Iran) *Journal of Food Processing and Preservation*, 2016, **40**(4), 667-674].

NPARR, 7(4), 2016-355 Prevalence of mcr-1 in *E. coli* from livestock and food in Germany, 2010-2015

Since the first description of a plasmid-mediated colistin resistance gene (mcr-1) in November 2015 multiple reports of mcr-1 positive isolates indicate a worldwide spread of this newly discovered resistance gene in Enterobacteriaceae. Although the occurrence of mcr-1 positive isolates of livestock, food, environment and human origin is well

documented only few systematic studies on the prevalence of *mcr-1* are available yet. Here, comprehensive data on the prevalence of *mcr-1* in German livestock and food isolates are presented. Over 10,600 *E. coli* isolates from the national monitoring on zoonotic agents from the years 2010-2015 were screened for phenotypic colistin resistance (MIC value >2 mg/l). Of those, 505 resistant isolates were screened with a newly developed TaqMan-based real-time PCR for the presence of the *mcr-1* gene. In total 402 isolates (79.8% of colistin resistant isolates) harboured the *mcr-1* gene. The prevalence was depending on the food production chain. The highest prevalence was detected in the turkey food chain (10.7%), followed by broilers (5.6%). A low prevalence was determined in pigs, veal calves and laying hens. The *mcr-1* was not detected in beef cattle, beef and dairy products in all years investigated. In conclusion, TaqMan based real-time PCR provides a fast and accurate tool for detection of *mcr-1* gene. The overall detection rate of 3.8% for *mcr-1* among all *E. coli* isolates tested is due to high prevalence of *mcr-1* in poultry production chains. More epidemiological studies of other European countries are urgently needed to assess German prevalence data [A. Irrgang, N. Roschanski, B. A. Tenhagen, M. Grobbel, T. Skladnikiewicz-Ziemer, K. Thomas, U. Roesler, A. Kasbohrer* (Fed Inst Risk Assessment, Dept Biol Safety, Natl Reference Lab Antimicrobial Resistance, Berlin, Germany) *Plos One*, 2016, **11**(7), DOI: 10.1371/journal.pone.0159863].

NPARR, 7(4), 2016-356 **Food and nutritional security requires adequate protein as well as energy, delivered from whole-year crop production**

Human food security requires the production of sufficient quantities of both high-quality protein and dietary energy. In a series of case-studies from New Zealand, we show that while production of food ingredients from crops on arable land can meet human dietary energy requirements effectively, requirements for high-

quality protein are met more efficiently by animal production from such land. We present a model that can be used to assess dietary energy and quality-corrected protein production from various crop and crop/animal production systems, and demonstrate its utility. We extend our analysis with an accompanying economic analysis of commercially available pre-prepared or simply-cooked foods that can be produced from our case-study crop and animal products. We calculate the per-person, per-day cost of both quality-corrected protein and dietary energy as provided in the processed foods. We conclude that mixed dairy/cropping systems provide the greatest quantity of high quality protein per unit price to the consumer, have the highest food energy production and can support the dietary requirements of the highest number of people, when assessed as all-year-round production systems. Global food and nutritional security will largely be an outcome of national or regional agroeconomies addressing their town food needs. We hope that our model will be used for similar analyses of food production systems in other countries, agroecological zones and economies [G. D. Coles*, S. D. Wratten, J. R. Porter (Lincoln Univ, Bioprotect Res Ctr, Lincoln, New Zealand) *Peerj*, 2016, **4**, DOI: 10.7717/peerj.2100].

NPARR, 7(4), 2016-357 **Histology as a valid tool to differentiate fresh from frozen-thawed marinated fish**

European Commission Regulation (EU) 1276/2011 requires that fishery products intended for raw consumption be frozen at -20 °C for not less than 24 h or at -35 °C for at least 15 h in order to kill viable parasites other than trematodes. But because marinating processes are not always effective in destroying nematode larvae, raw marinated fish preparations should be frozen before consumption. This study evaluated the performance of a standardized histological method to distinguish between fresh and frozen-thawed raw marinated fish. Sixty anchovy (*Engraulis encrasicolus*) fillets were sampled: 30

were marinated at +4 °C for 24 h, and 30 were frozen at 20 °C for 24 h before being marinated for 24 h. All 60 samples were fixed in formalin, processed for paraffin embedding, cut, and stained with hematoxylin and eosin. The slide preparations were examined microscopically by three independent histopathologists and classified as frozen-thawed or negative according to standard operating procedure criteria in use at our laboratory. Performance evaluation of the method showed 100% sensitivity (95% confidence interval [CI], 88.4 to 100%) and 100% specificity (95%

CI, 88.4 to 100%), and the interrater agreement (Cohen's kappa) was 1 (95% CI, 0.85 to 1). Histology proved a valid and reliable tool to distinguish fresh from frozen-thawed marinated fish. It can be applied to deliver safe raw fishery products to consumers in order to minimize the risk of anisakidosis [S. Meistro*, M. Pezzolato, D. Muscolino, F. Giarratana, E. Baioni, A. Panebianco, E. Bozzetta (Ist Zooprofilatt Sperimentale Piemonte Liguria & I-10154 Turin, Italy) *Journal of Food Protection*, 2016, **79**(8), 1457-1459].

FRUITS

NPARR, 7(4), 2016-358 Effect of cooking methods on nutritional quality and volatile compounds of Chinese chestnut (*Castanea mollissima* Blume)

This study aimed to evaluate the effects of different cooking methods on the content of important nutrients and volatiles in the fruit of Chinese chestnut. The nutritional compounds, including starch, water-soluble protein, free amino acids, reducing sugar, sucrose, organic acids and total flavonoids, of boiled, roasted and fried chestnuts were significantly ($P < 0.05$) lower than those of fresh chestnuts after cooking, while the amylose, fat, crude protein and total polyphenol content varied slightly ($P > 0.05$). L-Aspartic acid, L-glutamic acid and L-arginine were found to be the main reduced free amino acids in cooked chestnuts. The main aromatic compositions in fresh chestnuts were aldehydes and esters, while ketones, furfural and furan were formed in cooked chestnuts due to the Maillard reaction and degradation of saccharides, amino acids and lipids. Principle component analysis demonstrated that roasting and frying had a similar effect on the nutritional composition of chestnuts, which differed from that of the boiling process [Q. Li, X. Shi, Q. Zhao, Y. Cui, J. Ouyang*, F. Xu (Department of Food Science and Engineering, College of Biological Sciences and Technology, Beijing Key Laboratory of Forest Food Processing and Safety, Beijing Forestry University, China) *Food Chemistry*, 2016, **201**, 80-86].

NPARR, 7(4), 2016-359 Fatty acids composition of Spanish black (*Morus nigra* L.) and white (*Morus alba* L.) mulberries

This research has determined qualitatively and quantitatively the fatty acid composition of white (*Morus alba*) and black (*Morus nigra*) fruits grown in Spain, in 2013 and 2014. Four clones of each species were studied. Fourteen

fatty acids were identified and quantified in mulberry fruits. The most abundant fatty acids were linoleic (C18:2), palmitic (C16:0), oleic (C18:1), and stearic (C18:0) acids in both species. The main fatty acid in all clones was linoleic (C18:2), that ranged from 69.66% (MN 2) to 78.02% (MA1) of the total fatty acid content; consequently Spanish mulberry fruits were found to be rich in linoleic acid, which is an essential fatty acid. The fatty acid composition of mulberries highlights the nutritional and health benefits of their consumption [E. M. Sánchez-Salcedo*, E. Sendra, Á. A. Carbonell-Barrachina, J. J. Martínez, F. Hernández (Sánchez-Salcedo, E.M.; Ctra. de Beniel, km 3.2, Spain) *Food Chemistry*, 2016, **190**, 566-571].

NPARR, 7(4), 2016-360 Identification and expression profiling of the lectin gene superfamily in mulberry

Lectins are a diverse group of ubiquitously present, highly specific sugar-binding proteins. Members of this large gene family have been assigned broad biological functions from defense to acting as storage proteins. Despite possessing several interesting characteristics, their functions remain essentially undefined. Mulberry (*Morus* spp.) known for its medicinal benefits is also a rich source of lectins. Using an exhaustive hidden Markov model (HMM)-based search, we identified the lectin gene complement in *M. notabilis* C.K. Schneid with around 197 members. These putative lectin genes were classified into 12 distinct gene families based on the presence of characteristic sugar-binding domains. Members of this superfamily were assigned varied gene ontologies (GOs) to identify putative functions and determine cellular localizations. Interestingly, characteristic expression patterns were observed across the lectin superfamily in response to a variety of environmental cues. This is suggestive of specialized functions under diverse conditions possibly by linking the specificity of sugar recognition with mediating precise stress responses in plants. The identification of putative

gene family members from the genus *Morus* developed in this study can find wide applicability in lectin gene identification and characterization. It can also contribute immensely in the understanding of lectins from mulberry with potential medicinal uses [B. Saeed, V. K. Baranwal, P. Khurana* (Dep. of Plant Molecular Biology, Univ. of Delhi South Campus, New Delhi, India) *Plant Genome*. 2016, **9**(2), 13].

NPARR, 7(4), 2016-361 Artificial neural networks and thermal image for temperature prediction in apples

The inability to correctly implement and safeguard a product cold chain leads to premature product spoilage and increased product waste. Special care is required to both implement and monitor the cold chain for perishable goods in order to preserve them. Many technologies are available on the market today with varying levels of success. This article presents a new technique, namely thermal imaging predicts surface temperature over a pallet of apples whilst comparing packaging (plastic boxes and cardboard boxes). This temperature data was then introduced as an input in artificial neural network (ANN) software to estimate the temperature across the entire pallet. Results obtained (root mean squared error [RMSE]) indicate that the estimation with plastic boxes has an error of $0.41 \hat{\text{A}} \hat{\text{A}}^{\circ}\text{C}$ whilst the error, taking as a reference the surface temperature, would be $2.14 \hat{\text{A}} \hat{\text{A}}^{\circ}\text{C}$. In the case of cardboard boxes, the estimation error is $0.086 \hat{\text{A}} \hat{\text{A}}^{\circ}\text{C}$ whilst only taking into account the thermal image, data would be $3.56 \hat{\text{A}} \hat{\text{A}}^{\circ}\text{C}$. This article proves the concept of the possibility of temperature monitoring by ANN through thermal imaging technology [R. Badia-Melis*, J. P. Qian, B. L. Fan, P. Hoyos-Echevarria, L. Ruiz-García, X. T. Yang (Departamento de Ingeniería Agroforestal, ETSI Agrónomos, Universidad Politécnica de Madrid (UPM), Edificio Motores,

Avda. Complutense 3, Madrid, Spain) *Food and Bioprocess Technology*, 2016, **9**(7), 1089-1099].

NPARR, 7(4), 2016-362 Antioxidant and anti-inflammatory effects of various cultivars of kiwi berry (*Actinidia arguta*) on lipopolysaccharide-stimulated RAW 264.7 Cells

The present study evaluated the total phenolic and flavonoid contents as well as total antioxidant capacity (TAC) of three cultivars of *Actinidia arguta* Planch. kiwi berries; cv. Mansoo (Mansoo), cv. Chiak (Chiak), and cv. Haeyeon (Haeyeon). In addition, the anti-inflammatory effects of the three cultivars of kiwi berries were investigated using a lipopolysaccharide (LPS)-stimulated RAW 264.7 murine macrophage cell line. Mansoo had the highest total phenolic content and TAC among the three cultivars, whereas Chiak had the highest total flavonoid content. The total antioxidant capacities of the kiwi berry extracts were more strongly correlated with total phenolic content than with total flavonoid content. The kiwi berry extracts suppressed the secretion of pro-inflammatory cytokines, including interleukin-6 and tumor necrosis factor-alpha, from LPS-stimulated RAW 264.7 cells. The release of nitrite, an indirect indicator of nitric oxide, was also ameliorated by pre-treatment with the kiwi berry extracts in a dose-dependent manner. Cellular-based measurements of antioxidant capacity exhibited that the kiwi berry extracts had cellular antioxidant capacities. Such cellular antioxidant effects are possibly attributed to their direct antioxidant capacity or to the inhibition of reactive oxygen species generation via anti-inflammatory effects. Our findings suggest that kiwi berries are potential antioxidant and anti-inflammatory agents [X. An, S. G. Lee, H. Kang, H. J. Heo, Y. S. Cho, D. O. Kim* (Kyung Hee Univ, Dept Food Sci & Biotechnol, Yongin 17104, South Korea) *Journal of Microbiology and Biotechnology*, 2016, **26**(8), 1367-1374].

FUEL

NPARR, 7(4), 2016-363 Hydrocarbon bio-jet fuel from bioconversion of poplar biomass: life cycle assessment

Bio-jet fuels compatible with current aviation infrastructure are needed as an alternative to petroleum-based jet fuel to lower greenhouse gas emissions and reduce dependence on fossil fuels. Cradle to grave life cycle analysis is used to investigate the global warming potential and fossil fuel use of converting poplar biomass to dropin bio-jet fuel via a novel bioconversion platform. Unique to the biorefinery designs in this research is an acetogen fermentation step. Following dilute acid pretreatment and enzymatic hydrolysis, poplar biomass is fermented to acetic acid and then distilled, hydroprocessed, and oligomerized to jet fuel. Natural gas steam reforming and lignin gasification are proposed to meet hydrogen demands at the biorefineries. Separate well to wake simulations are performed using the hydrogen production processes to obtain life cycle data. Both biorefinery designs are assessed using natural gas and hog fuel to meet excess heat demands. Global warming potential of the natural gas steam reforming and lignin gasification bio-jet fuel scenarios range from CO₂ equivalences of 60 to 66 and 32 to 73 g MJ(-1), respectively. Fossil fuel usage of the natural gas steam reforming and lignin gasification bio-jet fuel scenarios range from 0.78 to 0.84 and 0.71 to 1.0 MJ MJ(-1), respectively. Lower values for each impact category result from using hog fuel to meet excess heat/steam demands. Higher values result from using natural gas to meet the excess heat demands. Bio-jet fuels produced from the bioconversion of poplar biomass reduce the global warming potential and fossil fuel use compared with petroleum-based jet fuel. Production of hydrogen is identified as a major source of greenhouse gas emissions and fossil fuel use in both the natural gas steam

reforming and lignin gasification bio-jet simulations. Using hog fuel instead of natural gas to meet heat demands can help lower the global warming potential and fossil fuel use at the biorefineries [E. Budsberg, J. T. Crawford, H. Morgan, W. S. Chin, R. Bura, R. Gustafson (Univ Washington, Sch Environm & Forest Sci, Box 352100, Seattle, WA 98195 USA) *Biotechnology for Biofuels*, 2016, **9**, DOI: 10.1186/s13068-016-0582-2].

