ISSN 2221-6421 (Print), ISSN 2223-2567 (Online)
Coden: PJSIC6 59(3) 117-174 (2016)

Pakistan Journal of Scientific and Industrial Research

Series B: Biological Sciences

Vol. 59, No.3, November-December, 2016

(for on-line access please visit web-site http://www.pjsir.org)

Published by
Scientific Information Centre
Pakistan Council of Scientific and Industrial Research
Karachi, Pakistan

Pakistan Journal of Scientific and Industrial Research
Series B: Biological Sciences

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Pakistan Journal of Scientific and Industrial Research
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Effect of Terminal Drought Stress on Morpho-physiological Traits of Wheat Genotypes

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(received May 05, 2015; revised March 30, 2016; accepted April 15, 2016)

Abstract. Development of wheat varieties with low moisture requirements and their ability to withstand moisture stress may cope-up well with the on-coming peril of drought conditions. Ten wheat genotypes including two new strains, PBGST-3, Hero, Bhittai, Marvi, Inqlab, Sarsabz, Abadgar, Kiran, Khirman and PBGST-4 were sown in split plot design with factorial arrangement in four replications at Experimental Field, Department of Plant Breeding & Genetics, Sindh Agricutlure University, Pakistan during 2012-13. The results revealed that water stress caused significant reductions in all morpho-physiological traits. The genotypes differed significantly for all the yield and physiological traits. The interaction of treatments × genotypes were also significant for all the traits except plant height, productive tillers/plant, grains/spike and harvest index, were non-significant which indicated that cultivars responded variably over the stress treatments suggesting that breeders can select the promising genotypes for both stress and non-stress environments. Among the genotypes evaluated Bhittai, Kiran-95, PBGST-3 and Sarsabz showed good performance as minimum reductions occurred under terminal stress conditions for all the traits studied. Hence, above mentioned genotypes were considered as drought tolerant group. The high positive correlations of physiological traits like chlorophyll content and relative water content with almost all yield traits indicated that these physiological traits could serve as reliable criteria for breeding drought tolerance in wheat. The negative correlations of electrolyte leakage with several important yield traits indicated that though this physiological trait has adverse effect on yield attributes, yet it could reliably be used to distinguish between drought tolerant and susceptible wheat genotypes.

Keywords: drought stress, yield attributes, physiological traits, correlations, wheat genotypes, eleclrolyte leakage

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Phenology and Yield of Strawberry as Influenced by Planting Time and Genotypes in a Sub Tropical Region

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(received April 6, 2015; revised June 8, 2016; accepted June 16, 2016)

Abstract. Effects of planting time on phenology of five strawberry genotypes 'Sweet Charlie', 'Festival', 'Camarosa', 'FA 008', and 'BARI strawberry-1' were evaluated at Bangladesh Agricultural Research Institute in two consecutive years 2009-2010 and 2010-2011. 'Sweet Charlie' took the shorter time to begin flowering, followed by 'BARI Strawberry-1' and 'Festival' when planted in 1st October. Genotype 'FA 008' took longer time to flower when planted in 1st December. Days to flowering of all the varieties was found to decrease with the increase in air temperature. Regardless of planting year, the genotype 'FA 005' followed by 'Camarosa' and 'Festival', planted on 1st September, exhibited the longest harvest duration, while 'Sweet Charlie' planted on 1st December exhibited the shortest harvest duration in both years. Genotype 'Festival' planted on October yielded fruit with the greatest fruit weight, followed by 'Sweet Charlie' and 'Camarosa' planted on the same date. Plants of 'FA 008' and 'BARI Strawberry-1' planted in December produced minimum fruit weight. Maximum number of fruits/plant as well as yield/plant obtained from 'Sweet Charlie' planted in October, while BARI Strawberry-1 planted in December yielded the least. With the use of quadratic equation it was estimated that maximum yield was obtained at ambient temperature 18.5 °C then it was decreased with the increase of temperature. Strawberry planted in early October was found to be the most suitable in Bangladesh. Among the studied genotypes, 'Sweet Charlie' was found to be superior in yield and early planting, and 'Camarosa' was suitable for late planting. 'Festival' was found less sensitive to planting date.

