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Executive Editor
# Pakistan Journal of Scientific and Industrial Research 
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Integrated Effects of Wheat Residue and Phosphorus Application on Rice Productivity and Soil Health under Salt Affected Soils

Land Resources Research Institute, National Agricultural Research Centre, Islamabad, Pakistan

(received December 29, 2014; revised September 10, 2015; accepted October 15, 2015)

Abstract. A field experiment was conducted to determine the effect of crop residue incorporation along with P application on rice production under salt affected soil having pH 8.57, ECe 5.65 (dS/m), SAR 17.38 (mmol/L)½ and available P (3.9 mg/kg). The study was carried out at MK Farm, Farooqabad, Sheikhpura, Pakistan during Kharif season in 2009. Treatments were arranged using randomised complete block design (RCBD) with three replications. The treatments were control (T1), straw incorporation @ 5 tonnes/ha (T2), T2+20 kg P2O5/ha (T3), T2+40 kg P2O5/ha (T4) and T2+60 kg P2O5/ha (T5). The highest grain yield (4.407 t/ha) was recorded in treatment receiving 5 tonnes wheat straw along with 40 kg P2O5/ha which is 14.6% more than control and the lowest grain yield (3.847 t/ha) was recorded in control. Maximum P (0.37%) and K (0.13%) contents of grain were recorded where wheat straw was applied @ 5 t/ha along with 40 and 60 kg P2O5/ha whereby P content of control was (0.3%). The residual P was 5.7 mg/kg where wheat straw was applied @ 5 t/ha along with 40 and 60 kg P2O5/ha. The residual P in control was 4.3 mg/kg. It can be concluded that incorporation of residue enhanced the availability of P, K and Ca to plant roots. Under saline-sodic/sodic conditions, plant can better cope with salinity in the presence of calcium and K availability.

Keywords: wheat residue, rice productivity, salt affected soils

Introduction

Rice and wheat are the leading staple food crops of the people of southeast Asia. More than 90% of rice and 43% of wheat in the world is produced and consumed in Asia (Chauhan et al., 2012). The rice-wheat cropping system is highly nutrient exhaustive system hence causes a considerable depletion of soil nutrients (Zahir et al., 2011) therefore, consequently requires heavy use of fertilizers each year for the potential yields. Large responses of wheat and rice to fertilizers are well documented (Akhtar et al., 2009; Bakht et al., 2009; Shafi et al., 2007; Suman, 2004; Shah and Khan, 2003; Roder et al., 1998).

Soil C, N, burning of residue crop and replenishing soil fertility status has been studied by Khankhane et al. (2009), Byous et al. (2004), Gupta et al. (2003), Mishra et al. (2001), Sarma et al. (2000), Rasmussen and Parton (1994) and Raison et al. (1979). Burning of rice straw prior to sowing of wheat is still a common practice in central and northern parts of India.

About 50% of wheat crop is being harvested with combined harvester. The combined harvester leaves behind a large amount of loose straw in the field whose disposal or utilization in the short time is difficult and compelling farmers to burn the residue to get rid of it (Gupta et al., 2003). Since plant nutrients remain in the straw (approximately 35% N, 30% P and 85% K and 40-50% S) much of this can be recycled for subsequent crop growth after its decomposition (Byous et al., 2004).

In many studies, recycling of crop residues is reported to increase the organic carbon and nutrient contents; decreased soil bulk density and increased crop yields (Mehdi et al., 2011; Eagle et al., 2000; Misra et al., 1996). Thus, it is high time to explore how this precious resource can be utilized and managed from improving soil physicalchemical characteristics and amelioration of salt affected lands for enhancing and sustaining productivity. A field experiment on salt-affected soil of Sheikhpura district is being conducted to determine the effect of crop residue incorporation with P on subsequent crop yield grown under variable soil salinity/sodicity.

Materials and Methods

A field experiment was conducted to determine the effect of crop residue incorporation along with P application on rice production at MK Farm, Farooqabad,
Effect of Integrated Nutrient Application on Growth and Yield of Maize

Muhammad Abid¹, Riaz Ahmed², Adnan Umar* and Muhammad Islam³
¹Directorate of Soil and Water Conservation, Rawalpindi, Pakistan
²Department of Agronomy, University of Agriculture Faisalabad, Pakistan
³Soil and Water Conservation Research Station Sohawa, Jhelum, Pakistan
⁴National Fertilizer Development Centre, Islamabad, Pakistan

(received April 11, 2014; revised October 29, 2015; accepted October 31, 2015)