NPARR, 7(4), 2016-364 Bio fuel production from crude Jatropha oil; addition effect of formic acid as an in-situ hydrogen source

The catalytic deoxygenation reaction of crude Jatropha oil (CJO) was carried out to produce oxy-free hydrocarbons in assistance with hydrogen in-situ produced from formic acid solution (30%) and addition effect of formic acid was discussed on the deoxygenation reaction and product distribution. Mixing of formic acid with reactant yielded higher oil conversion and higher selectivity to normal hydrocarbon (mainly C-15 and C-17) than those of the other cases (no mixing or water addition). Total surface area and total pore volume of used catalysts in the batch reactor followed the order Pd/C-formic acid solution >Pd/C-water >Pd/C-no co-reactant under constant conditions. Moreover, significantly higher degree of deoxygenation with a high initial resistance to catalyst deactivation was observed on Pd/C catalyst in the presence of formic acid during the continuous catalytic reaction. This means that addition of formic acid solution as the hydrogen donor is favorable the deoxygenation reaction and the initial deactivation of catalyst. As results of continuous deoxygenation reaction using the mixture of oil and formic acid, normal hydrocarbon in the liquid product was main product, about 97%, and the degree of deoxygenation was about 99.5% [K. R. Hwang, I. H. Choi, H. Y. Choi, J. S. Han, K. H. Lee, J. S. Lee (Korea Inst Energy Res, Biomass & Waste Energy Lab, Daejeon 305343, South Korea) *Fuel*, 2016, **174**, 107-113].

NPARR, 7(4), 2016-365 Blends of pyrolysis oil, petroleum, and other bio-based fuels: A review

Pyrolysis oil is a promising renewable fuel. However, crude pyrolysis oil use in conventional engines or boilers can be limited without modifications to these systems. Other bio-oils such as oils from vegetables or animal wastes face similar issues. One option to enhance the applicability of bio-oils is blending with petroleum or other bio-based fuels. A literature review on the blending of bio-oils to enhance their fuel properties is presented. Included in the review is information on types of oils that have been blended, additives used to enhance blending, and engine/boiler performance. Upgrading, such as transesterification or hydroprocessing, of bio-oils is often used to improve fuel properties. However, there is limited work on blending of "crude" bio-fuels (e.g. unrefined), such as pyrolysis oils and bio-based waste oils. Therefore, included in this review is a preliminary study of blending of fast pyrolysis oil from hardwood with fish oil extracted from fish processing by-product. The heating value and pH of the blended pyrolysis/fish oil is increased relative to pure pyrolysis oil while the cold flow properties of the blends are better than the pure fish oil. However, the miscibility of the oils is limited and therefore, the next step is to determine if this can be enhanced through upgrading or additives [A. Krutof, K. Hawboldt (Mem Univ Newfoundland, Fac Engr & Appl Sci, Dept Oil & Gas Engr, St John, NF A1B 3X5, Canada) *Renewable & Sustainable Energy Reviews*, 2016, **59**, 406-419].

NPARR, 7(4), 2016-366 Fuel properties and ageing of bioslurry prepared from glycerol/methanol/bio-oil blend and biochar

This study investigates the fuel properties and ageing of a series of bioslurry fuels prepared from glycerol/methanol/bio-oil (GMB) blend and biochar at different biochar loading levels (up to 16.7 wt%). The GMB/biochar (GMBB) bioslurry fuels generally exhibit non-Newtonian and thixotropic behaviour, especially those at high biochar to GMB blend ratios (2:20–4:20). An increase in biochar loading level also increases the HHV, density and surface tension of the GMBB bioslurry fuels. Compared to the bio-oil/biochar (BB) bioslurry fuels at the same biochar loading level, the GMBB bioslurry fuels have much lower viscosity, water content and total acids number (TAN). Both the GMBB and BB bioslurry fuels have increasing viscosity, decreasing water content and TAN with increasing biochar to liquid ratio. Ageing leads to decreases in the TAN and viscosity but an increase in water content of the GMBB slurry fuels. The leaching of AAEM species from biochar in the GMBB bioslurry fuels increases with ageing. The presence of methanol and glycerol in the GMBB slurry fuels slow down the ageing and also leads to less leaching of AAEM species from biochar after accelerated ageing [W. Gao, M. Zhang, H. Wu (Department of Chemical Engineering, Curtin University, GPO Box U1987, Perth, WA 6845, Australia) *Fuel*, 2016, **176**, 72–77].

INSECTICIDES (incl. Fungicides, Herbicides, Nematicides, Larvicides, etc.)

NPARR, 7(4), 2016-367 Droplet deposition and control effect of insecticides sprayed with an unmanned aerial vehicle against plant hoppers

A small unmanned aerial vehicle (UAV) that can spray pesticide with high efficiency and with no damage to crops is required for the timely and effective spraying of small fields and/or those in hilly mountains. The current study aimed to illuminate the influence of spraying parameters, such as operation height and operation velocity, of the UAV on droplet deposition on the rice canopy and protection efficacy against plant hoppers. Droplets of 480 g l⁻¹ chlorpyrifos (Regent EC) (at a dose of 432 g a.i. ha⁻¹, spray volume rate of approximately 15 l ha⁻¹) were collected using water-sensitive paper, and the coverage rates of the droplets on the rice canopy and lower layer were statistically analyzed. The deposition and distribution of droplets in the late stage of rice growth were closely related to the operational height and velocity of crop spraying as executed by the UAV, further affecting insect control. The spraying parameters for preventing plant hoppers were then optimized. When the spraying height was 1.5 m and the spraying velocity 5 m s⁻¹, the droplet deposition in the lower layer was maximized, and the droplets exhibited the most uniform distribution (CV = 23%). The insecticidal efficacy was 92%-74% from 3 to 10 days after spraying insecticide. Both the insecticidal efficacy and the persistence period were greater than those achieved with a hand lance operated from a stretcher-mounted sprayer (at dose of 432 g a.i. ha⁻¹, spray volume rate of approximately 750 l ha⁻¹), especially on the 5th day, indicating that UAV had a low-volume and highly concentrated spray pattern to enhance the duration of efficacy. This work offers a basis for the optimized design, improved performance, and rational application of UAV [W. C. Qin, B. J.

Qiu*, X. Y. Xue, C. Chen, Z. F. Xu, Q. Q. Zhou (Key Laboratory of Modern Agricultural Equipment and Technology, Ministry of Education, Jiangsu University, Zhenjiang, China) *Crop Protection*, 2016, **85**, 79-88].

NPARR, 7(4), 2016-368 Production of insecticide degradates in juices: Implications for risk assessment

This study was designed to observe the production of degradates of two organophosphorus insecticides and one pyrethroid insecticide in beverages. Purified water, white grape juice, apple juice, and red grape juice were fortified with 500 ng/g malathion, chlorpyrifos, and permethrin, and aliquots were extracted for malathion dicarboxylic acid (MDA), 3,5,6-trichloro-2-pyridinol (TCPy), and 3-phenoxybenzoic acid (3-PBA) several times over a 15 day period of being stored in the dark at 2.5 °C. Overall, first-order kinetics were observed for production of MDA, and statistically significant production of TCPy was also observed. Statistically significant production of 3-phenoxybenzoic acid was not observed. Results indicate that insecticides degrade in food and beverages, and this degradation may lead to preexisting insecticide metabolites in the beverages. Therefore, it is suggested that caution should be exercised when using urinary insecticide metabolites to assess exposure and risk [S. A. Radford*, P. Panuwet, R. E. Hunter, D. B. Barr, P. B. Ryan (Saint Francis University, Department of Chemistry, 211 Evergreen Drive, Loretto, PA, United States) *Journal of Agricultural and Food Chemistry*, 2016, **64**(22), 4633-4638].

NPARR, 7(4), 2016-369 Winter wheat yields are increased by seed treatment and fall-applied fungicide

Poor stand establishment resulting in lower yield is a major constraint to expanding winter wheat (*Triticum aestivum* L.) land area across the semiarid temperate regions of the northern Great Plains. We conducted a direct-

seeded study at nine sites across western Canada totaling 26 environments (site-years) over three growing seasons (2011–2013) to observe the responses of the winter wheat cultivar CDC Buteo to five levels of seed treatment (i) Check–no seed treatment, (ii) tebuconazole [(RS)- 1-(4-Chlorophenyl)-4,4-dimethyl-3-(1H, 1,2,4-triazol-1-ylmethyl)pentan- 3-ol], (iii) metalxyl {2-[(2,6-dimethylphenyl)-(2-methoxy-1-oxoethyl) amino] propanoic acid methyl ester}, (iv) imidacloprid (N-{1-[(6-Chloro-3-pyridyl)methyl]-4,5-dihydroimidazol-2-yl}nitramide), and (v) dual fungicide/insecticidal seed treatment: tebuconazole, + metalxyl + imidacloprid; and two levels of fall-applied fungicide (i) Check–no application or (ii) foliar-applied prothioconazole {2-[2-(1-chlorocyclopropyl)-3-(2-chlorophenyl)-2-hydroxypropyl]-1H-1,2,4-triazole-3-thione} performed in mid-October. The check and the fungicide seed treatment, metalxyl, produced similarly low grain yield resulting in lower net returns, whereas the dual fungicide/insecticide seed treatment provided the highest yield and net returns (CAN+\$13 ha⁻¹). Fall-applied fungicide improved yield (0.06 Mg ha⁻¹), but decreased net returns (~12 ha⁻¹). Plant density increased slightly (13 plants m⁻²) when seed treatments included the insecticide component, imidacloprid. Fall foliar fungicides generally improved spring plant density; however, no benefit was observed in seed treatments containing imidacloprid. Greater yield and plant stand stability was observed with fall-applied foliar fungicide applications; however, fall foliar would be cost prohibitive. The benefits of a fall foliar fungicide application requires further exploration in the context of an added input or as an alternative to a spring application as the net returns of a fall foliar compared to no application in the system render the input cost-prohibitive [T. K. Turkington, B. L. Beres, H. R. Kutcher, B. Irvine, E. N. Johnson, J. T. O'Donovan, K. N. Harker, C. B. Holzapfel, R. Mohr, G. Peng, F. C. Stevenson (Agric. and Agri-Food Canada, Lacombe Research and Development Centre, Lacombe,

AB, Canada) *Agronomy Journal*, 2016, **108**(4), 1379-1389].

***NPARR*, 7(4), 2016-370 Reductions in malaria in pregnancy and adverse birth outcomes following indoor residual spraying of insecticide in Uganda**

Indoor residual spraying of insecticide (IRS) is a key intervention for reducing the burden of malaria in Africa. However, data on the impact of IRS on malaria in pregnancy and birth outcomes is limited. An observational study was conducted within a trial of intermittent preventive therapy during pregnancy in Tororo, Uganda. Women were enrolled at 12-20 weeks of gestation between June and October 2014, provided with insecticide-treated bed nets, and followed through delivery. From December 2014 to February 2015, carbamate-containing IRS was implemented in Tororo district for the first time. Exact spray dates were collected for each household. The exposure of interest was the proportion of time during a woman's pregnancy under protection of IRS, with three categories of protection defined: no IRS protection, >0-20 % IRS protection, and 20-43 % IRS protection. Outcomes assessed included malaria incidence and parasite prevalence during pregnancy, placental malaria, low birth weight (LBW), pre-term delivery, and fetal/neonatal deaths. Of 289 women followed, 134 had no IRS protection during pregnancy, 90 had >0-20 % IRS protection, and 65 had > 20-43 % protection. During pregnancy, malaria incidence (0.49 vs 0.10 episodes ppy, P = 0.02) and parasite prevalence (20.0 vs 8.9%, P <0.001) were both significantly lower after IRS. At the time of delivery, the prevalence of placental parasitaemia was significantly higher in women with no IRS protection (16.8%) compared to women with 0-20% (1.1%, P = 0.001) or > 20-43% IRS protection (1.6%, P = 0.006). Compared to women with no IRS protection, those with > 20-43% IRS protection had a lower risk of LBW

(20.9 vs 3.1%, $P = 0.002$), pre-term birth (17.2 vs 1.5%, $P = 0.006$), and fetal/neonatal deaths (7.5 vs 0%, $P = 0.03$). In this setting, IRS was temporally associated with lower malaria parasite prevalence during pregnancy and at delivery, and improved birth outcomes. IRS may represent an important tool for combating malaria in pregnancy and for improving birth outcomes in malaria-endemic settings [M. K. Muhindo, A. Kakuru, P. Natureeba, P. Awori, P. Olwoch, J. Ategeka, P. Nayebare, T. D. Clark, A. Muehlenbachs, M. Roh, P. Jagannathan* (Univ Calif San Francisco, Dept Med, San Francisco, CA 94143 USA) *Malaria Journal*, 2016, **15**, DOI: 10.1186/s12936-016-1489-x].