Keywords: phenology, strawberry, planting time, sub tropical region

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Composition of Soil Seed Bank Over Cholistan Desert Microhabitats at Dingarh Fort Area, Pakistan

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(received May 28, 2015; revised April 12, 2016; accepted April 13, 2016)

Abstract. Soil seed banks were assessed in three soil layers (L1, from 0 to 2 cm, L2, 2 to 4 cm and L3, 4 to 6 cm depth) from five microhabitats i.e., Lee-ward side of sand dune (S1), Wind-ward side of sand dune (S2), Clayey area covered with sand (S3), Interdunal sandy area (S4) and Shifting sand dune of site Dingarh Fort area (S5) in Cholistan desert of Pakistan to analyse differences of soil seed bank among these habitats. Ten soil samples were collected from each microhabitat and from each layer i.e., 0-2 cm depth (L1), 2-4 cm depth (L2) and 4-6 cm depth (L3) by using 15×15×6 cm metallic sampler. Consistent differences in seed composition were observed among these microhabitats. Seedling emergence approach was used to assess the soil seed bank of Cholistan desert. Canonical correspondence analysis (CCA) was used for the soil seed bank and the plant species analysis. The microhabitats S3 (Clayey area covered with sand) and S4 (Interdunal sandy area) contributed prominently to the total variance in the species and had maximum density of seed bank and soil layer L1 contained maximum number of seeds.

Keywords: Cholistan desert, seed bank, microhabitat, canonical correspondence analysis

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Biochemical Characterisation and Dietary Fibre Analysis of Sugar Beet Supplemented Cookies

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(received February 1, 2016; revised May 12, 2016; accepted May 19, 2016)

Abstract. This study was planned to utilize sugar beet powder as a rich source of dietary fibre in cookies. Purposely, five treatments namely T_1, T_2, T_3, T_4 and T_5 with 4%, 8%, 12%, 16% and 20% sugar beet powder addition in wheat flour were chosen to estimate fibre, antioxidant profiling and engineering properties of cookies. Results showed an increased content of all above mentioned parameters. With the increment in sugar beet powder addition in treatments, dietary fibre analysis have shown that total dietary fibre (TDF), insoluble dietary fibre (IDF) and soluble dietary fibre (SDF) have depicted increasing trend with maximum for T_5 for all dietary fibre types. Significant results were obtained for *in vitro* antioxidant studies including total phenolic content (TPC) and DPPH that showed increasing trend with T_1 0.6 mg GAE/g and maximum values for T_5 with 2.0 mg GAE/g for TPC and for DPPH with T_5 being maximum value of 1.7% and minimum for T_1 with 1.3%. T_5 treatment with 20% sugar beet gave best physicochemical results but disturbed sensory properties while T_3 with 12% sugar beet powder showed good physicochemical and sensory characteristics. Therefore, T_3 with 12% level is considered as the best source of dietary fibre in bakery products and can be considered as the prospective choice to address metabolic syndromes.

Keywords: sugar beet, dietary fibre, biochemical characterisation, cookies, sensory analysis

Pak. j. sci. ind. res. Ser. B: biol. sci. 2016 **59**(3) 146-154

The Influence of Storage of Pawpaw *Carica papaya* Fruit on the Bioactive Components, Antioxidative Properties and Inhibition of Fe^{2+}-Induced Lipid Peroxidation of Water-Extracts of Pawpaw Seed

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(received August 25, 2015; revised February 16, 2016; accepted March 17, 2016)

Abstract. Freshly harvested, matured, newly ripe pawpaw (*Carica papaya*) fruit (Maradol variety) was stored at room temperature (27±1 °C) for 7days. The seeds of the freshly harvested and stored pawpaw fruit were taken and divided into two groups each; one was dried as dry sample, dry freshly harvested sample (DFHS) and dry stored sample (DSS) while the other was left as wet sample, wet freshly harvested sample (WFHS) and wet stored sample (WSS). The bioactive components, antioxidative properties and inhibition of Fe^{2+} induced lipid peroxidation activity of the water extract of the seed were investigated. Storage of pawpaw fruit caused a significant increase in ascorbic acid and flavonoid content of the pawpaw seed in both dry and wet samples but only in dry stored sample significant increase in the phenol content of the seed was observed. The dried pawpaw seed DFHS and DSS showed stronger inhibition of Fe^{2+} induced lipid peroxidation activities.

