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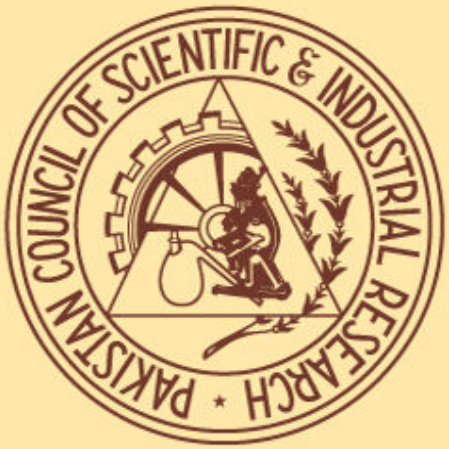

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Pakistan Journal of Scientific and Industrial Research
Series B: Biological Sciences
Vol. 59, No.1, March-April, 2016

Contents

Short Communications

Review

Pak. j. sci. ind. res. Ser. B: biol. sci. 2016 **59**(1) 1-5

Enhancing Soil Fertility through Intercropping, Inoculation and Fertilizer

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(received May 25, 2015; revised September 4, 2015; accepted September 22, 2015)

Abstract. The present study was conducted to investigate the effects of intercropping grass (*Panicum maximum*) and legumes (*Vicia sativa* and cowpeas) alone or coupled with inoculation or fertilizer on soil fertility. The study comprised of two field experiments conducted under rain fed conditions for two years (June, 2005 to September, 2007) at National Agriculture Research Centre, Islamabad, Pakistan. In one experiment intercropping (33, 50 and 67%) of grass and legumes alone as well as coupled with seed inoculation were studied while, same set of treatments was combined with fertilizer application at the rates of 25, 75 and 50 kg/ha (N, P_2O_5 and K_2O) in the second experiment. Total soil N increased by 0.008% due to symbiotic fixation in addition to plant uptake under best treatment when compared with grass alone while, soil organic matter increased by 0.19%. After crop harvest soil N content was determined to be higher in all the treatments of the experiment compared with growing grass alone. Legumes caused rhizobial N fixation that caused an increase in soil N. Similarly, intercropping and inoculation increased this soil characteristic that was found to be non-significant in the first crop but later on became significant, especially when intercropping of grass with legumes after seed inoculation was investigated or fertilizer was supplemented to the crops. Thus, not only grass used the symbiotically fixed N by companion legumes but also enhanced the soil N content. The effect of fertilizer was not measurable statistically in case of soil organic matter. This parameter, in general, was not affected significantly when assessed after first crop harvest. Nevertheless, legumes alone or intercropped within grass increased this important soil constituent. Inoculation proved further beneficial in this regard but combination of intercropping (especially 67%) either with seed inoculation or application of fertilizer was found as the best technique for increasing soil organic matter.

Keywords: soil fertility, *Panicum maximum,* forage legumes , intercropping, inoculation, fertilizer application

Pak. j. sci. ind. res. Ser. B: biol. sci. 2016 **59**(1) 6-11

Variation in *Myrtus communis* L. Essential Oil Composition and its Antibacterial Activities Components

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(received January 29, 2015; revised May, 28, 2015; accepted June 5, 2015)

Abstract. The *Myrtus communis* L. leaves samples were collected from five locations of its native grown areas in Lattakia, Syria, during their blooming seasons (June, 2009). Essential oil (EO) extraction was carried out by hydro-distillation in a Clevenger apparatus. The EO was analysed by both gas chromatography -Flame Ionization Detector (GC-FID) and gas chromatography/mass (GC/MS) techniques. The EO yield of the dry samples was found to be around 1.88%. The main identified components of EO were: ∝-pinene 30.40%, 1,8-cineole 17.66%, limonene 8.96%, myrtenol 5.78%, and β-caryophyllene 5.00%. The bulk EO and the separated components were tested for their antibacterial activities against *Escherichia coli* O157, *Salmonella typhimurium*, *Klebsiella pneumoniae*, *Yersinia enterocolitica* O9, *Brucella melitensis*, *Proteus* spp., and *Pseudomonas aeruginosa* by using broth micro-dilution method. It was found that citronellal and nerol were the most effective components against all pathogens.