NPARR, 7(4), 2016-371 Length of efficacy for control of curly top in sugar beet with seed and foliar insecticides

Curly top in sugar beet caused by Beet curly top virus (BCTV) is an important yield-limiting disease that can be reduced via neonicotinoid and pyrethroid insecticides. The length of efficacy of these insecticides is poorly understood; therefore, field experiments were conducted with the seed treatment Poncho Beta (clothianidin at 60 g a.i. + beta-cyfluthrin at 8 g a.i. per 100,000 seed) and foliar treatment Asana (esfenvalerate at 55.48 g a.i./ha). A series of four experiments at different locations in the same field were conducted in 2014 and repeated in a neighboring field in 2015, with four treatments (untreated check, Poncho Beta, Asana, and Poncho Beta + Asana) which were arranged in a randomized complete block design with eight replications. To evaluate efficacy, viruliferous (contain BCTV strains) beet leafhoppers were released 8, 9, 10, or 11 weeks after planting for each experiment, which corresponded to 1, 2, 3, and 4 weeks after Asana application. Over both years, in 30 of 32 observation dates for treatments with Poncho Beta and 14 of 16 observation dates for Asana, visual curly top ratings decreased an average of 41 and 24%,

respectively, with insecticide treatments compared with the untreated check. Over both years, in eight of eight experiments for treatments with Poncho Beta and six of eight experiments for Asana, root yields increased an average of 39 and 32%, respectively, with treatment compared with the untreated check. Over both years, the Poncho Beta treatments increased estimated recoverable sucrose (ERS) yield by 75% compared with the untreated check for weeks 8 and 9. By week 10, only the Poncho Beta + Asana treatment led to increases in ERS in both years, while the influence of increasing host resistance may have made other treatments more difficult to separate. When considering curly top symptoms, root yield, and ERS among all weeks and years, there was a tendency for the insecticides in the Poncho Beta + Asana treatment to complement each other to improve efficacy [C. A. Strausbaugh*, E. J. Wenninger, I. A. Eujayl (USDA ARS, NWISRL, Kimberly, ID 83341 USA) *Plant Disease*, 2016, **100**(7), 1364-1370].

NPARR, 7(4), 2016-372 Effect of surfactant on the efficacy of insecticides against onion thrips (*Thrips tabaci*)

The present experiment was carried out with an objective to find out the effect of surfactant on the efficacy of insecticides, because the use of insecticides for the control of onion thrips (*Thrips tabaci* Lindeman) is relatively less promising due to onion leaf pattern and texture. The minimum thrips population (6.48/plant) and thrips incidence (19.57%) were recorded at 15 days after spray in the fipronil 5 SC at 2 ml + surfactant at 0.5 ml/l of water, followed by lambda cyhalothrin 5 EC at 2 ml + surfactant at 0.5 ml (8.85/plant and 21.51%, respectively). While, imidacloprid 17.8 SL alone at 0.4 ml/l of water showed higher thrips population (21.78/plant) when compared to other treatments and which was found at par with untreated control. The efficacy of insecticides was significantly increased by addition of surfactant from 14.60 to 33.20 and 7.52 to 23.10% in

minimizing the number of thrips/plant and thrips incidence %, respectively. The minimum thrips damage severity (1.36) and maximum bulb yield (254.83 q/h) with highest cost benefit ratio (1:6.84) was recorded in fipronil 5 SC at 2 ml + surfactant at 0.5 ml/l of water followed by lambda cyhalothrin 5 EC at 2 ml + surfactant at 0.5 ml (1.62, 249.50 q/ha and 1:6.14, respectively). Fipronil 5 SC and lambda cyhalothrin 5 EC without surfactant showed intermediate thrips damage severity (1.68 and 1.96, respectively), bulb yield (241.53 and 238.52 q/ha, respectively),

and cost benefit ratio (1:5.68 and 1:5.26, respectively). The insecticides along with surfactant reduced the thrips damage severity (10.46-19.05%) and increased the bulb yield (1.97-5.51%) in different treatments when compared with the insecticides without surfactant. Along with insecticides the use of surfactant could be highly desirable [R. K. Gangwar*, G. S. Jat, S. S. Rathore, R. K. Sharma (Krishi Vigyan Kendra, Jaipur 303702, Rajasthan, India) *Indian Journal of Agricultural Sciences*, 2016, **86**(6), 757-761].

MANURE/FERTILIZERS

NPARR, 7(4), 2016-373 Phosphate fertiliser application effects on seasonally dry hill country pasture and soil

A grazed trial established in 1980 evaluated the effects of superphosphate fertiliser application on pasture growth on Easy (10°–20° slope) and Steep (30°–40° slope) land in the Waikato, North Island, New Zealand. Continuous and rotational grazing showed no effects on pasture responses to fertiliser. Mean annual pasture dry matter (DM) production ranged from 11,275 to 14,155 kg DM ha⁻¹ on Easy, and 6413 to 7480 kg DM ha⁻¹ on Steep slopes through the range of 10–100 kg ha⁻¹ yr⁻¹ of phosphate (P) fertiliser rates. Initial fertiliser effects on Olsen P tests were in the 0–3 cm depth only, and in the 7–15 cm soil depth only in the 100 kg ha⁻¹ yr⁻¹ treatment by year 4. Near maximum (97%) annual production, derived from relative yield analysis, was obtained at 0–7 cm depth soil tests of 30 on Easy slopes and at 12 on Steep slopes. Results from this trial are directly relevant to the variable fertiliser rate aerial application technology currently being developed [A.G. Gillingham (Agricultural Research Consultant, Palmerston North, New Zealand) *New Zealand Journal of Agricultural Research*, 2016, **59**(3), 280-300].

NPARR, 7(4), 2016-374 Biogas production from thermophilic codigestion of air-dried rice straw and animal manure

In order to evaluate the effects of organic loading rate (OLR) on thermophilic codigestion of air-dried rice straw (RS) with pig manure (PM), cow manure (CM), and chicken manure (CHM), continuous bench experiments (40 L) were carried out at OLRs of 3.0, 3.6, 4.2, 4.8, 6.0, 8.0, and 12.0 kg VS/(m³ . d). Stable biogas production without inhibition by volatile fatty acids (VFA) or ammonia and foaming was achieved at OLRs of 3-12, 3-6, and 3-4.8 for the

codigestions of RS + PM, RS + CM, and RS + CHM, respectively. Maximum average volumetric biogas production rates of 4.98, 2.64, and 2.03 m³/(m³ . d) were obtained at OLRs of 12, 6, and 4.8 kg VS/(m³ . d) for the codigestions of RS + PM, RS + CM, and RS + CHM. Foaming was occurred at OLRs of 8 kg VS/(m³ . day) for the codigestions of RS + CM. The codigestion of RS + CHM was inhibited by the accumulation of ammonia instead of VFA when the OLR was ≥ 6 kg VS/(m³ . d). This study provided references for the engineering application of codigestion of RS and animal manure [D. Li, Z. L. Mei, W. He, Y. X. Yuan, Z. Y. Yan, J. Li, X. F. Liu* (Chinese Acad Sci, Chengdu Inst Biol, Key Lab Environm & Appl Microbiol, Environm Microbiol Key Lab Sichuan Prov, 9 Sect 4, Renmin Nan Rd, Chengdu 610041, Sichuan, Peoples R China) *International Journal of Energy Research*, 2016, **40**(9), 1245-1254].

NPARR, 7(4), 2016-375 Heavy metal mobility and potential availability in animal manure: Using a sequential extraction procedure

In this study, dairy cow manure, goat manure, and chicken manure were collected from three farms and analyzed to find out the concentration of Cd, Co, Cr, Cu, Mn, Ni, Pb, and Zn. The concentration and potential of mobility and availability of heavy metals were studied in the animal manure samples. BCR Sequential extraction procedure was used to determine the binding forms of the metals. In this study, pseudo total concentrations of Mn and Zn were found out to be predominant in all the types of animal manure samples. According to the results, it was traced that Cr, Cu, and Ni were observed to be at the second highest level while Cd, Co, and Pb were seen at the lowest level in all the manure samples. When extractable amounts of heavy metals are taken into consideration, it is seen that the amount of the mobile fractions of heavy metals except for Cr and Ni are higher in comparison with that of immobile fraction in all the animal manure samples. It was also viewed

that Mn, Cd, and Zn are more available in dairy cow manure and chicken manure whereas Cd, Co, and Mn are more available in goat manure [A. Sungur, M. Soylak, S. Yilmaz, H. Ozcan (Erciyes Univ, Dept Chem, Fac Sci, TR-38039 Kayseri, Turkey), *Journal of Material Cycles and Waste Management*, 2016, **18**(3), 563-572].

NPARR, 7(4), 2016-376 The effects of different organic wastes on mineral element content in organic strawberry cultivation

In this article, five different organic waste effects on mineral uptake in growing organic strawberries was investigated. In the experiment, the impacts of different organic wastes, such as hazelnut husk (H), hazelnut husk compost (HC), rice hull (R), rice hull compost (RC), and farmyard manure on mineral element contents of strawberry cultivars Camarosa and Sweet

Charlie were investigated. The harvesting of the plants was performed at the beginning of resting, fluorescence, and at the end of the harvest throughout the experiment in order to examine the impacts of organic wastes on mineral element contents, which were detected in the leaf samples extracted from these harvests. In this experiment, it was observed that the applications H Compost and H yielded better results than farmyard manure and other wastes regarding mineral element content. In the research, when examined pull up dates, N, P, Mg, Fe, and Mn contents were adequate, but K, Ca, and Zn contents were found to be insufficient in strawberry leaves [G. Balci, H. Demirsoy, L. Demirsoy (Department of Horticulture, Faculty of Agriculture and Natural Sciences, Campus of Erdođan, Yozgat, Turkey) *Compost Science and Utilization*, 2016, **24**(3), 174-181].

OIL/ FATS

NPARR, 7(4), 2016-377 Effect of the distribution of saturated fatty acids in the melting and crystallization profiles of high-oleic high-stearic oils

The composition and distribution of fatty acids in triacylglycerol (TAG) molecules are commonly considered as factors that determine the physical properties of a given oil or fat. The distribution of any fatty acid in fats and oils can be described through the a coefficient of asymmetry, which can be calculated from the TAG composition and fatty acid composition of the sn-2 position of the TAGs determined through lipase hydrolysis. High-oleic high-stearic oils and fats are considered stable and healthy, and they are good substitutes for hydrogenated vegetable oils and palm fractions in many food products, such as spreads and confectionery. Here, different high-oleic high-stearic acid oils were formulated which contained different distributions of saturated fatty acids in their TAGs, while maintaining a similar fatty acid composition. The aim of this work was to discuss the possibility of using the a coefficient to predict the physical properties of fats in function of their chemical composition and their melting and crystallization behavior as examined by differential scanning calorimetry [M. A. Bootello, R. Garcés, E. Martínez-Force, J. J. Salas* (Instituto de la Grasa, CSIC, Sevilla, Spain) *Grasas y Aceites*, 2016, **67**(3), DOI: 10.3989/gya.0441161].

NPARR, 7(4), 2016-378 Adding talc particles improves physical properties of palm oil-based shortening

This paper reports the effects of adding talc particles on the physical properties of palm oil (PO)-based shortening formed by working refined PO (RPO) after rapid cooling. We examined the thermal and viscoelastic behavior of RPO in bulk fat systems, and the

polymorphism and hardness of the shortening in the presence and absence of talc particles. In addition, the microstructure of fat crystals formed was observed. The effects of talc addition are summarized as follows: (i) When RPO was cooled at a rate of 5 °C/min, crystallization of the high-melting fraction, including tripalmitoylglycerol (PPP) and 1,3-dipalmitoyl-2-oleoyl glycerol (POP), was preferentially promoted to form small-sized microcrystals. During cooling, the increase in the viscoelasticity of RPO was suppressed at low temperatures. (ii) When the shortening was stored at 5 °C, β' -crystallization of 1-palmitoyl-2,3-dioleoyl glycerol (POO) and β -crystallization, probably of a molecular compound (MC) of POP and 1,2-dipalmitoyl-3-oleoyl glycerol (PPO), were delayed compared to β' -crystallization of PPP and POP. During storage, the homogeneity of the fat crystal dispersion improved and the hardness of the shortening decreased. These results indicate that talc improved the physical properties of the PO-based shortening by changing the crystallization kinetics and the networking processes of the fat crystals. Practical applications: The present study showed that adding talc particles effectively improved the physical properties of palm oil (PO)-based shortening during storage. This is considered beneficial for resolving problems in the quality control of PO-based products, such as post-hardening and the formation of granular crystals due to low rates of crystallization. Storage modulus (G') of refined palm oil (RPO) with and without talc particles in bulk fat systems, obtained from dynamic viscoelasticity measurements during cooling at a rate of 5 °C/min. Adding talc particles drastically changed the three-stage increases in G' of pure RPO, promoting the first-stage increase but suppressing subsequent increases at low temperatures [S.Yoshikawa*, H. Kida, Y. Matsumura, K. Sato (R&D Division for Future Creation, Fuji Oil Co., Ltd., Tsukubamirai, Japan) *European Journal of Lipid Science and Technology*, 2016, **118**(7), 1007-1017].