Keywords: pawpaw seed, storage influence, phenol, ascorbic acid, flavonoid, DPPH scavenging ability, lipid peroxidation

Pak. j. sci. ind. res. Ser. B: biol. sci. 2016 **59**(3) 155-163

Stabilisation of Some Vegetable Oils by Sugarcane Leaf Extract at Ambient Temperature

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(received February 19, 2015; revised October 10, 2015; accepted November 13, 2015)

Abstract. The present study was aimed to assess the antioxidant activity of ethanolic sugarcane leaf extract for the stabilisation of sunflower, (SFO), soybean and (SBO) canola oils (CO) at ambient temperature. SFO, SBO and CO were added with 600 ppm sugarcane leaf extract, filled in transparent PET bottles, stored at ambient temperature for 180 days, sampled at 0, 60, 120 and 180 days for the assessment of oxidative stability. Total phenolic content in sugarcane leaf extract (SLE) was 724.3 (mg GAE/100g). 2,2,diphenyl- 2 picrylhydrazyl free radical scavenging activity of SLE was 76% as compared to 88% in butylated hydroxyl toluene. C18:1 and C18:2 in fresh, 6 months stored controls and SLE supplemented SFO were 46.12%, 42.59%, 44.91% and 47.15%, 40.29, 43.13%, respectively. C18:2 and C18:3 in fresh and 180 days stored control and SLE supplemented SBO were 51.19%, 45.61%, 48.97% and 6.19%, 3.37% and 5.67%, respectively. Similar trend was also recorded in canola oil. Induction period of supplemented vegetable oil was higher than the un-supplemented samples ($P<0.05$). Viscosity and specific gravity of supplemented vegetable oils were not different from non-supplemented samples. Sensory characteristics of SLE supplemented vegetable oils were not different from the control. Sugarcane leaf extract can be used for the long term preservation of SFO, SBO and CO at ambient temperature.

Keywords: sunflower oil, soybean oil, canola oil, oxidative stability, sugarcane leaf

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An Assessment of the Bivalve *Perna viridis*, as an Indicator of Heavy Metal Contamination in Paradise Point of Karachi, Pakistan

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(received September 3, 2015; revised May 6, 2016; accepted May 12, 2016)

Abstract. The edible bivalves *Perna viridis* (green mussel), (n = 100) were analysed for their total Hg, Pb, Cu, Ni, Zn, Co, Fe, Cr, Cd, and Mn concentrations to indicate heavy metal contamination in Paradise Point of Karachi coast using atomic absorption spectrophotometer. There are large seasonal variations in the metal concentrations of Mn (0.025-0.67 µg/g), Fe (0.055-7.740 µg/g), Ni (0.004-0.52 µg/g), Hg (0.0001-0.004 µg/g), Zn (0.04-3.32 µg/g), Cu (0.008-1.66 µg/g), Pb (0.022-2.43 µg/g), Co (0.01-0.044 µg/g), Cd (0.04-0.88 µg/g) and Cr (0.13-1.20 µg/g) recorded in bodies/soft tissues of *P. viridis* obtained in the samples of the year 1993 and 2012 at the Paradise Point of Karachi coast. The results of heavy metals are in the following descending order of concentration in the samples collected in the year 1993: Fe>Cr>Zn>Mn>Pb>Cd>Cu>Ni>Co>Hg, while Fe>Zn>Pb>Cu>Cr>Cd>Mn>Ni>Co>Hg order was recorded in samples collected in the year 2012. The high accumulation of metals was found mostly in the samples collected in the year 2012 when compared with the samples of the year 1993. This is an indication that the area under study showed signs of being exposed to significant levels of heavy metal pollution due to direct discharge of industrial and domestic wastes along the coast. The concentrations of these heavy metals were lower than the permissible limits for human consumption. However, if this pollution persists, it can prove to be very detrimental in future.