Abstract. Comparative effect of organic and inorganic fertilizer on the growth and yield of maize variety Hicorn-984 was studied at agronomic research area of University of Agriculture, Faisalabad during the year 2005. The trial was laid out according to randomised complete block design in triplicate and plot size was 3 m × 6 m. There were six treatments comprising of various levels of organic and inorganic fertilizer in different combinations and a control. Combined application of organic and inorganic fertilizer differed significantly from control as well as from their sole application. Comparison of treatments showed that inorganic fertilizer application at the rate of 70-50-35 kg NPK/ha along with 5 t/ha poultry manure showed maximum plant growth parameters such as leaf area (1537 cm²), plant height (195 cm), number of grains per cob (452) and thousand grain weight (234 g) which were at par with T₅ (70 - 50-35 kg NPK/ha along with 8 t/ha FYM) but significantly higher than the treatments where organic manures and inorganic fertilizers were applied separately. Maximum grain yield (5.7 t/ha) and cost-benefit ratio (1.7) were achieved in the treatment T₅ (NPK at 70-50-35 kg/ha along with 5 t/ha poultry manure) while, minimum grain yield (2.3 t/ha) and cost benefit ratios (1.1) were recorded in control. Combined application of organic and inorganic fertilizer results in increase in yield and profitability to farmer as compared to their sole application.

Keywords: farm yard manure, inorganic fertilizers, maize, nitrogen, poultry manures, yield components

Introduction

Maize is an important food and feed cereal crop in the world and is a staple food for more than 1.2 billion people in Sub-Saharan Africa and Latin America. Worldwide production of maize is 785 million tonnes and annual consumption by humans is 116 million tonnes with maximum consumption per capita of 174 kg/year in Lesotho, Eastern and Southern Africa uses 85% of their production as food, while Africa as a whole uses 95% of its production (IITA, 2009). In Pakistan, maize is grown on an area of 1087 thousand hectares with an annual grain production of 4338 thousand tonnes and average grain yield is about 3991 kg/ha (GoP, 2012-2013). Maize occupies 4.8% of the cropped area and contributes 3.5% of the values of agricultural outputs.

Average maize yield in Pakistan is much lower than developed countries of the world because imbalanced fertilizer use, soil nutrient depletion and poor crop husbandry practices. According to a report of NFDC (2008), there is a negative nutrient balance of approximately -472.99 for N, -313.14 for P, 00-3707.33 for K and -4493.46 for total nutrients in most of the soils of Pakistan. Organic manures and inorganic fertilizers together are of great importance for agricultural sustainability, soil productivity as well as for soil properties (Saha et al., 2008). The use of inorganic fertilizers to restore the fertility of the soil has not been effective because of high leaching, continued exports of nutrients through crop harvest and unbalanced mineral contents in the soil (Kone et al., 2013). However, integrated use of organic and inorganic manures seems to be an approach for sustainable production of crops (Rong et al., 2001). It improves the efficiency of the chemical fertilizers and thus may reduce their use (Hill, 2007). Integrated use of organic inputs such as crop residues, manures and compost has great potential for improving soil productivity and crop yield through the improvement of physical, chemical and microbiological properties of the soil as well as nutrient supply (Shah et al., 2009). Nutrients contained in organic matter are released slowly and are available for a longer time in the soil, thereby ensuring long residual effects (Arancon et al., 2004). The use of organic fertilizers together with chemical fertilizers, compared to the addition

*Author for correspondence; E-mail: adnumumair@gmail.com
Seasonal Variation in Foliage Quality of *Acacia modesta* Wall.
Growing in Different Ecological Zones of Pothwar, Pakistan

Muhammad Yasin*, Muhammad Mehmood-ul-Hassan#, Rizwan Ahmad, Atiya Azim, Irshad Ahmad Khan* and Muhammad Arshadullah*  
*LRRI, National Agricultural Research Centre, Park Road, Islamabad, Pakistan  
#Animal Nutrition, National Agricultural Research Centre, Park Road, Islamabad, Pakistan  
*Department of Forestry and Range Management, Arid Agriculture University, Rawalpindi, Pakistan  

(received August 7, 2014; revised August 6, 2015; accepted August 28, 2015)

**Abstract.** In this study, the seasonal variability in nutritive value of foliage of *Acacia modesta* Wall. was evaluated. Leaves and twigs of *A. modesta* were collected from low, medium and high rainfall Pothwar regions of Pakistan i.e. Rawalpindi, Jhelum and Talagang during spring, summer and fall seasons. The forage samples were analysed for dry matter (DM), crude protein (CP), ether extract (EE), ash content (AC), crude fibre (CF), acid detergent fibre (ADF), neutral detergent fibre (NDF) and acid detergent lignin (ADL). Dry matter varied from 44.3 to 65.0% and was significantly higher during fall than spring and summer season at all three sites. Talagang site had the highest dry matter followed by Jhelum and Rawalpindi sites. The CP was in the range of 14.4-17.4%. The CP was in order of spring, summer and fall season. Rawalpindi and Jhelum had the highest CP (16.4%) followed by Talagang site (15.9%). Ash content and ether extract (EE) ranged from 5.8 to 10.4% and 1.1 to 3.2% in season and site interaction. Crude fibre (CF) value ranged from 19.9 to 27.6% and was significantly higher in fall than spring and summer. The highest CF (24.6%) was found at Rawalpindi followed by Jhelum (21.6%) and Talagang (22.1%). Seasonal variation in ADF and NDF ranged from 34.4 to 38.5% and 50.5 to 56.5%, respectively. The ADF and NDF were lower in summer season than in spring and fall seasons. ADF was the highest (36.4%) at Jhelum followed by Talagang (36.3%) and Rawalpindi site (35.9%). The ADL ranged from 9.8 to 13.4% and was higher in summer than in spring and fall seasons. Based on chemical composition, it was concluded that *A. modesta* foliage contained high nutritional values and can be fed to ruminants as supplement to low-quality feeds particularly during the dry season.