NPARR, 7(4), 2016-379 Effects of an high-fat diet enriched in lard or in fish oil on the hypothalamic amp-activated protein kinase and inflammatory mediators

The high fat diet (HFD) rich in lard induces obesity, inflammation and oxidative stress, and the deregulation of hypothalamic nuclei plays an important role in this mechanism. One important factor involved in the food intake and inflammation is adenosine monophosphate-dependent kinase (AMPK), a serine/threonine kinase activated by phosphorylation. Omega (omega)3-polyunsaturated fatty acids (PUFA) are dietary compounds known to attenuate the obesity-related diseases, although the molecular mechanisms underlying their actions in the hypothalamus are not completely understood. We hypothesized that the beneficial effects of PUFA may be mediated by AMPK in the hypothalamus. To this aim, rats were fed a control diet (CD), or isocaloric HFD containing either fish oil (FD rich in omega 3-PUFA) or lard (LD) for 6 weeks, and the activation of AMPK, inflammatory state (IKK beta, TNF-alpha) and oxidative stress were analyzed in the hypothalamus. In addition, we also studied serum lipid profile, homeostatic model assessment (HOMA) index, and pro-inflammatory parameters. Our results showed, at the hypothalamic level of LD-fed rats, an increase of AMPK activation, inflammation and oxidative stress, while no modifications were detected in FD fed animals compared to CD. In addition body weight gain, serum lipid profile, pro-inflammatory parameters and insulin resistance were reduced in FD animals compared to LD. In conclusion, our data indicate that the substitution of saturated by unsaturated fatty acids in the diet has beneficial effects on modulation of hypothalamic inflammation and function in obesity, underlying, at hypothalamic level, the interaction among insulin and/or leptin resistance, AMPK activation and hyperphagia [E. Viggiano, M. P. Mollica, L. Lionetti, G. Cavaliere, G. Trinchese, C. De Filippo, S. Chieffi,

M. Gaita, A. Barletta, B. De Luca, M. Crispino* (Univ Naples Federico II, Dept Biol, Naples, Italy) *Frontiers in Cellular Neuroscience*, 2016, **10**, DOI: 10.3389/fncel.2016.00150].

NPARR, 7(4), 2016-380 Effects of membrane-filtered soy hull pectin and pre-emulsified fiber/oil on chemical and technological properties of low fat and low salt meat emulsions

The objectives of this study were to determine efficacy of a membrane filtration in soy hull pectin purification and evaluate combined effects of soy hull pectin and pre-emulsified fiber/oil (PE) on chemical composition and technological properties of low fat and low salt meat emulsions. Soy hull pectin was purified through two different methods (alcohol-washed (ASP) and membrane-filtered (MSP)). Insoluble soy hull residues after pectin extraction were incorporated with sunflower oil and water for the PE preparation. Meat emulsion was formulated with 58 % pork, 20 % ice, 20 % pork backfat, and 2 % NaCl as control. A total of six low fat and low salt meat emulsions (1 % NaCl and 10 % backfat) was manufactured with 1 % pectin (with/without ASP or MSP) and 10 % PE (with/without). The pectin content of ASP and MSP was 0.84 and 0.64 g (L)-galacturonic acid/g dry sample, respectively. The inclusion of soy hull pectin caused similar results on chemical composition, color, cooking loss, and texture of the meat emulsions, regardless of the purification method. In addition, positive impacts of the combined treatments with soy hull pectin and PE compared to single treatments on cooking loss and texture of the meat emulsions were observed. Results suggest that membrane filtration could be an effective alternative method to purify pectin, instead of alcohol-washing, and both soluble pectin and insoluble fiber from soy hulls could be used as a functional non-meat ingredient to manufacture various low fat and low salt meat products [H. W. Kim, Y. J. Lee, Y.

H. B. Kim* (Purdue Univ, Dept Anim Sci, Meat Sci & Muscle Biol Lab, 901 W State St, W Lafayette, IN 47907 USA) *Journal of Food Science and Technology-Mysore*, 2016, **53**(6), 2580-2588].

NPARR, 7(4), 2016-381 **Effects of encapsulated fish oil by polymerized whey protein on the textural and sensory characteristics of low-fat yogurt**

Five types of polymerized whey protein (PWP1, PWP2, PWP3, PWP4 and PWP5) containing different amounts of fish oil were added to low-fat yogurt as fat replacers. The texture, apparent viscosity, and sensory properties of the yogurts were analyzed in comparison with full-fat (3.0%, w/w, fat) and low-fat (1.5%, w/w; and 1.2%, w/w) milk yogurt

controls. The majority (~85%) of the particle size distribution was in the range of 1106±158 nm. Thermal property analysis indicated PWP was thermally stable between 50°C and 90°C. Yogurts formulated with 12% of PWP4 and 14% of PWP5 demonstrated higher firmness, springiness and adhesiveness (P <0.05), and lower cohesiveness (P <0.05) than the low-fat milk yogurt controls. There was no fat separation and they had less fishy smell. Yogurts incorporated with 12% of PWP4 had comparable sensory and textural characteristics to the full-fat milk yogurt control [D. Liu, T. Zhang*, N. Jiang, C. Xi, C. Sun, J. Zheng, M. Guo (College of Light Industry and Economics and Management, Jilin University, 5333 Xi'an Road, Changchun, China) *Polish Journal of Food and Nutrition Sciences*, 2016, **66**(3), 189-198].

PHYTOCHEMICALS

NPARR, 7(4), 2016-382 Variability in yield and phytochemicals content in mandukapanri (*Centella asiatica*) as influenced by nutrient management

A two years field experiment was conducted to study the influence of nutrient management on herbage yield, triterpenes content and their correlation with NPK, triterpenes yield, and NPK content and their use efficiencies in *Centella asiatica* (L.) Urban. Results indicated that application of FYM 15 tonnes/ha and NPK 60:50:60 at planting and NK 60:60 kg/ha at 5th harvest as basal along with N 20 kg/ha as split application at each harvest recorded highest dry herbage yield. The asiaticoside (AS) and madecassoside (MS) content increased with FYM application, whereas, decreased with NPK, however, asiatic acid (AA) and madecassic acid (MA) content markedly increased with FYM and NPK both. Highly strong relationships were exhibited between plant NPK content with AA and MA content. Triterpenes yield was recorded highest with the application of FYM 15 tonnes/ha and NPK 60:50:60 at planting and NK 60:60 kg/ha at 5th harvest as basal along with N 20 kg/ha as split application at each harvest. Application of FYM and NPK significantly influenced N and K content and their agronomic and use efficiencies, whereas, P content and its agronomic and use efficiency were significant with NPK and non-significant with FYM. Thus, application of FYM 15 tonnes/ha and NPK 60:50:60 at planting and NK 60:60 kg/ha at 5th harvest as basal along with N 20 kg/ha as split application at each harvest found optimum to harvest maximum herbage and triterpenes yield and to produce quality raw drugs of *C. asiatica* [R. S. Jat*, N. A. Gajbhiye (ICAR Directorate Med & Aromat Plants Res, Anand 387310, Gujarat, India) Indian Journal of Agricultural Sciences, 2016, **86**(8), 1004-1009].

NPARR, 7(4), 2016-383 Functional properties of spinach (*Spinacia oleracea* L.) phytochemicals and bioactives

Overwhelming evidence indicates that diets rich in fruits and vegetables are protective against common chronic diseases, such as cancer, obesity and cardiovascular disease. Leafy green vegetables, in particular, are recognized as having substantial health-promoting activities that are attributed to the functional properties of their nutrients and non-essential chemical compounds. Spinach (*Spinacia oleracea* L.) is widely regarded as a functional food due to its diverse nutritional composition, which includes vitamins and minerals, and to its phytochemicals and bioactives that promote health beyond basic nutrition. Spinach-derived phytochemicals and bioactives are able to (i) scavenge reactive oxygen species and prevent macromolecular oxidative damage, (ii) modulate expression and activity of genes involved in metabolism, proliferation, inflammation, and antioxidant defence, and (iii) curb food intake by inducing secretion of satiety hormones. These biological activities contribute to the anti-cancer, anti-obesity, hypoglycemic, and hypolipidemic properties of spinach. Despite these valuable attributes, spinach consumption remains low in comparison to other leafy green vegetables. This review examines the functional properties of spinach in cell culture, animals and humans with a focus on the molecular mechanisms by which spinach-derived non-essential phytochemicals and bioactives, such as glycolipids and thylakoids, impart their health benefits [J. L. Roberts*, R. Moreau (Univ Nebraska, Dept Nutr & Hlth Sci, Lincoln, NE 68583 USA) Food & Function, 2016, **7**(8), 3337-3353].

NPARR, 7(4), 2016-384 Isolation of sesquiterpenes lactone from *Curcuma aeruginosa* rhizome and the cytotoxic activity against human cancer cell lines

The objectives of this research were to isolate bioactive compounds from *Curcuma*

aeruginosa Roxb. and to study the cytotoxic activity against human cancer cell lines. The in vitro cytotoxicity test was done on human cancer cell lines such as Breast carcinoma MCF-7 and T-47D; Cervical carcinoma Ca Ski and Hela S3 by MTT ([3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide] assay. Cytotoxicity test was also conducted on Vero cells (normal cells). The isolation of bioactive compounds from this extract of *C. aeruginosa* rhizome was carried out by chromatographic method and the structure elucidation was performed by interpretation of spectroscopic data, including UV, IR, ¹H and ¹³C NMR 1D and 2D. The study showed that n-hexane and chloroform fraction from *C. aeruginosa* had low cytotoxic activity against MCF-7 and Ca-ski (IC₅₀ <100 μg/mL), but not toxic against Hela S3, T-47D, and Vero cell lines (IC₅₀ >500 μg/mL). From the chloroform fraction of *C. aeruginosa* we isolated a new sesquiterpene lacton aeruginon (1) and a known compound curcumenon (2). It can be concluded that according to the present study, *C. aeruginosa* can be used as a potent source of natural bioactive compounds that is rich in sesquiterpene compounds [S. Atun*, R. Arianingrum, N. Aznam, S. N. Ab Malek (Department Chemistry education, Yogyakarta State University, Jl. Colombo No. 1, Depok, Sleman, Yogyakarta, Indonesia) *International Journal of Pharmacognosy and Phytochemical Research*, 2016, **8**(7), 1168-1172].

NPARR, 7(4), 2016-385 **Phytochemicals as future drugs for Parkinson's disease: A comprehensive review**

Parkinson's disease (PD) is the second most common chronic neurodegenerative disease that affects motor skills and cognitive performance. The conventional therapeutic approaches for the management of PD are just able to alleviate symptoms. Exploring for achieving novel substances with therapeutic benefits in PD patients is the focus of a wide range of current investigations. The aim of the present study is to comprehensively

review phytochemicals with protective or therapeutic activities in PD and focus on their neuropsychopharmacological mechanisms. Various subgroups of polyphenols (flavonoids, phenolic acids, stilbenes, and lignanes) and terpenes are the most abundant groups of phytochemicals with well-established antiparkinsonian effects. Other phytochemical categories, such as alkaloids, cinnamates, carbohydrates, amino acids, and fatty acid amides, also have some representatives with positive effects in PD. Phytochemicals perform their antiparkinsonian effect through several mechanisms of action, including suppressing apoptosis (via the reduction of Bax/Bcl-2, caspase-3, -8, and -9, and alpha-synuclein accumulation), decreasing dopaminergic neuronal loss and dopamine depletion, reducing the expression of proinflammatory cytokines (such as prostaglandin E-2, interleukin-6, interleukin-1 beta, and nuclear factor-kappa B), and modulating nuclear and cellular inflammatory signaling, elevation of neurotrophic factors, and improvement of antioxidant status. Plant-derived natural products can be considered as future pharmaceutical drugs or adjuvant treatment with conventional therapeutic approaches to improve their efficacy and alleviate their psychological adverse effects in the management of PD. Well-designed clinical trials are mandatory to evaluate the protective and healing benefits of phytochemicals as promising future drugs in the management of neurodegenerative diseases [Z. Shahpiri, R. Bahramsoltani, M. H. Farzaei, F. Farzaei, R. Rahimi* (Univ Tehran Med Sci, Sch Tradit Med, Dept Tradit Pharm, Tehran 1417653761, Iran) *Reviews in the Neurosciences*, 2016, **27**(6), 651-668].

NPARR, 7(4), 2016-386 **Phytochemicals and potential health effects of *Sambucus williamsii* Hance (Jiegumu)**

Sambucus williamsii Hance (Jiegumu) is traditionally used in Chinese medicine to treat bone and joint diseases. The major phytochemicals in *S. williamsii* are lignans,

terpenoids, and phenolic acids, together with trace amounts of essential oils, minerals, amino acids, and natural pigments. In this review, a database search for studies published from 1990 to November 2015 was conducted using PubMed, the China Academic Journals Full-Text Database, and Google Scholar with the keywords "*Sambucus williamsii* Hance", "*Sambucus williamsii*", "*Sambucus williamsii* + clinic", "*Sambucus williamsii* + biology", "*Sambucus williamsii* + chemicals", and "Jiegumu", which covered chemical studies, cell culture studies, animal experiments, and

clinical studies. This article reviewed the compounds isolated from *S. williamsii* that may reduce the risk of cancer, and exert antifungal, antioxidant, anti-inflammatory, bone fracture healing, and anti-osteoporotic effects [H. H. Xiao, Y. Zhang, R. Cooper, X. S. Yao, M. S. Wong* (Hong Kong Polytech Univ, State Key Lab Chinese Med & Mol Pharmacol Incubat, Shenzhen Res Inst, Shenzhen 518057, Peoples R China) *Chinese Medicine*, 2016, **11**, DOI: 10.1186/s13020-016-0106-9].

RUBBER/GUM/RESIN

NPARR, 7(4), 2016-387 Chemical evaluation of composites natural rubber/carbon black/leather tannery projected to antistatic flooring

In this study the composites which are commonly called NR/CB/Leather were developed in order to apply them as antistatic flooring and coating. They were developed using vulcanized natural rubber, carbon black to add an electric conduction property and industrial leather waste. The leather industrial waste was micronized and added to the rubber matrix in proportions of 60 and 80 phr using an opened mixing cylinder according to ASTM D 3182 standard. The composites were exposed to the sanitizing agents, (i) bleach and (ii) disinfectant, aiming to simulate a real cleaning context, and to meet the health standards of the Brazilian Ministry of health. Physical-chemical and microbiological evaluations were carried out to determine the structural and chemical stabilities of the composites. After this, low water absorption level (<1.5%), immobilization and low chromium oxide level (<1.5), pH within the neutrality rate and an excellent resistance to microbiological contamination were identified for the composites. Thus, from a physical-chemical perspective, the composites NR/CB/Leather displayed suitable properties and potential for application as antistatic flooring and coatings. Besides using leather industrial waste in their production, their manufacture can boost this industrial sector economically and, consequently, promote a reduction in environmental impact [M. R. Ruiz, P. L. S. Cabreira, E. R. Budemberg, E. A. P dos Reis, F. S. Bellucci, A. E. Job* (UNESP Univ Estadual Paulista, FCT, CP 467, BR-19060900 Presidente Prudente, SP, Brazil) *Journal of Applied Polymer Science*, 2016, **33**(27), DOI: 10.1002/app.43618].