Keywords: Paradise Point, heavy metals, pollutants, industrial wastes, domestic wastes

Pak. j. sci. ind. res. Ser. B: biol. sci. 2016 **59**(3) 172-174

Short Communication

Early Growth Behaviour of Wheat Genotypes as Affected by Polyethylene Glycol (PEG-6000)

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(received August 27, 2014; revised April 22, 2016; accepted May 9, 2016)

Abstract. Polyethylene glycol (PEG-6000) is often used for the early establishment screening of the wheat genotypes against drought stress conditions. A collection of twenty-one newly developed bread wheat genotypes (developed through conventional and mutational breeding techniques) and four commercial drought tolerant check varieties were included in screening at seedling stage under three treatments of PEG-6000; T1 (0.5 MPa) and T2 (0.75 MPa) along with control T3 (distill water only). Three important early growth establishment traits like germination percentage, root length and shoot length of the wheat genotypes were observed. Significant variation among genotypic means regarding the observed traits was recorded at both the treatments. Wheat genotypes performance including check varieties for germination percentages was recorded as T1 (86.1%), T2 (72.4%) with reduction percentage of 12.5% and 33.8%. Root length of genotypes decreased by 37.0% in 0.5 MPa and 82.75% in 0.75 MPa, whereas, shoot length reduction was recorded as 38.9% (T1) and 84.6% (T2) as compared to control. This study provided essential information about the performance of advanced wheat genotypes under water stress conditions at early seedling establishment.

Keywords: moisture stress, PEG-6000, germination percentage, root length, shoot length

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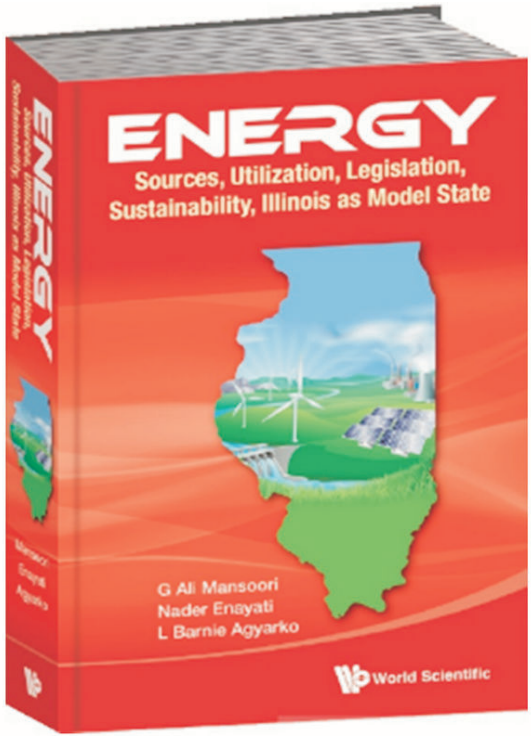
ENERGY: Sources, Utilization, Legislation, Sustainability, Illinois as Model State

Authored by G.A. Mansoori, N. Enayati and B. Agyarko; World Scientific Publishing Co., Hackensack, NJ, 810 pages (January 2016). (Hardcover: $(US) 214.00,
ISBN 978-981-4704-00-7); (Ebook: $(US) 171.00. ISBN 978-981-4704-02-1)



This new book authored by Prof. GA Mansoori and his co-authors aims to ease understanding of the general public of energy storage and conversion methods, environmental concerns associated with energy conversion, economics and future trends of energy conversion technologies. The book is written in an excellent fashion, partly in technical language (reporting mathematical equations and chemical formulae, flow charts, graphs and tables) of interest to scientific and engineering community, and partly in non-technical language to make it easy to understand by non-technical communities. All the energy sources including fossil fuels, nuclear, wind, solar, geothermal and biomass along with energy storage methods are discussed and all the real examples of energy conversion and storage methods are illustrated. Examples of central governments, state and local governments and private businesses involvement in promoting energy efficiency and environmental protection are shown to illustrate effectiveness of collective action. Of course, considering that the State of Illinois, USA, has been a pioneer in all aspects of energy it is used as a model state in this book. State of Illinois is where the peaceful use of nuclear energy was first utilized to produce electricity, the state with biggest user of coal and pioneer in conversion of energy uses to renewable sources.

It is interesting and quite significant to note that this book is quite timely published, immediately after the UNFCCC COP 21, also known as the 2015 Paris Climate Conference, held last December in Paris, France. Nearly 200 countries, including Pakistan and USA signed the COP21 Climate Agreement on December 12, 2015. This historic agreement aimed to reduce, or even prevent, environmental effects of global warming by reducing release of greenhouse gases into the atmosphere. This marvelous book covers all the possible ways to achieve the aims of the COP21 Climate Agreement.

An introductory chapter which is open access by publisher for everyone to read and get familiar with the excellent contents of the book is available at: (*www.worldscientific.com/doi/suppl/10.1142/9699/suppl_file/9699_chap01.pdf*).

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