**Keywords:** seasonal variation, foliage quality, *Acacia modesta*, nutritive value

**Introduction**

Pothwar is a semi-arid region of Pakistan with hot summer and cold winter and with a short dry season early in the summer. Scarcity and fluctuation in quantity and quality of the year-round supply of fodder due to seasonal variation are major constraints of the area (Noor, 1989). This fluctuation in quality and quantity can be controlled through supplementation of foliage trees such as *Leucaena leucocephala, Acacia modesta, Ziziphus mauritiana* etc. in ruminant diets which can improve the utilisation of low quality roughages mainly by supplying protein to rumen microbes (Charbonneau et al., 2007). Several shrubs in the dry areas have potential as stock-feed and for re-vegetation of degraded rangelands, but their quantitative data on their fodder yield and quality are scanty (Intiaz et al., 2014).

*Acacia modesta* Wall. is a valuable browse shrub for Pothwar because of its adaptation and productivity in dry to wet, sandy to calcareous and acidic soils (Sher et al., 2012). The plant has common uses as fuel wood and fodder and specific medicinal uses like remedy of mouth ulcer, used as tooth brushes for cleaning and protection of teeth, bark is used in gastric pains, skin diseases and has potential anti-bacterial and antimicrobial activity (Bashir et al., 2012). It is relished by all species of livestock due to palatability and nutritional values. It is a semi evergreen tropical legume tree, commonly known as ‘Phulai’ in Pothwar (Noor, 1989). It is a fast growing tree in its early age and grows well within the range of 250-1350 mm annual rainfall; temperatures of 40 °C to below zero (Baquar, 1995). It is strong light demander and fairly drought resistant and can grow in barren land and eroded sites but grows much better in deep soil of Pothwar which is classified as an important component of subtropical dry evergreen forest (Khan and Khan, 2000).

Rawalpindi, Jhelum and Talagang cities are main districts of Pothwar, Pakistan. Total precipitation in spring
Estimation of Heterosis and Combining Ability in F1 Hybrids of Upland Cotton for Yield and Fibre Traits

Bushra Tahira Arain, Muhammad Jurial Baloch*, Qurat-Ul-Ain Bughio, Pervish Sial, Muhammad Ahmed Arain and Amanullah Baloch
Department of Plant Breeding and Genetics, Sindh Agriculture University Tandojam, Sindh, Pakistan

(received January 20, 2015; revised November 2, 2015; accepted November 10, 2015)

Abstract. The experimental research was conducted so as to determine the general combining ability (GCA) and specific combining ability (SCA) estimates and heterotic effects for seed cotton yield and fibre traits in 5 × 5 diallel crosses of upland cotton (Gossypium hirsutum L.). The parental genotypes studied were; CRIS-134, IR-3701, IR-1524, FH-113 and MG-6. The characters such as bolls/plant, sympodial branches/plant, boll weight (g), plant height (cm), fibre length (mm), seed cotton yield/plant (g), seed index (g) and ginning outturn percentage were studied. The experiment was laid-out in a randomized complete block design with four replications at experimental field of the Department of Plant Breeding & Genetics, Sindh Agriculture University Tandojam, Pakistan during 2013. The results revealed that, parents and hybrids differed significantly for their mean performance regarding all the traits studied. The importance of heterotic effects was evident from the significance of parents vs. hybrids performance. The variances due to GCA and SCA were significant for all the traits except that GCA was non-significant for boll weight only whereas, SCA was non-significant for boll weight, seed index and ginning outturn %. The significance of GCA indicated the importance of additive genes advocating the traits while, the involvement of non-additive genes was evident from the significance of SCA variances. The GCA variances were greater than SCA for bolls per plant, plant height, seed cotton yield and lint % while, SCA variances were higher than GCA for sympodial branches/plant and fibre length. Parents IR-3701, FH-113 and MG-6 displayed higher positive GCA effects for bolls/plant, sympodial branches/plant, fibre length, seed cotton yield, seed index and ginning outturn%. The per se performance of these three parents was exactly reflected in their GCA effects and such happenings are exceptional. Such results suggested that, all three parents were good general combiners covering most of the traits studied and may be preferred for hybridization and selection programmes. The crosses like CRIS-134 × MG-6, IR-3701 × FH-113 and IR-3701 × MG-6 with higher estimates of SCA for almost all the traits also expressed higher heterotic effects, thus these hybrids with dominant and over dominant genes could be potential hybrids for the exploitation of heterosis in cotton.