NPARR, 7(4), 2016-388 VOC sorption in stretched cross-linked natural rubber

Sorption of volatile organic compound (VOC) vapors in natural rubber (NR) was measured at 20 degrees C using a magnetic suspension balance. Experiments were performed with non-cross-linked NR, as well as NR cross-linked with dicumyl peroxide. Stretching the cross-linked NR samples leads to crystal formation and therefore to a constraint to volume swelling of the amorphous domains. To investigate the influence of NR stretching and therefore of crystal formation on the VOC sorption, measurements of nonstretched NR were compared to data for cross-linked NR samples stretched with different extension ratios. Analysis of the VOC sorption data revealed a reduced VOC sorption in the stretched NR compared to fully amorphous, nonstretched NR. The sorption data were modeled using the perturbed-chain statistical associating fluid theory (PC-SAFT) accounting for network elasticity by an additional Helmholtz-energy contribution. Influence of crystallinity content on VOC solubility in stretched NR was finally accounted for following a recently proposed approach and thus accounting for an additional contribution to pressure in the amorphous phase as a result of constraint imposed by crystalline domains. Comparison of modeling results with measured solubility for several VOCs in NR confirmed the overall consistency of the modeling approach used [N. Gushterov, F. Doghieri, D. Quitmann, E. Niesing, F. Katzenberg, J. C. Tiller, G. Sadowski* (TU Dortmund, Dept Biochem & Chem Engr, Lab Thermodynam, Emil Figge Str 70, D-44227 Dortmund, Germany) *Industrial & Engineering Chemistry Research*, 2016, **55**(26), 7191-7200].

NPARR, 7(4), 2016-389 Effect of sulfur to accelerator ratio on crosslink structure, reversion, and strength in natural rubber

A new relationship among the sulfur to accelerator (S/A) ratio, the degree of reversion or the netloss of crosslinks at the prolonged cure

time, and the tensile strength and crosslink structure of gum natural rubber (NR) vulcanizates is described here. To study this, N,N-dicyclohexyl-2-benzothiazole sulfenamide (DCBS), N-cyclohexyl-2-benzothiazole sulfenamide (CBS), 2,2'-dithiobisbenzothiazole (MBTS), and tetrabenzylthiuram disulfide (TBzTD) were used as accelerators. The results showed that for all four tested accelerators, the degree of reversion and tensile strength of the vulcanizates did not simply increase with increasing S/A ratios within the range of 0.26-6.67 by weight. This was because the proportion of polysulfidic linkages playing an important role on these properties was not simply proportional to the S/A ratios but turned out to pass through a maximum and then decline with further increasing S/A ratios for the DCBS, CBS, and MBTS cure systems. Nevertheless, when considering the effect of crosslink structure on the thermal and mechanical properties, it was observed that for all four tested accelerators, the increase in the extent of polysulfidic linkages gave the vulcanizate with the lower reversion resistance but the higher tensile strength. Therefore, the generalization that it is the high concentration of polysulfidic linkages in the network that causes a decrease in the reversion resistance but an increase in the tensile strength is seemingly still applicable [K. Boonkerd, C. Deeprasertkul, K. Boonsomwong (Chulalongkorn Univ, Fac Sci, Dept Mat Sci, Bangkok 10330, Thailand) *Rubber Chemistry and Technology*, 2016, **89**(3), 450-464].

NPARR, 7(4), 2016-390 **Molecular cloning and characterization of a stress responsive peroxidase gene HbPRX42 from rubber tree**

Plant peroxidases participate in versatile biological processes and stress responses. Peroxidase activity significantly increased under drought stress in rubber tree. To identify the functions of peroxidase genes in response to drought stress, the full-length cDNA of HbPRX42 was isolated from rubber tree. The

HbPRX42 contains 338 amino acid residues and a plant peroxidase-like superfamily domain. Phylogenetic analysis with Arabidopsis Class III peroxidases revealed that HbPRX42 shared high identities with AtPRX42. Although HbPRX42 was expressed in all tissues, it was preferentially expressed in flower and latex in rubber tree. HbPRX42 expression was significantly upregulated in leaves by drought stress. Moreover, light, mechanical wounding, H₂O₂, abscisic acid, ethylene, methyl jasmonic acid, and salicylic acid treatments also led to marked accumulation of HbPRX42 transcripts in leaves, too. However, HbPRX42 transcripts were downregulated by powdery mildew infection. In a word, these results indicated the involvement of HbPRX42 in both biotic and abiotic stress responses via multiple signaling pathways in rubber tree [L. F. Wang, J. K. Wang, F. An, G. S. Xie (Danzhou Investigation and Experiment Station of Tropical Crops, Ministry of Agriculture, Rubber Research Institute, Chinese Academy of Tropical Agricultural Sciences, Danzhou, Hainan, China) *Revista Brasileira de Botanica*, 2016, **39**(2), 475-483].

NPARR, 7(4), 2016-391 **Non-linear modeling of seismic isolation systems made of recycled tire-rubber**

This article considers the effectiveness of a seismic isolation system composed of a shallow layer of soil mixed with sand and rubber from shredded tires. A thorough review of past work is first provided, which is then followed by an evaluation of the constitutive properties of sand-rubber soil mixtures when these undergo large states of deformation and slip. Finally, a comprehensive set of simulations that involve a structure underlain by a strongly non-linear, seismic isolating layer when subjected to a variety of actual earthquakes scaled to various peak accelerations, are considered in detail. It is shown that the concept of using soil-rubber mixtures for the purposes of seismic isolation

appears promising. A thickness for the rubber-soil mixture of just 2-3 m is likely to be enough to achieve good levels of reductions in the seismic response of the structure. This suggests the desirability of following these analyses with large-scale experimental verifications, not only to fully validate the concept, but also to quantify and assess the numerical predictions with our

simple even if non-linear mechanical models, and verify the large-strain constitutive properties of the soil mixtures inferred from laboratory analyses [S. Brunet*, J. C. de la Llera, E. Kausel (Civil Engineer, Spoerer Ingenieros Asociados SpA, Marchant Pereira 367, Of.701, Santiago, Chile) *Soil Dynamics and Earthquake Engineering*, 2016, **85**, 134-145].

SPICES/CONDIMENTS

NPARR, 7(4), 2016-392 The biotechnology of Ugba, a Nigerian traditional fermented food condiment

Legumes and oil bean seeds used for the production of condiments in Africa are inedible in their natural state: they contain some anti-nutritional factors especially undigestible oligosaccharides and phytate. Fermentation impact desirable changes by reducing anti-nutritional factors and increasing digestibility. Ugba is an alkaline fermented African oil bean cotyledon (*Pentaclethra macrophylla*) produced by the Ibos and other ethnic groups in southern Nigeria. Seen as a family business in many homes, its preparation is in accordance with handed-down tradition from previous generations and serves as a cheap source of plant protein. Its consumption as a native salad is made possible by fermentation of the cotyledon for 2-5 days, but could also serve as a soup flavoring agent when fermentation last for 6-10 days. The fermentation process involved is usually natural with an attendant issue of product safety, quality and inconsistency. The production of this condiment is on a small scale and the equipment used are very rudimentary, devoid of good manufacturing procedures that call to question the issue of microbial safety. This paper therefore reviews the production process and the spectrum of microbial composition involved during fermentation. In addition, potential spoilage agents, nutritional and biochemical changes during production are examined. Furthermore, information that can support development of starter cultures for controlled fermentation process in order to guarantee microbiological safety, quality and improved shelf life are also discussed [N. A. Olasupo, C. P. Okorie, F. A. Oguntoyinbo (Lagos State Univ, Fac Sci, Dept Microbiol, Food Microbiol Res Lab, Lagos, Nigeria) *Frontiers in Microbiology*, 2016, **7**, DOI: 10.3389/fmicb.2016.01153].

NPARR, 7(4), 2016-393 Molecular analysis of bacterial community dynamics during the fermentation of soy-daddawa condiment

Bacterial community dynamics during soy-daddawa fermentation was investigated using culture-dependent and PCR-denaturing gradient gel electrophoresis (PCR-DGGE) molecular methods. The total titratable acidity (TTA), pH, and bacterial counts (BCs) were monitored daily during a 72-h fermentation period. Bacteria were characterized based on 16S rRNA gene sequencing. TTA ranged from 0.08 to 0.26 mg lactic acid/g, whereas pH ranged from 7.01 to 8.19. BCs increased from 3.9 to 10.61 log CFU/g. Fifty-eight isolates were obtained by culture method and clustered into seven operational taxonomic units (OTUs) at 97% sequence similarity, whereas four OTUs were obtained from the PCR-DGGE method. Taxonomic identification revealed that bacteria belonged to the genera *Bacillus*, *Enterobacter*, *Enterococcus*, and *Staphylococcus* with *B. subtilis* being present throughout fermentation. Medically significant isolates, including *B. anthracis*, *Enterococcus casseliflavus*, and *Enterobacter hormaechei* were detected. These results emphasize the need for starter culture utilization and offer a platform for starter culture screening and selection [O. Ezeokoli, A. Gupta, T. Popoola, C. Bezuidenhout* (North West Univ, Unit Environm Sci & Management, Potchefstroom Campus, ZA-2520 Potchefstroom, South Africa) *Food Science and Biotechnology*, 2016, **25**(4), 1081-1086].

NPARR, 7(4), 2016-394 Effect of enzyme pretreatment on yield and quality of fresh green chilli (*Capsicum annuum* L) oleoresin and its major capsaicinoids

The effect of enzyme pretreatment on extraction yield and quality of oleoresin from fresh green chilli (*Capsicum annuum* L) samples and its major capsaicinoids were evaluated using various enzymes viz., Celluclast 1.5L, Pectinex Ultra SP.L, ViscozymeL, Protease and an equal

combination of Celluclast 1.5L, Pectinex Ultra SP.L and ViscozymeL. Optimization of the enzyme activity was carried out by varying the enzyme concentration, reaction temperature, pH, and incubation time. The quality of the oleoresin was further evaluated using High Performance Liquid Chromatography (HPLC) coupled with Photo Diode Array (PDA) detector. Scanning Electron Microscopic (SEM) studies were conducted to visualize the effect of these enzymes on green chilli cell walls. It was observed that the capsaicinoids recovery was higher in ViscozymeL pretreated green chilli (22%) followed by chilli pretreated with enzymes Celluclast (20%) Pectinex (17.5%) and Protease (14%) with respect to the control sample. The HPLC finger printing of capsaicinoids showed no alterations in their profile as compared with the control sample. The SEM analysis revealed that the enzyme pretreatment, especially with enzymes ViscozymeL and Celluclast was potentially effective in rupturing the cell walls and making them more susceptible to extraction medium. In economic point of view, the results of the present study could be used effectively in the spice industry to increase the extraction yield and quality of oleoresin from green chilli [K. C. Baby, T. V. Ranganathan* (University, Karunya Nagar, Coimbatore, Tamil Nadu, India) *Biocatalysis and Agricultural Biotechnology*, 2016, **7**, 95–101].

NPARR, 7(4), 2016-395 **Choleretic activity of turmeric and its active ingredients**

Turmeric, a rhizome of *Curcumin longa* L. is widely used as both a spice and an herbal medicine. The traditional use of turmeric in gastroenterology is mainly based on its choleretic activity. The aim of this study is to determine the effects of turmeric on bile flow (BF) and total bile acids (TBAs) excretion in a bile fistula rat model after acute duodenal administration. A significant dose-dependent enhancement in both BF and TBAs was detected after treatment with the turmeric decoctions which suggested the choleretic activity was bile acid-dependent

secretion. In order to direct the active group of compounds, aqueous (AE), ethyl acetate (EtOAc), and petroleum ether (PE) extracts were investigated. The EtOAc and PE extracts showing high effects were purified to locate the active ingredients. Three curcuminoids (curcumin, demethoxycurcumin, and bisdemethoxycurcumin) and 2 sesquiterpenes (bisacurone B and ar-turmerone) were isolated. It was found Bisacurone B was the most potent choleretic ingredient followed by ar-turmerone, bisdemethoxycurcumin demethoxycurcumin, and then curcumin. The amounts of the active ingredients were quantitatively analyzed by high-performance liquid chromatography. The EtOAc and PE extracts had high sesquiterpenes and curcuminoids content, while the AE extract had poor content of sesquiterpenes and curcuminoids which affected neither BF nor TBAs. Based on the results of multiple linear regression analysis, the content of BIS and TUR were dominant factors ($P < 0.01$) of controlling BL and TBAs in EtOAc and PE extracts [Y. Wang, L. Wang, X. Zhu*, D. Wang, X. Li (Authors Y. Wang and Zhu are with Medical School, Southeast Univ, Nanjing, China) *Journal of Food Science*, 2016, **81**(7), H1800-H1806].