Keywords: essential oil, bacteria, minimum inhibitory concentration, susceptibility, *Myrtus communis*

Pak. j. sci. ind. res. Ser. B: biol. sci. 2016 **59**(1) 12-19

Functional Properties and Amino acid Profile of *Spirulina platensis* Protein Isolates

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(received July 14, 2015; revised September 21, 2015; accepted September 28, 2015)

Abstract. Protein malnutrition and food insecurity represent serious obstructions to sustainable development, poverty reduction and food quality throughout the world. The present study has been designed to evaluate the *Spirulina platensis* (SP) as a protein alternative source for the utilization in food products. A protein isolate was prepared from *S. platensis* powder through extraction with 0.1N NaOH, precipitation at pH 3, neutralization of the dispersed precipitate to pH 6.8-7.0, and subsequent freeze drying. The *S. platensis* isolate amino acids compositions revealed that the total essential amino acids contribution was comparatively higher in SPI (31.16±1.43 g/100 g) as compared with SP (27.75±1.21 g/100 g). Moreover, oil and water absorption capacities, foaming and emulsifying properties, surface hydrophobicity and nitrogen solubility index were found better functional properties under laboratory conditions except emulsion properties. Conclusively, SP and its isolates might be used in various food products to curtail protein energy malnutrition.

Keywords: *Spirulina platensis*, amino acid, protein isolates, functional properties

Introduction

Malnutrition exists in those regions where overall food supply is inadequate due to poor economy; less access to dietary information; political unrest conditions and instability has interrupted food supplies. The tremendous increase in global population and production of insufficient protein has directed to search alternate sources of protein. The greater part of the world, especially developing countries use cereals as the staple foods that are generally deficient in lysine and threonine. Protein quality of the cereals can be improved by algal supplementation as these are good source of essential amino acids (Spolaore *et al*., 2006; Pimentel and Pimentel, 2003).

Spirulina (*Spirulina platensis*) has attained promising position among protein alternative sources due to its amino acids, fatty acids, phytonutrients and vitamin A contents. Both, *Spirulina platensis* and *Spirulina maxima* are commonly used as foods supplement. Spirulina is one of the most prehistoric life forms on earth and has been used as food by humans for centuries (Vigani *et al*., 2015; Habib *et al*., 2008). Marine protein hydrolysates can deliver nutritional benefits and play a vital role as functional ingredients for food industries along with potential use in health issues and as functional ingredients for food processing (Vijaykrishnaraj and Prabhasankar, 2015). Microalgae can be used to enhance the nutritional value of foods due to their abundance in compounds with beneficial attributes (Benelhadj *et al*., 2016).

Spirulina contains about 65-70% protein (dry weight) that is higher than any other natural food, and considered as a good protein source for human consumption. Furthermore, spirulina protein is easily digestible whilst considered more appropriate for malnourished children (Chaiklahan *et al*., 2011; Li *et al*., 2006; Khan *et al*., 2005). Also spirulina has a unique blend of nutrients that no single plant source can provide. It has a high protein concentration (60-70% on dry weight), supplying 18 amino acids, including all essential amino acids in balanced proportion (Kim and Kang, 2011; Fradique *et al*., 2010).

Spirulina has wide food applications ranging from juice smoothies, confectionary, food bars, baked desserts, doughnuts, muffins, pasta, salad dressing, frozen desserts, snack foods, popcorn, corn chips, crackers, breakfast cereals, soups and instant meals. Spirulina protein isolates (SPI) are currently of special interest to processors and consumers due to low fat and high protein content (Widjanarko *et al*., 2011; Fradique *et al*., 2010; Hassan *et al*., 2010). Besides imparting nutritional and therapeutic benefits, spirulina supplementation in the food products improves the texture and colour of the products (Fradique *et al*., 2010).