Keywords: general combining ability, specific combining ability, heterosis, upland cotton

Introduction
Estimation of genetic variation and combining ability are useful breeding tools being used in determining the breeding value of some populations or parents which guide cotton breeders to apply appropriate breeding procedures. The concept of combining ability is useful in testing procedures where, breeding objective focuses on comparing the performance of lines in hybrid combinations. Combining ability or productivity of hybrids is defined as the ability of parents or cultivars to combine amongst each other through hybridization so that favourable genes are transmitted to their progenies. Two types of combining ability, general and specific are well recognized in quantitative genetics. General combining ability (GCA) is defined as an average performance of a parent in a series of crosses whereas, specific combining

*Author for correspondence; E-mail: j.rind58@gmail.com
Genetic Component Analysis for Yield and Morphological Traits in Pearl Millet (*Pennisetum glaucum* (L.) R. Br.) Genotypes

Muhammad Yaqoob
Arid Zone Research Institute, Ratta Kulachi, D.I. Khan, Khyber-Pakhtunkhwa, Pakistan

(Received April 30, 2014; revised July 16, 2014; accepted October 22, 2014)

**Abstract.** The main objectives of present investigation were to find out the extent of genetic variability, heritability (bs), component of variance and genetic advance for yield and yield related traits of pearl millet, *Pennisetum glaucum* (L.) R. Br. For this purpose twenty five (25) pearl millet (local and exotic) germplasm accessions were evaluated in a Randomized Complete Block Design having three replications at Arid Zone Research Institute, PARC, D.I. Khan, Pakistan during 2013. Highly significant (*P*<0.01) differences were observed for all the traits except days to maturity which was mere significant (*P*<0.05). A substantial amount of genetic variability among the genotypes revealed that accessions under studies belonged to diversified sources indicating the expediency of genotypes for future breeding of millet varieties. The line MS-3 proved its superiority through producing the highest grain yield of 132.70 g/plant. High genotypic (68.06) as well as phenotypic co-efficient of variation (71.50) were recorded for grain yield. Moderate to high heritability was recorded for number of leaves per plant (47.11), leaf area index (46.75), days to heading (69.34) and days to maturity (68.58). A very high heritability (89.54%) was recorded for 1000-grain weight and grain yield. The high heritability amalgamated with high genetic advance (171.04) as percent of mean was recorded for grain yield indicating the least environmental effect and presence of more additive gene effect leading to crop improvement through simple selection.

**Keywords:** pearl millet, genetic variability, heritability, genetic advance

**Introduction**

Among various kinds of millet (finger millet, foxtail millet, kodo millet, little millet, pearl millet and proso millet), the pearl millet (*Pennisetum glaucum* (L.) R. Br.) is the most popular one in Pakistan. It is mostly grown in rainfed ecologies across the country. Its stalk is used for fodder while grains are used for poultry feed however, very rarely consumed by people directly. Unlike some African countries for instance, in Ethiopia millet utilization is deep rooted in culture and its grain is used for making a native bread, injera, porridge and genfo (thick porridge) alone or mixed with teff (Eragrostic teff) maize and barley (Kebere et al., 2006). In Pakistan millet stalk as well as grain yields are quite low due to lack of improved varieties, drought stress and unimproved production technology. Furthermore, millets are mostly relegated to marginal land making more complications in getting the higher yield. Among all the factors responsible for low yield, the use of local land races is the most important problem to be addressed by the breeders. Old varieties must be replaced by new high yielding pure line varieties.

Germplasm is considered as raw material in many crop breeding programmes. For effective utilization of genetic variability in available germplasm, it is important prerequisite to evaluate and characterise the individual genotype. The progress in any crop improvement programme depends mainly upon the variability existing in the base population (Salini et al. 2010). Various genetic parameters like, genetic variability, genotypic co-efficient of variation, phenotypic co-efficient of variation, heritability and genetic advance are the important tools leading to choose the breeding approaches and methodology (either through simple selection or use of heterosis etc.). Shinde et al. (2010) suggested that use of broad sense heritability is apt for prediction of selection response to the entire genotypic value transmitted to progeny when selection is advanced through selfing. Johnson (1955) suggested that heritability values alone may not provide clear predictability of selection made. Therefore, heritability values along with estimates of genetic advance would be more reliable than heritability alone. Gupta and Mushonga (1992) studied grain yield and nine morphological traits and reported significant variation for all the traits. Heritability was high for days to flowering whereas low for finger length and 1000 grain weight. John (2006) observed high genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) for number of productive
**In-vitro Phytochemical and Antibacterial Activity of Abies ciliicica subsp. ciliicica**

Basel Saleh* and Ayman Al-Mariri
Department of Molecular Biology and Biotechnology, Atomic Energy Commission of Syria,
P.O. Box 6091, Damascus, Syria