NPARR, 7(4), 2016-396 **Pharmacological evaluation of synthetic cannabinoids identified as constituents of spice**

In recent years, many synthetic cannabinoid (CB) receptor agonists have appeared on the market as constituents of herbal incense mixtures known as “spice”. Contrary to the declared use, they are perorally consumed as a replacement for marijuana to get “high”. In many cases, detailed information on the physicochemical and pharmacological properties of the synthetic compounds found in spice preparations is lacking. We have now evaluated a large series of heterocyclic compounds, 1,3-disubstituted indole and 2-azaindole derivatives known or assumed to be CB1 receptor agonists, many of which have previously been identified in forensic samples. The mainly observed structural

variations to circumvent restriction by law were bioisosteric exchanges of functional groups in known CB1 agonists. We analyzed the structure-activity relationships of compounds at human CB1 and CB2 receptors based on affinities obtained in radioligand binding studies, and determined their efficacy in cAMP accumulation assays. Moreover, we investigated the activities of the compounds at the orphan G protein-coupled receptors GPR18 and GPR55 both of which are known to interact with cannabinoids. Most of the investigated compounds behaved as potent full agonists of CB1 and CB2 receptors with affinities in the low nanomolar to subnanomolar

concentration range. Some compounds were moderately potent GPR55 antagonists, while none interacted with GPR18. Most derivatives were predicted to cross the blood-brain barrier as determined by bioinformatics tools. These data are useful for assessing synthetic cannabinoids and will be helpful for predicting pharmacological properties of novel compounds that appear on the illicit drug market [C. Hess, C. T. Schoeder, T. Pillaiyar, B. Madea, C. E. Müller (PharmaCenter Bonn, Pharmaceutical Institute, Pharmaceutical Chemistry I, University of Bonn, An der Immenburg 4, Bonn, Germany) *Forensic Toxicology*, 2016, **34**(2), 329-343].

SUGAR

NPARR, 7(4), 2016-397 Sugar-sweetened beverage consumption and risk of incident chronic kidney disease: Tehran lipid and glucose study

To evaluate cross-sectional and longitudinal relationships between sugar sweetened beverages (SSBs), sugar sweetened carbonated soft drinks (SSSDs), and fruit juice drink consumption and risk of chronic kidney disease (CKD) in a population based study. At baseline, 2382 participants, aged >27 years, of the Tehran Lipid and Glucose Study with complete data on serum creatinine, cardio-metabolic risk factors, and diet were included for cross-sectional analysis. After 3 years, 1690 subjects, free of baseline CKD and with complete follow-up data, were included for longitudinal analysis. Estimated glomerular filtration rate (eGFR) was calculated using the Modification of Diet in Renal Disease Study equation and CKD was defined as eGFR<60 mL/min per 1.73m². Dietary intake was collected using a food-frequency questionnaire and SSSDs and all kinds of fruit juice drinks were combined to estimate the intake of SSBs. To assess the association of SSBs and CKD, logistic regression adjusted for age, sex, energy intake, smoking, physical activity, body mass index, sodium, diabetes, and hypertension were used. The mean age of participants and serving of SSBs/week were 45.0 years and 2.3, respectively. Compared to participants taking <0.5 serving/week, consumption of more than four servings of SSBs and SSSDs per week was associated with increased odds ratio (OR) of prevalent CKD (1.77 and 2.14, respectively). In longitudinal analyses, the risk of incident CKD increased by consumption of four servings/week, compared to less than 0.5 serving/week of SSBs (OR: 1.96; 95% confidence interval (CI):1.23-3.15) and SSSDs (OR: 2.45; 95% CI:1.55-3.89). Consumption of over four servings per week of SSBs and SSSDs was associated with higher

prevalence and incidence of CKD. In this Iranian cohort study with a 3-year followup period, the authors demonstrate an association between sugar-sweetened beverage consumption and risk of developing chronic kidney disease [E. Yuzbashian, G. Asghari, P. Mirmiran*, A. Zadeh-Vakili, F. Azizi (Shahid Beheshti Univ Med Sci, Natl Nutr & Food Technol Res Inst, Fac Nutr Sci & Food Technol, Dept Clin Nutr & Dietet, POB 19816-19573, Tehran, Iran) *Nephrology*, 2016, **21**(7), 608-616].

NPARR, 7(4), 2016-398 Impact of sugar syrup and pollen diet on the bacterial diversity in the gut of indoor-reared bumblebees (*Bombus terrestris*)

In this project, we showed the influence of diet on the microbial composition in the gut of indoor-reared bumblebees (*Bombus terrestris*), using Illumina MiSeq 16S ribosomal RNA (rRNA) sequencing. Three sugar syrups and sterilized pollen from three suppliers were tested. Different effects were observed depending on the developmental stage of the gut microbiota at the start of the dietary treatment. Fructose-rich sugar syrup prevented the colonization of Bifidobacteriaceae in the microbiota of newly emerged bumblebees. This effect was correlated with a lower bacterial community richness and diversity. The pollen diet with the best parameters, regarding the protein content and bumblebee offspring, showed the lowest bacterial richness and diversity. The interaction between diet and the microbiota of bumblebees provides new insights for bumblebee breeders. Diet could be used to modulate the bacterial composition in the gut to improve the health of mass-produced bumblebees used for biological pollination [A. Billiet, I. Meeus, F. Van Nieuwerburgh, D. Deforce, F. Wackers, G. Smagghe* (Univ Ghent, Fac Biosci Engn, Dept Crop Protect, Lab Agrozoool, Coupure Links 653, B-9000 Ghent, Belgium) *Apidologie*, 2016, **47**(4), 548-560].

NPARR, 7(4), 2016-399 The influence of impurities on calcium phosphate floc structure and size in sugar solutions

Settling, dewatering and filtration of flocs are important steps in industry to remove suspended solids and improve subsequent processing of the aqueous system. The influence of non-sucrose impurities (Ca^{2+} , Mg^{2+} , phosphate and aconitic acid) on the calcium phosphate floc structure (scattering exponent, Sf), size and shape were examined in synthetic and authentic sugar juices using X-ray diffraction techniques. In synthetic juices, Sf decreases with increasing phosphate concentration to values where loosely bound and branched flocs are formed. These types of flocs are effective for the removal of suspended colloidal particles. Ca^{2+} and Mg^{2+} ions, and

aconitic acid did not affect Sf increasing concentration, although the floc size significantly decreased with increasing aconitic acid concentration, thereby reducing the ability of the flocs to remove particles. In authentic juices, the flocs structures were marginally affected by increasing proportions of non-sucrose impurities. However, optical microscopy indicated the formation of well-formed macro-floc network structures in sugar cane juices containing lower proportions of non-sucrose impurities. These structures are better placed to remove suspended particles in sugar solutions [C. C. D. Thai, L. Moghaddam*, W. O. S. Doherty (Centre for Tropical Crops and Biocommodities, Queensland University of Technology, Brisbane, QLD, Australia) *Journal of Food Engineering*, 2016, **181**, 20-27].

THERAPEUTICS

NPARR, 7(4), 2016-400 Off the shelf cellular therapeutics: Factors to consider during cryopreservation and storage of human cells for clinical use

The field of cellular therapeutics has immense potential, affording an exciting array of applications in unmet medical needs. One of several key issues is an emphasis on getting these therapies from bench to bedside without compromising safety and efficacy. The successful commercialization of cellular therapeutics will require many to extend the shelf-life of these therapies beyond shipping “fresh” at ambient or chilled temperatures for “just in time” infusion. Cryopreservation is an attractive option and offers potential advantages, such as storing and retaining patient samples in case of a relapse, banking large quantities of allogeneic cells for broader distribution and use and retaining testing samples for leukocyte antigen typing and matching. However, cryopreservation is only useful if cells can be reanimated to physiological life with negligible loss of viability and functionality. Also critical is the logistics of storing, processing and transporting cells in clinically appropriate packaging systems and storage devices consistent with quality and regulatory standards. Rationalized approaches to develop commercial-scale cell therapies require an efficient cryopreservation system that provides the ability to inventory standardized products with maximized shelf life for later on-demand distribution and use, as well as a method that is scientifically sound and optimized for the cell of interest. The objective of this review is to bridge this gap between the basic science of cryobiology and its application in this context by identifying several key aspects of cryopreservation science in a format that may be easily integrated into mainstream cell therapy manufacture [E. J. Woods, S. Thirumala¹*, S. S. Badhe-Buchanan, D. Clarke, A. J. Mathew (Correspondence: Erik J.

Woods, PhD, Cook Regentec, 1102 Indiana Avenue, Indianapolis, IN, USA) *Cytotherapy*, 2016, **18**(6), 697–711].

NPARR, 7(4), 2016-401 Characterization of chemical, biological, and antiproliferative properties of fermented black carrot juice, shalgam

Shalgam juice is a dark red-colored and sour fermented beverage produced and consumed in Turkey. The main ingredient of shalgam juice is black carrot, which is rich in anthocyanins. In this study, commercially available shalgam juice was characterized by determining its chemical composition and antioxidant capacity and by identifying its microflora. The predominant acid in the shalgam juice was lactic acid. LC/MS/MS analysis revealed the presence of the anthocyanins cyanidin-3-galactoside, cyanidin-3-glucoside, and cyanidin-3-arabinoside. The total phenolic content (517.21 $\mu\text{g GAE/mL}$) and antioxidant capacity (in $\mu\text{mol Trolox equivalents/mL}$) determined by ABTS (3.42), DPPH (4.44) and FRAP (2.26) assays of the commercial shalgam juice were similar to other common fruit juices. A total of 21 *Lactobacillus* species and subspecies were identified in shalgam juice using species-specific PCR with the nucleotide sequences of some of the identified lactic acid bacteria. Shalgam juice inhibited the growth of Caco-2 cells lines in a dose-dependent manner and had significantly higher inhibition at 3200 $\mu\text{g/mL}$ compared to black carrot ($p < 0.05$). These results suggest that in addition to the actions of it (poly)phenolic constituents, shalgam juice might have a potent as antioxidant, probiotic and antiproliferative agents [F. Y. Ekinci*, G. M. Baser, E. A. Zcan, M. Korachi, A. Sofu, J. B. Blumberg, C. Y. O. Chen (Food Engineering Department, Yeditepe University, Kayisdagi, Istanbul, Turkey) *European Food Research and Technology*, 2016, **242**(8), 1355-1368].

NPARR, 7(4), 2016-402 Utilizing cell-based therapeutics to overcome immune evasion in hematologic malignancies

Hematologic malignancies provide a suitable testing environment for cell-based immunotherapies, which were pioneered by the development of allogeneic hematopoietic stem cell transplant. All types of cell-based therapies, from donor lymphocyte infusion to dendritic cell vaccines, and adoptive transfer of tumor-specific cytotoxic T cells and natural killer cells, have been clinically translated for hematologic malignancies. The recent success of chimeric antigen receptor-modified T lymphocytes in B-cell malignancies has stimulated the development of this approach toward other hematologic tumors. Similarly, the remarkable activity of checkpoint inhibitors as single agents has created enthusiasm for potential combinations with other cell-based immune therapies. However, tumor cells continuously develop various strategies to evade their immune-mediated elimination. Meanwhile, the recruitment of immunosuppressive cells and the release of inhibitory factors contribute to the development of a tumor microenvironment that hampers the initiation of effective immune responses or blocks the functions of immune effector cells. Understanding how tumor cells escape from immune attack and favor immunosuppression is essential for the improvement of immune cell-based therapies and the development of rational combination approaches [C. Sun, G. Dotti, B. Savoldo* (Univ N Carolina, Lineberger Comprehensive Canc Ctr, Chapel Hill, NC 27599 USA) *Blood*, 2016, **127**(26), 3350-3359].

NPARR, 7(4), 2016-403 A new glucocerebrosidase-deficient neuronal cell model provides a tool to probe pathophysiology and therapeutics for Gaucher disease

Glucocerebrosidase is a lysosomal hydrolase involved in the breakdown of glucosylceramide. Gaucher disease, a recessive

lysosomal storage disorder, is caused by mutations in the gene GBA1. Dysfunctional glucocerebrosidase leads to accumulation of glucosylceramide and glycosylsphingosine in various cell types and organs. Mutations in GBA1 are also a common genetic risk factor for Parkinson disease and related synucleinopathies. In recent years, research on the pathophysiology of Gaucher disease, the molecular link between Gaucher and Parkinson disease, and novel therapeutics, have accelerated the need for relevant cell models with GBA1 mutations. Although induced pluripotent stem cells, primary rodent neurons, and transfected neuroblastoma cell lines have been used to study the effect of glucocerebrosidase deficiency on neuronal function, these models have limitations because of challenges in culturing and propagating the cells, low yield, and the introduction of exogenous mutant GBA1. To address some of these difficulties, we established a high yield, easy-to-culture mouse neuronal cell model with nearly complete glucocerebrosidase deficiency representative of Gaucher disease. We successfully immortalized cortical neurons from embryonic null allele *gba(-/-)* mice and the control littermate (*gba(+/+)*) by infecting differentiated primary cortical neurons in culture with an EF1 alpha-SV40T lentivirus. Immortalized *gba(-/-)* neurons lack glucocerebrosidase protein and enzyme activity, and exhibit a dramatic increase in glucosylceramide and glycosylsphingosine accumulation, enlarged lysosomes, and an impaired ATP-dependent calcium-influx response; these phenotypical characteristics were absent in *gba(+/+)* neurons. This null allele *gba(-/-)* mouse neuronal model provides a much-needed tool to study the pathophysiology of Gaucher disease and to evaluate new therapies [W. Westbroek, M. Nguyen, M. Siebert, T. Lindstrom, R. A. Burnett, E. Aflaki, O. Jung, R. Tamargo, J. L. Rodriguez-Gil, W. Acosta, E. Sidransky* (NHGRI, Sect Mol Neurogenet, Med Genet Branch, NIH, Bethesda, MD 20892 USA) *Disease Models & Mechanisms*, 2016, **9**(7), 769-778].

NPARR, 7(4), 2016-404 **Stem cells and injectable hydrogels: Synergistic therapeutics in myocardial repair**

One of the major problems in the treatment of cardiovascular diseases is the inability of myocardium to self regenerate. Current therapies are unable to restore the heart's function after myocardial infarction. Myocardial tissue engineering is potentially a key approach to regenerate damaged heart muscle. Myocardial patches are applied surgically, whereas injectable hydrogels provide effective minimally invasive approaches to recover functional myocardium.