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Pak. j. sci. ind. res. ser. B: biol. sci. 2016 **59**(1) 20-32

Preparation of Sesame Flour Supplemented High Protein and Energy Food Bars

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(received July 22, 2015; revised October 18, 2015; accepted October 20, 2015)

Abstract. In this study, defatted sesame flour was mixed in different proportions (0, 25, 50, 75 and 100% and given names as T_0, T_1, T_2, T_3, T_4, respectively) with peanut flour and semolina to develop protein enriched sesame bars. These bars were analysed for physicochemical properties. Water activity, texture, calorific value, mineral profile, microbial examination and sensory evaluation were done at ambient temperature for 90 days. Results showed that water activity decreased from T_0-T_4 with mean values 0.6038-0.4308, respectively. Hardness decreased within treatments from T_0-T_4 with mean values ranges from 966.86 to 211.48 g while, factorability increased from 70.41 to 100.33 mm. Calorific value was also increased with maximum energy value found in T_4 (5355.5Kcal/g) and minimum in T_0 (3445.9Kcal/g). During storage, mold growth was increased from 3.2758CFU/g (T_0) to 3.6008CFU/g (T_4). Sensory evaluation results showed that T_2 gave overall best results having moisture content 4.5%, crude protein 35.73%, crude fat 0.61%, crude fibre 2.14%, total ash 2.44% and nitrogen free extract (NFE) 46.04.

Keywords: protein energy, malnutrition, sesame flour, supplemented flour, energy bars

Pak. j. sci. ind. res. Ser. B: biol. sci. 2016 **59**(1) 33-37

Effect of Different Combinations of Gums and Emulsifiers on the Quality of Bread

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(received December 8, 2014; revised August 31, 2015; accepted September 21, 2015)

Abstract. A project was designed to evaluate the effect of different combinations of emulsifiers and gums on the quality of bread. Wheat variety AARI-11 was milled to get straight grade flour and mixed with the Emulsifiers (DMG & DATEM) and Gums (G.G & CMC) in a quantity of (0.3- 0.6 %). Both, straight grade flour as well as treated flour (combination with gums and emulsifiers) were subjected to proximate and rheological analysis. Results of the rheological study showed a significant change in water absorption, dough development time, dough stability time and dough viscosity i.e. W/A 61.33-62.93%, D.D.T 3.9-4.8 min, D.S.T 7-9.1 min and 818.33-950.00 BU, respectively. Breads prepared with both flours were also studied for their sensory attributes during storage after the interval of 24 h. The highest score was awarded to T_1 (0.3% DATEM & 0.5% guar gum) on the bases of its excellent external attributes (colour of crust, volume, symmetry of form, evenness of bake and crust character) and internal characteristics (aroma, grain, texture, taste, mastication and colour of crumb). After the sensory and physicochemical analyses, it is concluded that with the addition of DATEM (0.3%) and guar gum (0.5%) resulted in good quality of bread.

Keywords: bakery product**,** straight grade flour, rheological study, water absorption

Pak. j. sci. ind. res. Ser. B: biol. sci. 2016 **59**(1) 38-43

Improvement of the Physical and Oxidative Stability Characteristics of Ice Cream through Interesterified *Moringa oleifera* Oil

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(received December 1, 2014; revised August 19, 2015; accepted September 3, 2015)