(received March 4, 2015; revised June 18, 2015; accepted July 27, 2015)

**Abstract.** Leaf and flowering cones methanolic, ethanolic and acetonite extracts of *Abies ciliicica* subsp. *ciliicica* plant were screened for phytochemical and inhibitory effect against 8 bacterial isolates. Qualitative phytochemical assay revealed that, flowering cones acetone extract exhibited the most of bioactive compounds compared to the leaf extracts with all examined solvents. Antibacterial activity of *A. ciliicica* subsp. *ciliicica* was determined by measuring the zone inhibition diameter (ZIs), activity index (A.I) and minimum inhibitory concentrations (MICs) against 8 bacteria (*Staphylococcus aureus*, *Listeria monocyctogenes*, *Bacillus cereus*, *Salmonella typhimurium*, *Escherichia coli*: O157, *Acinetobacter baumannii*, *Brucella abortus* and *Pseudomonas aeruginosa*) isolates. Overall, acetonite flowering cones extracts were more potent against all tested isolates compared to the leaf ones. The lowest MICs value was recorded to be 0.42, 0.52 and 1.04 μg/mL for acetone, methanol and ethanol flowering cones, respectively, against the same pathogen *A. baumannii*. Based upon the current investigation, *A. ciliicica* spp. *ciliicica* could be considered as a potential endemic source against bacterial isolates.

**Keywords:** *Abies ciliicica*, antibacterial activity, phytochemical assay, flowering cones

**Introduction**

*Abies ciliicica* subsp. *ciliicica* is an endemic subspecies to the mountains adjacent to the north-eastern Mediterranean coast. It occurs in Syria, Lebanon and Turkey. In Syria, it occurs at Sloufch (Lattakia) and forms mixed forests with *Ostrya carpinifolia*, *Carpinus orientalis*, *Sorbus torminalis*, *Fraxinus ornus* and *Cerasus mahleb* (Browicz, 1982). It is known as Cilician fir as an associated name. It is evident that this subspecies becomes one of the near threatened in the world. It worth noting that this subspecies is threatened in Syria and Lebanon (Knees and Gardner, 2013).

In Syria it grows in nature reserve located at 1500 m altitudes and occupies an area of 1350 hectares of a series of Syrian coastal mountains on eastern and western summit of the Prophet Mata (the highest peak in the Syrian coastal mountains 1562 m). It has been declared natural reserve since 1996, but the start of its implementation was delayed until 2002. It has been protected by the financing of the Global Environment Facility.

*Abies ciliicica* (Ant. and Kotschy) subsp. *ciliicica* (Cilician fir) belongs to the Pinaceae (Abietaceae) family. *Abies* genus involved 10 species and divided into 2 sub-species: subsp. *ciliicica* (Buds not rosinous; young shoots hairy) and subsp. *isaurica* (Buds reinous; young shoots glabrous). *A. ciliicica* subsp. *ciliicica* is native to Mediterranean region of Turkey (Dayisoylu et al., 2009; Davis, 1967).

It has been demonstrated that, the essential oil cones *A. ciliicica* subsp. *ciliicica* has antimicrobial activity due to the effective compounds found, mainly, limonene, α-pinene, β-pinene, and myrcene (Dayisoylu et al., 2009). Whereas, Alma et al. (2003) reported the antimicrobial activity of leaves essential oil of Syrian oreganum (*Origanum syriacum* L.). The later investigation revealed that, γ-terpinene, carvacrol, p-cymene and β-caryophyllene were the major compounds present in the *O. syriacum* L. leaf oil.

Recently, Patel et al. (2014) reported biological activity of *A. pindrow* leaves extracts and found that, leaf methanolic extract exhibited antioxidant effect due to presence of phenol and flavonoids. While, broncho-protective activity was also attributed to the presence of terpenoids and flavonoids in leaf benze, acetone and ethanol extracts.

Few investigations focused on antibacterial and antifungal activities of *Abies* spp. extracts (Dayisoylu et al., 2009; Lee and Hong, 2009; Kizil et al., 2002; Diğrak et al., 1999; Bağci and Diğrak, 1997). Vishnoi
Physicochemical and Amino Acid Profiling of Cheddar, Mozzarella and Paneer Whey

Sheraz Ahmed*, Mian Kamran Sharif*, Masood Sadiq Butt* and Haq Nawaz*

*Faculty of Food, Nutrition and Home Sciences, University of Agriculture, Faisalabad-38040, Pakistan
Institute of Animal Nutrition and Feed Technology, University of Agriculture, Faisalabad-38040, Pakistan