These hydrogels are easily administered and can be either cell free or loaded with bioactive agents and/or cardiac stem cells, which may apply paracrine effects. The aim of this review is to investigate the advantages and disadvantages of injectable stem cell-laden hydrogels and highlight their potential applications for myocardium repair [M. Sepantafar, R. Maheronnaghsh, H. Mohammadi, S. Rajabi-Zeleti, N. Annabi, N. Aghdami, H. Baharvand* (ACECR, Royan Inst Stem Cell Biol & Technol, Dept Stem Cells & Dev Biol, Cell Sci Res Ctr, POB 19395-4644, Tehran, Iran) *Biotechnology Advances*, 2016, **34**(4), 362-379].

VEGETABLES

NPARR, 7(4), 2016-405 *Colletotrichum truncatum*, a new cause of anthracnose on Chinese flowering cabbage (*Brassica parachinensis*) in China

Colletotrichum truncatum was for the first time found to cause severe anthracnose of Chinese flowering cabbage (*Brassica parachinensis* L. H. Bailey) (Cruciferae), in Guangdong province, China. Identification of this *Colletotrichum* species with curved conidia was based on morphological and cultural characteristics and multi-gene phylogenetic analysis, which showed that this fungus belongs to *C. truncatum*. Artificially inoculated seedlings of Chinese flowering cabbage showed typical symptoms of anthracnose similar to those observed in the field. To understand the cross-pathogenicity of *C. truncatum* isolates infecting Chinese flowering cabbage and soybean, artificial inoculations on both hosts were carried out and the results indicated that the isolates of Chinese flowering cabbage could infect soybean, and vice versa. *C. truncatum* was consistently re-isolated from the artificially infected tissues of both hosts. Furthermore, a comparison of the effects of environmental factors on *C. truncatum* isolates CBP001 and XST01 from Chinese flowering cabbage and soybean, respectively, demonstrated that these two isolates have similar biological characteristics. Therefore, it is concluded that *C. truncatum* is the causal agent of anthracnose of Chinese flowering cabbage [Y. Y. He, Q. G. Chen, C. W. Shu, M. Yang, E. X. Zhou* (South China Agr Univ, Coll Agr, Guangdong Prov Key Lab Microbial Signals & Dis Co, Guangzhou 510642, Guangdong, Peoples R China) *Tropical Plant Pathology*, 2016, **41**(3), 183-192].

NPARR, 7(4), 2016-406 Evaluation of antioxidant and antimicrobial properties of potato (*Solanum tuberosum*) peels

Peels of vegetables are generally considered as waste products and are normally

thrown away by us. But different studies conducted on peels revealed the presence of important constituents. A number of components are isolated from potato peels which have different properties like antioxidant, antimicrobial, anti-inflammatory, antiproliferative etc. The present study was designated to evaluate the antioxidant and antimicrobial properties of potato peels. The methanolic extract of dried potato peel showed an appreciable DPPH radical scavenging activity and ferric reducing ability. Total phenolic content was also higher in potato peel extract. Secondary metabolite screening of the methanolic extract of potato peels showed the higher levels of flavonoids. The antibacterial activity of methanolic extract of potato peel was determined by agar well diffusion method and it showed significant effect on growth inhibition of gram positive (*Bacillus amyloiquefaciens* and *Staphylooccus aureus*) and gram negative bacteria (*Escherichia coli* and *Pseudomonas aeruginosa*). [N. Sinha*, D. Dua (Amity Institute of Biotechnology, Amity University, Greater Noida Expressway, Sector-125, Noida, India) *Indian Journal of Agricultural Biochemistry*, 2016, **29**(1), 23-27].

NPARR, 7(4), 2016-407 The Cd:Zn ratio in a soil affects Cd toxicity in Spinach (*Spinacea oleracea* L.)

Cadmium (Cd) is a highly soil mobile heavy metal which is toxic even at very low concentrations and is thus of potential human health concern due to its entry into the food chain via consumption of edible crops. The plant nutrition is the most economical and practicable method among all strategies for reducing the accumulation of Cd in the edible parts of the plants. This experiment investigated the effect of changing the Cd:zinc (Zn) ratio in the soil in order to minimize the accumulation of Cd in the edible parts, i.e. the leaves of spinach. Overall spinach growth was decreased in Cd contaminated soil, and Cd concentrations in spinach leaf increased with increased exposure to

Cd. However, while spinach growth increased at a moderate Cd:Zn ratio of 1:10, at higher Zn soil concentrations (Cd:Zn = 1:100) plant growth was decreased, but this was also accompanied by a significantly decreased ($P < 0.05$) in the accumulation of Cd the spinach leaves. Thus the ratio of Cd:Zn in Cd contaminated soils can simultaneously decrease the adverse effects of Cd on plant growth and also minimize Cd uptake into edible plant parts [T. Hussain*, G. Murtaza, A. Ghafoor, M. A. Cheema (Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad, Pakistan) *Pakistan Journal of Agricultural Sciences*, 2016, **53**(2), 419-424].

NPARR, 7(4), 2016-408 **Comparative transcriptome analysis reveals heat-responsive genes in Chinese cabbage (*Brassica rapa* ssp. *chinensis*)**

Chinese cabbage (*Brassica rapa* ssp. *chinensis*) is an economically and agriculturally significant vegetable crop and is extensively cultivated throughout the world. Heat stress disturbs cellular homeostasis and causes visible growth inhibition of shoots and roots, severe retardation in growth and development, and even death. However, there are few studies on the transcriptome profiling of heat stress in non-

heading Chinese cabbage. In this study, we investigated the transcript profiles of non-heading Chinese cabbage from heat-sensitive and heat-tolerant varieties "GHA" and "XK," respectively, in response to high temperature using RNA sequencing (RNA seq). Approximately 625 genes were differentially expressed between the two varieties. The responsive genes can be divided into three phases along with the time of heat treatment: response to stimulus, programmed cell death and ribosome biogenesis. Differentially expressed genes (DEGs) were identified in the two varieties, including transcription factors (TFs), kinases/phosphatases, genes related to photosynthesis and effectors of homeostasis. Many TFs were involved in the heat stress response of Chinese cabbage, including NAC069 TF which was up-regulated at all the heat treatment stages. And their expression levels were also validated by quantitative real-time-PCR (qRT-PCR). These candidate genes will provide genetic resources for further improving the heat-tolerant characteristics in non-heading Chinese cabbage [A. Wang, J.Hu, X. Huang, X. Li, G. Zhou*, Z. Yan (Wuhan Vegetable Research Institute, Wuhan Academy of Agricultural Science and Technology, Wuhan, China) *Frontiers in Plant Science*, 2016, **7**, 1-14].

WOOD

NPARR, 7(4), 2016-409 **Compensatory mechanisms mitigate the effect of warming and drought on wood formation**

Because of global warming, high-latitude ecosystems are expected to experience increases in temperature and drought events. Wood formation will have to adjust to these new climatic constraints to maintain tree mechanical stability and long-distance water transport. The aim of this study is to understand the dynamic processes involved in wood formation under warming and drought. Xylogenesis, gas exchange, water relations and wood anatomy of black spruce [*Picea mariana* (Mill.) B.S.P.] saplings were monitored during a greenhouse experiment where temperature was increased during daytime or night-time (+6°C) combined with a drought period. The kinetics of tracheid development expressed as rate and duration of the xylogenesis sub-processes were quantified using generalized additive models. Drought and warming had a strong influence on cell production, but little effect on wood anatomy. The increase in cell production rate under warmer temperatures, and especially during the night-time warming at the end of the growing season, resulted in wider tree-rings. However, the strong compensation between rates and durations of cell differentiation processes mitigates warming and drought effects on tree-ring structure. Our results allowed quantification of how wood formation kinetics is regulated when water and heat stress increase, allowing trees to adapt to future environmental conditions [L. Balducci*, H. E. Cuny, C. B. K. Rathgeber, A. Deslauriers, A. Giovannelli, S. Rossi (Département des Sciences Fondamentales, Université du Québec à Chicoutimi, 555 Boulevard de l'Université, Chicoutimi, QC, Canada) Plant, Cell and Environment, 2016, **39**(6), 1338-1352].

NPARR, 7(4), 2016-410 **Prolonged soil frost affects hydraulics and phenology of apple trees**

Restoration of an adequate water supply in spring is a prerequisite for survival of angiosperm trees in temperate regions. Trees must re-establish access to soil water and recover xylem functionality. We thus hypothesized that prolonged soil frost impairs recovery and affects hydraulics and phenology of *Malus domestica* var. 'Golden Delicious.' To test this hypothesis, over two consecutive winters the soil around some trees was insulated to prolong soil frosting. From mid-winter to early summer, the level of native embolism, the water and starch contents of wood, bark and buds were quantified at regular intervals and findings correlated with various phenological parameters, xylogenesis and fine root growth. The findings confirm that prolonged soil frost affects tree hydraulics and phenology but the severity of the effect depends on the (PLC) decreased from about 70% at the end of winter to about 10% in May. Thereby, xylem refilling strongly coincided with a decrease of starch in wood and bark. Also treated trees were able to restore their hydraulic system by May but, in the warm spring of 2012, xylem refilling, the increases in water content and starch depolymerization were delayed. In contrast, in the cold spring of 2013 only small differences between control and treated trees were observed. Prolongation of soil frost also led to a delay in phenology, xylogenesis, and fine root growth. We conclude that reduced water uptake from frozen or cold soils impairs refilling and thus negatively impacts tree hydraulics and growth of apple trees in spring. Under unfavorable circumstances, this may cause severe winter damage or even dieback [B. Beikircher*, C. Mittmann, S. Mayr (Institute of Botany, University of Innsbruck, Innsbruck, Austria) *Frontiers in Plant Science*, 2016, **7**, DOI: 10.3389/fpls.2016.00867].

NPARR, 7(4), 2016-411 **Impact of air-plasma treatment at atmospheric pressure on wood and wood extractives**

This study addresses the question of whether the extractives or the main components of wood are responsible for the alterations in surface energy after air-plasma treatment. For this purpose, x-ray photoelectron spectroscopy was carried out on untreated, microtomed and air-plasma-modified beech wood surfaces. A dielectric barrier discharge at atmospheric pressure was used for plasma modification. The results indicate that air-plasma treatment affects the O/C-ratio and surface energy characteristics of wood surfaces by oxidative alteration and exposition of the wood main components [G. Avramidis*, R. Wascher, H. Militz, W Viöl (Faculty of Natural Sciences and Technology, University of Applied Sciences and Arts, Göttingen, Germany) *International Wood Products Journal*, 2016, 7(2), 76-79].

NPARR, 7(4), 2016-412 **The role of chemical transport in the brown-rot decay resistance of modified wood**

Chemical modification of wood increases decay resistance but the exact mechanisms

remain poorly understood. Recently, Ringman and coauthors examined established theories addressing why modified wood has increased decay resistance and concluded that the most probable cause of inhibition and/or delay of initiation of brown-rot decay is lowering the equilibrium moisture content. In another recent study, Jakes and coauthors examined moisture-induced wood damage mechanisms, including decay and fastener corrosion, and observed that these mechanisms require chemical transport through wood cell walls. They proposed that chemical transport within wood cell walls is controlled by a moisture-induced glass transition in interconnected networks of hemicelluloses and amorphous cellulose. This paper shows how these models jointly suggest mechanisms by which wood modifications can inhibit brown-rot. Alternative mechanisms are also discussed. These models can be used to understand and further improve the performance of wood modification systems [S. L. Zelinka, R. Ringman, A. Pilgård, E. E. Thybring, J. E. Jakes, K. Richter (US Forest Service, Forest Products Laboratory, United States) *International Wood Products Journal*, 2016, 7(2), 66-70].

OTHERS (incl. Cultivation, Distribution, New species, Postharvest Technologies, Packaging Technology, New technologies/Know How Developed, Book reviews, Forthcoming events)

CULTIVATION

NPARR, 7(4), 2016-413 **Genetic consequences of selection cutting on sugar maple (*Acer saccharum* Marshall)**

Selection cutting is a treatment that emulates tree-by-tree replacement for forests with uneven-age structures. It creates small openings in large areas and often generates a more homogenous forest structure (fewer large leaving trees and defective trees) that differs from old-growth forest. In this study, we evaluated whether this type of harvesting has an impact on genetic diversity of sugar maple (*Acer saccharum* Marshall). Genetic diversity among seedlings, saplings, and mature trees was compared between selection cut and old-growth forest stands in Québec, Canada. We found higher observed heterozygosity and a lower inbreeding coefficient in mature trees than in younger regeneration cohorts of both forest types. We detected a recent bottleneck in all stands undergoing selection cutting. Other genetic indices of diversity (allelic richness, observed and expected heterozygosity, and rare alleles) were similar between forest types. We concluded that the effect of selection cutting on the genetic diversity of sugar maple was recent and no evidence of genetic erosion was detectable in Québec stands after one harvest. However, the cumulative effect of recurring applications of selection cutting in bottlenecked stands could lead to fixation of deleterious alleles, and this highlights the need for adopting better forest management practices [N. Gaignic*, F. Tremblay, Y. Bergeron (Institut de Recherche sur les Forêts, Université du Québec en Abitibi-Témiscamingue, Rouyn-Noranda, QC, Canada) *Evolutionary Applications*, 2016, 9(6), 777-790].