Abstract. This study aimed to investigate the effect of high melting point interesterified *M. oleifera* oil (35.6°C) with substantial amount of unsaturated fatty acids on physicochemical and oxidative stability characteristics of ice cream. Of the 10% fat in the ice cream, 30% was replaced by interesterified *M. oleifera* oil at three levels i.e. 10, 20 and 30% (T_1, T_2 and T_3, respectively). Oleic acid increased from 26.55% to 31.69%, 36.94% and 42.15% in T_1, T_2 and T_3 with no effect on melting time, compositional attributes and free fatty acid content of ice cream ($P>0.05$). Supplementation of ice cream with interesterified *M. oleifera* oil inhibited the autoxidation process in ice cream during 3 months storage period ($P<0.05$).The loss of oleic and linoleic acid in fresh and 3 months stored control and T_2 was 26.55%, 24.15%, 26.39% and 1.93%, 1.24% and 1.79%, respectively. Peroxide value of three months stored control and T_3 was 1.12 and 0.39 ($meqO_2/kg$). The overall acceptability score of T_2 was 80% of the total score (9).

Keywords: *Moringa oleifera* oil, interesterification, ice cream, oxidative stability

Pak. j. sci. ind. res. Ser. B: biol. sci. 2016 **59**(1) 44-47

Short Communication

The Resistance of Exotic Wheat Germplasm to Stripe Rust (*Puccinia striiformis* f. sp. *tritici*) under Nature Infection at Dera Ismail Khan, Pakistan

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(received December 4, 2014; revised July 29, 2015; accepted August 10, 2015)

Abstract. An experiment comprising of 49 exotic wheat germ plasm accessions was conducted at Arid Zone Research Institute, Dera Ismail Khan, Pakistan under rainfed condition during 2013-14 for their resistance against stripe rust disease. The trial was laid out in randomised complete block design with three replications. All entries were planted in a four-row plot with 3 m for row length and 25 cm for space among rows. A local susceptible check was repeatedly sown after every 10 test entries. The crop was maintained under rainfed conditions. Results revealed that all the exotic genotypes were genetically divergent in response to stripe rust disease. The disease score ranged from very highly susceptible to very highly resistant. Among 49 exotic lines, 27 exhibited from very highly resistant while 10 were susceptible to very highly susceptible.

Keywords: wheat germ plasm, stripe rust, *Puccinia striiformis* f. sp. *tritici*, rainfed condition

Pak. j. sci. ind. res. Ser. B: biol. sci. 2016 **59**(1) 48-51

Short Communication

Control of Cabbage Aphid *Brevicoryne brassicae* (Homoptera: Aphididae) through Allelopathic Water Extracts

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Abstract. Laboratory experiments were conducted to evaluate the effect of sorghum, sunflower, brassica and mulberry water extracts on mortality of cabbage aphid *Brevicoryne brassicae* (L.) (Homoptera: Aphididae) which damages the canola crop. The aphids were collected from canola field and applied with different concentrations of allelopathic water extracts or their combinations under laboratory conditions. Allelopathic water extracts of crops such as sorghum, brassica, sorghum + mulberry, sorghum + sunflower and sunflower alone were effective in controlling the aphid. The higher concentrations of these extracts (8 or 16%) were most effective in controlling aphid (>50%) at 24 h after application.

Keywords: allelopathy, cabbage aphid, control, water extracts

Pak. j. sci. ind. res. Ser. B: biol. sci. 2016 **59**(1) 52-58

Review

Role of Alphasatellite in Begomoviral Disease Complex

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(received April 29, 2015; revised June 17, 2015; accepted August 19, 2015)

Abstract. A circular single stranded satellite, called as alphasatellite (initially identified as DNA-1), was characterised and confirmed to be associated with the Geminivirus begomovirus-betasatellite complexes. Alphasatellites are single stranded DNA (ssDNA) components, frequently accompanying with monopartite begomovirus or some time with bipartite begomovirus and/or betasatellite complex. The genome of alphasatellite DNAs are nearly half size of its helper virus genome and have no similarity with it. Furthermore, their function in begomovirus-betasatellite complex is still unclear. Recent advances in application of molecular tools helped in finding new viruses and allied satellite components that further help in advancing our understanding of this satellite DNA and this evolution.

Keywords. Geminivirus, begomovirus, alphasatellite