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Abstract. The present study characterised locally available whey samples of cheddar, mozzarella and paneer for physicochemical and nutritional attributes. The results revealed that the cheddar whey exhibited pH (5.41±0.16), crude protein (0.83±0.03%), fat (0.25±0.01%), lactose (4.95±0.21%) and total solids (6.55±0.27%), slightly higher than those of mozzarella and paneer whey. On the other hand, the paneer whey showed acidity (0.30±0.01) and ash content (0.56±0.02), slightly higher than those of cheddar and mozzarella whey. Furthermore, the mozzarella whey revealed the total plate count values (3.17±0.09 × 10⁴ cfu/mL), slightly higher than those of cheddar and paneer whey samples. The paneer whey contained the amount of calcium (25.02 ± 1.34), magnesium (4.88 ± 0.23), sodium (32.11 ± 1.37) and potassium (97.55 ± 3.54) slightly higher, when compared to those of cheddar and mozzarella whey. The cheddar whey possessed the highest amount of essential and non-essential amino acid contents, followed by mozzarella and paneer whey. Thus, cheddar whey exhibited the best physicochemical and nutritional profile among all the whey samples, so it can be used to prepare high quality novel and nutritious sports drink for sportman.

Keywords: whey proteins, nutrition, cheese-whey, by-products, mozzarella whey

Introduction

The food industry is producing massive quantities of by- and co-products being discharged in streams or dumped into soil resulting in environmental pollution. These by-products are exploitable source of bioactive components. The technologically advanced countries are extracting valuable ingredients from these wastes including proteins, peptides, organic acids, vitamins, minerals, lactose etc. Whey is nutritious co-product of cheese manufacturing industry with great potential for diverse food applications due to its high quality proteins and essential amino acids. Depending upon the raw material (enzyme or acid) used in milk coagulation; it is broadly classified into sweet whey or acid whey (Zimecki and Kruzeln, 2007; Gill et al., 2000; Singh et al., 1999). The current world production of whey is about 125 million tonnes, about 64% is produced in European countries and 24% in North America. Pakistan contributes almost 45000 tonnes whey per year. The channa (gram) and paneer (cheese) whey give the major contribution (80%) in total whey production (Naik et al., 2009). Playne (2003) reported that 55% of total whey is treated and converted into various valuable food ingredients.

Jaun et al. (2009) revealed lactose 5%, soluble proteins 0.6 to 0.8%, lipids 0.5% and minerals 8 to 10%. Whey salts contain more than 50% of potassium chloride and sodium chloride and salts of calcium (phosphates).

Whey proteins are approximately 20% of the milk proteins and comprised of β-lactoglobulin (50%), α-lactalbumin (20%), bovine serum albumin (10%) and other minor proteins (10%) like lactoferrin, peptone, immunoglobins, prolactin, proteose, folate, calmodulin and binding proteins.

Otte et al. (2007) reported several applications of whey proteins in beverage, confectionary, desserts manufacturing, dairy and bakery industries because of certain functional and nutritional properties, such as solubility, whipping ability, emulsification, viscosity, gelation, foam formation, firmness, creaminess to end product and heat stability.

Omoni et al. (2012) considered whey protein as a useful ingredient for infant formula because of its low allergen causing ability, weight gain, as well as in protein fortified fruit juices and other healthy foods and drinks. The vitamins and minerals present in whey have high bioavailability, while its amino acid profile has high amount of branched-chain amino acids such as valine, isoleucine and leucine.
Teratological Effects of Dimethoate on 12th Day Desi Chick Embryo
(*Gallus gallus domesticus*)

Shamila Sabir*, Muhammad Sajjad Ansari*, Muhammad Nadeem Abbasa*, Razia Iqbal*, Javed Iqbal*, Saima Kausar* and Sadaf Chaudhary*

aDepartment of Zoology, University of Gujrat, Hafiz Hayat Campus, Gujrat, Pakistan
bPunjab Group of Colleges, 64 E1 Gulberg III, Lahore, Pakistan

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**Abstract.** Developmental toxicity of commercially used Dimethoate was assessed on ‘desi’ chick embryos (*Gallus gallus domesticus*). Five different concentrations (0, 0.3, 0.6, 0.9 and 1.2%) of this insecticide were administered as a single dose in ovo in a volume of 100 μL per egg on day “0” of incubation. Embryonic development and morphological malformations were evaluated on day 12th. Mortality rate increased with the insecticide concentration. Moreover, this insecticide induced teratological and morphological changes in all treated groups compared to untreated group.

**Keywords:** development toxicity, dimethoate, chick embryo, morphometric changes, mortality rate

**Introduction**

Dimethoate (C₅H₁₀NO₃PS₂) is a highly stable compound and partially decomposes even at extremely higher temperature. It is widely used organophosphate to control insect pests in agricultural and non-agricultural areas (Farag et al., 2007). The main mode of action is the inhibition of acetylcholinesterase (AChE) enzyme in the nervous system. This enzyme stimulates the hydrolysis of acetylcholine in cholinergic synapses. Inhibition of AChE leads to an accumulation of the neurotransmitter, causing overstimulation of cholinergic receptors (Guilhermino et al., 1996; Payne et al., 1996), neuromuscular paralysis and uncoordinated movements which can result in the organism's death (Howcroft et al., 2011). Dimethoate residues persist in the surrounding environment, and affects non target organisms like the domestic chicken. Moreover, its residues on soil, commercial feed and ingredients are potential routes of exposure to domestic birds. Dimethoate is highly toxic to birds, as its residues persist in their tissues (Ahmad et al., 2010; Botella et al., 2004). Whereas, developing chick embryos are more vulnerable than adults, because their immune system, detoxifying enzymes, liver metabolism, and the blood brain barrier are not completely developed (Alhifi, 2011; Newbold et al., 2007).