NPARR, 7(4), 2016-414 **Environmental sustainability assessment of fruit cultivation and processing using fruit and cocoa residues for bioenergy and compost. Case study from Ghana**

Agro-industrial businesses often have easy access to agricultural and processing residues with which they may reduce costs and pollution by integrating their production with bioenergy production. In regions with unreliable power supply, on-site electricity generation is a means to secure stable production conditions. Furthermore, recycling of nutrients may help to reduce biomass suppliers' dependence on synthetic fertiliser. In this Environmental Sustainability Assessment (ESA) of fruit production in Ghana we compare two technology options for the production of mixed, fresh, tropical fruit, including cultivation, transport and processing. The option 'Present practice' presents data from a case study where production is characterised by soil loss and synthetic fertiliser dependence in cultivation and grid supply of electricity in processing. The option 'Biogas' is hypothetical and characterised by biogas and electricity production using farming and processing residues and by recycling of nutrients and carbon to soil. Cocoa shells are used as a co-substrate in the biogas production. Estimating the environmental impact of cocoa shell residues exposes the multifunctionality issue, continuously debated in ESA, particularly concerning bioenergy production. We compare the use of allocation of cocoa production impacts and system expansion that includes cocoa production as possible methods to manage multifunctionality of inputs. In assessments of residue-based production, we recommend using the latter method. Applying the system expansion method, we find that, in comparison with 'Present practice', the option 'Biogas' eliminates net soil carbon loss and reduces synthetic fertiliser, diesel and external electricity requirements at the expense of a relatively small increase in human labour input. The ESA includes the following indicators

and shows that the 'Biogas' option is superior to 'Present practice' with regard to Cumulative Energy Demand (-39%), Cumulative fossil Energy Demand (-34%), Food Energy Return On energy Investment (+65%), Food Energy Return On fossil energy Investment (+53) and Global Warming Potential (-29%) and similar to 'Present practice' in terms of the Emergy Assessment indicators Unit Emergy Value, Global Renewability Fraction, and Local Supply Fraction. Discarding the system expansion method, the same conclusion applies even if the emergy indicators are more ambiguous [A. Kamp, H. Ostergard* (Tech Univ Denmark, Dept Chem & Biochem Engr, Soltofts Plads 229, DK-2800 Lyngby, Denmark) *Journal of Cleaner Production*, 2016, **129**, 329-340].

NPARR, 7(4), 2016-415 Impacts of long-term cultivation of flooded rice in gley soils

The objective of this work was to evaluate soil attributes in response to different land use systems in the south of the state of Minas Gerais, Brazil. The soils sampled were gley soils under native forest, flooded rice (*Oryza sativa*) and common bean (*Phaseolus vulgaris*) croplands, as well as a dryland Ultisol under native forest. Cultivation increased bulk density in the gley soils, up to 0.4-m soil depth, which resulted in lower weighted mean diameter and lower geometric mean diameter of aggregates, especially for rice crops under flooding, annually tilled with rotary hoe. Micromorphological analyses of soil showed that soil compaction occurred due to the lower macroporosity among aggregates, as well as to the lower porosity derived from biological activity. Soil organic C (SOC) and total nitrogen (N) in the cultivated gley soils were approximately 55 and 40% lower than in gley soil under native forest, as a consequence of accelerated organic decomposition caused by tillage. However, the gley soil under native forest showed contents and stocks of SOC and N similar to those of the Ultisol under forest, which suggests that the effect of anaerobiosis on soil organic matter was

weaker than expected [G. J. Marrenjo*, E. J. de Padua, C. A. Silva, P. C. Soares, Y. L. Zinn (Univ Pedagog Delegacao & Massinga, Caixa Postal 111, Maputo, Mozambique) *Pesquisa Agropecuaria Brasileira*, 2016, **51**(8), 967-977].

NPARR, 7(4), 2016-416 Use of fish-farming wastewater in lettuce cultivation

Lettuce stands out as the main leafy vegetable consumed in Brazil, with divergence regarding adaptability to different environmental conditions, which include salinity. The objective of the work was to evaluate the response of lettuce cultivars to the use of saline wastewater from fish farming. The experiment was conducted in a completely randomized design with four replicates, in a factorial 7 x 4, corresponding to seven cultivars (Regiane, Vera, Isabela, Elisa, Amelia, Lavinia and Angelina) and four salt concentrations (1.2, 2.2, 3.2 and 4.2 dS m⁻¹). The evaluated characteristics were: number of leaves, leaf area, crown diameter and shoot fresh and dry matter. Diluted wastewater from fish farming can be used in the preparation of solution for fertigation of lettuce. The cultivars Regiane and Elisa had higher production of leaves and leaf area, while Amelia and Angelina were the most productive in terms of biomass. The cultivars Vera, Isabela, Amelia and Angelina were more tolerant to the salinity of the fertigation solution [I. P. Guimaraes, F. D de Oliveira, S. B. Torres*, F. E. C. B. Pereira, F. D. de Franca, M. K. T. de Oliveira (Univ Fed Rural Semi Arido, Dept Ciencias Vegetais, Mossoro, RN, Brazil) *Revista Brasileira De Engenharia Agricola E Ambiental*, 2016, **20**(8), 728-733].

NPARR, 7(4), 2016-417 Engineering analysis of the high-density heterotrophic cultivation of mung bean sprouts

This study investigated the heterotrophic growth behavior of mung beans cultivated in an individual bed under water supply. The fresh weight of mung beans in the bed was estimated, and changes in temperature, and oxygen and

carbon dioxide concentrations were recorded during the cultivation period. The specific growth rate, oxygen uptake rate, and carbon dioxide evolution rate, based on the fresh weight in the bed, were calculated. Growth under heterotrophic cultivation can be classified into the following three stages. Reductions in specific oxygen uptake rate, specific carbon dioxide evolution rate, and specific energy production rate corresponded to that of specific growth rate. Indicators of biological activity related to oxygen and carbon dioxide were evaluated quantitatively for beds under high-density heterotrophic cultivation. Moreover, the results obtained from this study successfully demonstrate that there is a relationship between the growth of mung beans and indicators of biological activity [H. Tamate, R. Nakai, Y. Nakamori, M. Esashi, Y. Iwamoto, Y. Tsukada*, M. Saito, D. Ishikawa, T. Fujii (Taishi Food Inc, Sannohe, Japan) *Bioscience Biotechnology and Biochemistry*, 2016, **80**(8), 1602-1608].

***NPARR*, 7(4), 2016-418 Nitrogen and phosphorus regulation of soil enzyme activities in acid forest soils**

The activities of soil extracellular enzymes are important in governing rates of organic matter decomposition and nutrient cycling in forest ecosystems. Measurements of soil enzyme activities can provide insights on microbial function, in terms of how much energy microbial communities are investing to acquire particular nutrients from OM substrates. In ecosystems enriched with nitrogen (N), phosphorus (P) supply may play an important role in regulating microbial activity, enzyme production, and organic matter decomposition. The response of extracellular enzyme activity to chronic N-enrichment was assessed at a long-

term paired watershed N-enrichment experiment, the Bear Brook Watershed in Maine (BBWM) in hardwood and softwood forest types. Specifically, we measured the ambient (extant) activity of C hydrolyzing β -glucosidase (BG) and xylosidase (XYLO), N hydrolyzing N-acetylglucosaminidase (NAG), and P hydrolyzing acid phosphatase (AP) in the watershed subjected to chronic N-enrichment, and in the reference watershed. Secondly, in a series of soil incubations, we characterized the extent to which microbial C and P acquisition were regulated by N and P availability. In these incubations, we measured BG and AP activity response to acute (high-dose fertilizer) nutrient amendments. We hypothesized that soil enzyme activities would respond more to enhanced P availability than N, particularly in the N-enriched watershed. Our results from extant enzyme activity measurements suggest that chronic N-enrichment inhibited rather than stimulated extant soil hydrolytic enzyme activities, which could reflect suppression of microbial biomass and activity. In the acute nutrient amendment incubations, our data indicate that inorganic P was more important than N in regulating soil microbial C and P acquisition in soils from both the N-enriched and reference watersheds. Our results also indicate that the extent to which P availability regulated microbial acquisition of P in O horizon soils was greatest in softwood soils subjected to chronic N-enrichment. Findings from this study suggest that both forest type and soil inorganic P availability could be more important in influencing soil biological response to N pollution than previously recognized [F. R. Fatemi, I. J. Fernandez, K. S. Simon, D. B. Dail (St. Michael's College, One Winooski Dr., Colchester, VT, United States) *Soil Biology and Biochemistry*, 2016, **98**, 171-179].

POST HARVEST TECHNOLOGY

NPARR, 7(4), 2016-419 Triple bagging hermetic technology for post-harvest preservation of paddy rice *Oryza sativa* L. in the Sahel of West Africa

Trials of the Purdue Improved Crop Storage (PICS) bag technology for the storage of paddy rice, *Oryza sativa* L., were conducted in Burkina Faso, Ghana and Niger. Paddy rice naturally infested with insects, the most abundant species being *Tribolium* spp. and *Rhizopertha dominica*, was sealed in triple layer PICS bags, or in conventional woven polypropylene sacks. At the end of 7-18 months of storage in PICS bags the number of insects did not increase, the weight of 100 seeds did not change, and the proportion of damaged seeds was not different from that present when the paddy was first put into the bags. By contrast, paddy stored in the conventional way in woven polypropylene bags exhibited weight losses ranging from 3 to 8.7%. In Bolgatanga, Ghana, where paddy was stored for 18 months, germination of paddy kept in the PICS bags was comparable to that present at the beginning of the experiment. PICS bags can be used for the safe, low-cost, insecticide free storage of paddy rice [I. B. Baoua, L. Amadou, O. Bakoye, D. Baributsa, L. L. Murdock* (Purdue Univ, Dept Entomol, W Lafayette, IN 47907 USA) *Journal of Stored Products Research*, 2016, **68**, 73-79].

NPARR, 7 (4), 2016-420 Characterization of edible films of *Swartzia burchelli* phosphated starches and development of coatings for post-harvest application to cherry tomatoes

The market demand for corn starch and cassava continues to increase because of their use in edible applications, their biodegradable nature, and other appealing properties. As a result, there is a need to identify alternative starch sources, for example, the seeds of *S. burchelli*, with the

potential to be modified for use in post-harvest applications. Therefore, this study aimed to develop and characterize edible films based on the starch phosphates of the seeds of *S. burchelli*, with the specific aim to apply these starches to cherry tomatoes for post-harvest conservation. After extraction, the starch was phosphorylated with sodium tripolyphosphate (STP) in different concentrations and times according to a 2 x 2 factorial design with additional treatment (native starch). After modification, the starch phosphates were selected for the preparation of edible films using glycerol as a plasticizer, in proportions of 5, 10, 15 and 20% for each selected starch. The films were measured for thickness, permeability to water vapor and solubility in water. According to their permeability values, 4 films were selected for application in the coverage of cherry tomatoes. The conservation of cherry tomatoes with and without coverage was studied over 8 evaluation times (up to 21 days) at 10±2 °C and 80±5% relative humidity. The weight loss, soluble solids, titratable acidity, maturation index, and firmness were measured every 3 days during storage. The starch phosphates showed a phosphorus content within that established by standards, such that the resulting films are acceptable for use in food for human consumption. The edible films presented with an acceptable appearance and without the development of cracks. The concentration of glycerol and the type of starch influenced the characteristics of the films, increasing the permeability and reducing the water solubility of the various edible films. The best result obtained regarding the conservation of cherry tomatoes was observed for fruits with edible coatings of greater permeability to water vapor; such fruits exhibited only a slight decline in firmness during storage compared with the control. It can be concluded that the modification performed on the starch and the glycerol concentration positively influenced the properties of the edible films, allowing for optimal use in post-harvest applications. Similarly, the edible coatings conferred better

appearance to the fruits, maintaining their maturation index and firmness during the experimental period and providing better post-harvest storage conditions for the cherry tomatoes [M. A. Gomes*, D. P. R. Ascheri, A. J. De Campos (e em Engenharia Agrícola, Universidade Estadual de Goiás, Anápolis, GO, Brazil) *Semina: Ciências Agrárias*, 2016, **37**(4), 1897-1910].

NPARR, 7(4), 2016-421 Mathematical modeling and performance analysis of thin layer drying of bitter gourd in sensible storage based indirect solar dryer

An indirect forced convection solar dryer integrated with porous sensible heat storage medium was developed. The effect of porous thermal storage and mass flow rate of air on the performance of the system for drying bitter gourd was studied. The experimental setup consists of a blower, solar flat plate collector with corrugated absorber plate (2 m²) and a drying chamber. The thermal storage medium (pebble) is placed below the corrugated absorber plate, in the air passage as a porous medium. The experiments have been carried out with various mass flow rates of air and different drying models have been used for explaining the drying behaviour of sliced bitter gourd. The result shows that, (i) the initial moisture content 92% (w.b) of bitter gourd was reduced to 9% (w.b) in 7 h in the proposed drying system, while it was 10 h for open sun drying, (ii) the maximum specific moisture extraction rate

was observed as 0.215 kg/kWh at the mass flow rate of 0.0636 kg/s and the corresponding specific energy consumption was 4.44 kWh/kg, (iii) the collector and drying efficiency of the system were 22% and 19% respectively. The two term model and Midilli-Kucuk model are most suitable for indirect solar dryer and open sun drying in terms of statistical parameter respectively. The drying inside sensible heat storage based indirect dryer was more consistent and produced better quality product as compared to open sun drying. Industrial relevance Every year post harvest losses are increasing rapidly due to the lack of storage facilities. Solar dryers are the most suitable technology that can be easily availed at low cost and in small scale and it can be used as an income generation option for farmers and women in rural areas. The role of solar dryers in food processing industries is significant especially in developing countries in the following areas For preserving fruits and vegetables Dairy industries Agricultural crop drying Timber drying Industrial waste drying The utilization of thermal storage medium in the solar dryers is being focused much for the reasons of extending the availability of the system for operation and to achieve better quality of the products [S. Vijayan*, T. V. Arjunan, A. Kumar (Department of Mechanical Engineering, Coimbatore Institute of Engineering and Technology, Coimbatore, India) *Innovative Food Science and Emerging Technologies*, 2016, **36**, 59-67].

ANNOUNCEMENTS

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