Poultry is a rich source of cheap, palatable nutritious protein and a constituent of our daily food in the form of eggs and white meat (Ghafoor et al., 2010). In subcontinent (Pakistan and India), farmers rear local poultry breeds to fulfill meat requirements (Kumaresa et al., 2008). Poultry meat is a good substitute for beef and mutton (Tufail et al., 2012). In Pakistan, more than 79.6 million rural poultry birds, contribute 32% and 15% of the egg and meat production, respectively (Memon, 2013). Desi chicken (*Gallus gallus domesticus*) is a common domestic fowl, belonging to the Phasiandae family (Perrins and Buffalo, 2003). It is a good and delicious source of meat and eggs, and alternative income among the households in the rural areas (Lingaya et al., 2007). However, its production is least compared to market demands in the country. The hazardous chemicals in the environment, poor reproductive potentials and lack of genetically improved indigenous breeds are mainly responsible for this low production. Insecticides, metals and fungicides cause morphological and histopathological abnormalities, biochemical changes, organ dysfunction and mortality in the young embryos (Anwar, 2003).

Previously, many authors documented the toxicity of dimethoate on broilers, mammals, aquatic and soil inhabiting organisms (Paithane et al., 2012; Farag et al., 2011; 2007; Juhasz et al., 2005; Budai et al., 2001; Varnagy et al., 2001). However, there is dearth of literature on the toxicological and morphological impact of dimethoate on ‘desi’ chicks (Budai et al., 2003; Varnagy et al., 2001). Therefore, the present study was designed to investigate the embryotoxic and teratogenic effects of dimethoate on

*Author for correspondence; E-mail: abbasmdr@gmail.com*
Short Communication

Estimation of Genetic Variability and Heritability (Broad sense) for Yield and Yield Components in Some *Brassica juncea* Genotypes

Amanullah and Muhammad Mansoor*
Arid Zone Research Institute (PARC), Dera Ismail Khan, KPK, Pakistan

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**Abstract.** Broad sense heritability and genetic advance were estimated among ten mustard (*Brassica juncea* L.) genotypes for yield and yield contributing parameters in RCB design with three replications. Broad sense (BS) heritability estimates were higher (above 60%) for days to flowering, plant height, days to maturity, branches/plant and number of pods/plant. Moderate heritability values were observed for grain yield. The expected response to selection was higher (≥ 20%) for number of pods/plant and grain yield kg/ha and moderate values ranging from 10-20% for selection response was recorded for plant height. Days to flowering, days to maturity and number of branches/plant showed lower values (≤ 10%) for expected response to selection. The genotypes 022860, J-38 and 022862 have shown better results for most of the traits and could be used in focused future breeding programmes.

**Keywords:** *Brassica juncea*, heritability, genetic advance, phenotypic variance

Rapeseed/mustard (*Brassica*) is the conventional oilseed crop in Pakistan. The cultivated area of rapeseed/mustard is declining mainly due to low yields and the main reason for low yield seems cultivation of varieties with low yield potential.

Genetic improvement is the main source for increasing the grain yield of *Brassica*. Broad sense (BS) heritability estimates and considerable genetic advance could be a valuable tool for breeders to select improved genotypes of *Brassica* for higher grain yield (Pant and Singh, 2001). Idahoa *et al.* (2010) investigated that the magnitude of genetic variability present in base population of the crop species is also pivotal to crop improvement which must be exploited by plant breeders for yield improvement. Information on heritability estimates along with genetic advance is normally more helpful in predicting the gain under selection then heritability estimates alone hence, studies have been taken by many researchers (Ejaz-ul-Hasan *et al.*, 2014; Junaid *et al.*, 2014; Ahmad *et al.*, 2013; Ali *et al.*, 2013; Rameeh, 2011; Aytaç and Kinaci, 2009; Iqbal and Khan, 2003; Ali *et al.*, 2002; Larik and Rajput, 2000).

Keeping in view the importance of genetic potential studies, broad sense heritability, genetic variability and genetic potential among *B. juncea* genotypes were explored for various characters which were ultimately important for selection of best lines for successful breeding programme.

*Author for correspondence; E-mail: joyadkpk@gmail.com

The experiment was conducted at Arid Zone Research Institute, Dera Ismail Khan (KPK) during the Rabi period year, 2013-14. Ten genotypes *viz.* 019493, 019509, 019510, 019511, 019518, 019528, 022852, 022860, 022862 and 023980 were tested in the trial using RCB design. Each entry was planted in 4 rows, 5 m long and 30 cm apart. Sowing was done with the help of hand drill. Plants were thinned leaving 3-4 cm space between plant to plant. Fertilizer was applied @ 75-60 NP kg/ha. Half dose of urea was applied with 2nd irrigation. All the cultural practices were kept constant from sowing till harvesting. Data were recorded on days to flowering, days to maturity, plant height, branches/plant, pods/plant and grain yield kg/ha. Data were recorded on the two central rows for grain yield and the data collected were subjected to analysis of variance (ANOVA) using Genstat discovery statistic software. Least significant differences (LSD) test was applied to find out the mean differences. The genotypic, phenotypic and environmental variances, broad sense heritability, genetic advance and its percentage were calculated. Calculation of broadsense heritability (h²b) estimate on mean basis was done as suggested by Eckebl *et al.* (1977).

Estimates of heritability, genetic advance and genetic advance as percentage of the population mean are shown in Table 1. The magnitude of heritability was generally high in all characters. According to Ansari *et al.* (2004) high heritability percentage reflects the large heritable variance which may offer the possibility of improvement
Review

Modification of Milk Fat

Muhammad Nadeem
Department of Dairy Technology, University of Veterinary and Animal Sciences, Lahore, Pakistan

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Abstract. The potential health benefits associated with the intake of unsaturated fatty acids for the reduction of bad LDL cholesterol has been scientifically proven. Concentration of unsaturated fatty acids in milk and dairy products can be increased by many ways, however, many of the modification strategies do not have any significant impact on the reduction of cholesterol from milk and milk products. The concentration of unsaturated fatty acids in milk fat can also be decreased by dry fraction, interesterification, transesterification etc. Milk products with higher magnitude of unsaturated fatty acids may have significant influence on the reduction of serum cholesterol.

Keywords: fatty acid composition, cholesterol, interesterification, fractionation, milk fat

Introduction

Milk and dairy products are the regular part of the average diet of an individual, however, milk and dairy products are not the great source of beneficial unsaturated fatty acids, milk contains only 25-30% unsaturated fatty acids, the role of unsaturated fatty acids in the reduction of bad low density lipoprotein (LDL) cholesterol and enhancement of beneficial high density lipo protein (HDL) cholesterol is scientifically established (Williams, 2000). Due to the existence of lower magnitude of unsaturated fatty acids in dairy products, about 44% of the American population have started to avoid milk and milk products (Hansel et al., 2007). People are becoming more and more health conscious and currently, food industry is focusing on the development of functional foods.

Cardiovascular disease is the number one killer of mankind. Presently killing about 17 million people every year and mortalities are forecasted to reach beyond 25 million in the year 2020. In the USA 41.2% deaths are due to cardiovascular diseases (NCAHA, 2000). It is the biggest cause of deaths in the United Kingdom, Europe and Australia (BHF, 2005; EHN, 2005). About 21.5% of people over the age of 15 years living in the cities of Pakistan and one out of three people over 45 years suffer from hypertension (Nishter, 2002). American Heart Association and World Health Organization advised the consumers to intake unsaturated oils to decrease the risk of cardiovascular diseases (USDA, 2000). By increasing the concentration of unsaturated fatty acids, they may be used as a neutraceutical to decrease the risk of cardiovascular diseases (Sacks and Katan, 2002). Results of several investigations have disclosed that by increasing the concentration of unsaturated fatty acids, the concentration of medium chain fatty acids in milk decreases (Michael, 2007). Nadeem et al. (2013) reported that concentration of oleic acid in milk increased from 21 to 30%, through the manipulation in bovine feeding, the role of oleic acid in the reduction of serum cholesterol is well documented and nutritionists recommend that oleic acid must be included in the diet to reduce the incidence of cardiac diseases.

Milk fat with higher concentration of unsaturated fatty acid is susceptible to autoxidation as compared to unmodified milk fat (Gonzalez et al., 2003). Average temperature of Pakistan for the greater part of the year remains in the range of 35-40 °C. The exposure of fats and oils to high temperature results in oxidative and hydrolytic rancidity which not only decreases the nutritional value but also reduces the customer’s acceptability (Fereidoon, 2005).

Production of higher concentrations of free radicals in the body lead to atherosclerosis, carcinogenesis, diabetes, cataract and accelerated ageing (Adedapo et al., 2008). The food industry has started to focus on the development of foods containing bio-active compounds for better health and prevention of fatal diseases (Dong et al., 2007). Recent studies have disclosed that diets containing poly phenolic antioxidants have cardiac and hepatic protective effects (Kris-Etherton et al., 2002). This paper describes various practicable and adaptable techniques and their efficiency for the reduction of saturated fatty acids and cholesterol from dairy and dairy products.

E-mail: sheikhnadeem@live.com