Abstracts

RECENT STATUS OF PROTECTED AGRICULTURE IN PAKISTAN

Nadeem Akhtar Abbasi, Ambreen Bhatti, Touqeer Ahmad, Ishfaq Ahmad Hafiz* and Abdul Rehman Khan
Department of Horticulture, University of Arid Agriculture, Rawalpindi, Pakistan
*Email: decenthafiz60@yahoo.com

Pakistan's 70% of the population is engaged in agriculture. In the fields, sometimes quality product is not produced due to less control on environmental factors. The perishable products like vegetables, fruits and flower can only be made available in good quality during a limited time. Protected agriculture is the modification of the natural environment to increase yield and extend the growing season. So for, the initial focus of protected agriculture is upon off-season vegetable production in Pakistan. In the absence of storage infrastructure and vegetable processing industry in the country, off-season vegetable farming is the only viable option that can add value to the farmer produce. Health consciousness, increasing population at exponential rates and changing dietary patterns has generated a year round high demand for vegetables in the country in general and in major city centers in particular. Protected agriculture is a wide category of production methods providing some level of control over environmental constraints. Owing to less capital investment requirements plastic tunnels are a popular choice among the farmers for production of off season vegetables. The combination of earliness and greater yields significantly increases profits for the growers. In technologically advance countries it is routine practice to produce off season fruit crops like apples, guavas peaches, almonds and citrus etc by providing them suitable artificial environment and application of a variety of plant growth regulators. Moreover the tissue culture propagation is a good technique among several biotechnologies available today for vegetative propagation of horticultural crops, due to its commercial interests. Controlled/partially controlled environmental conditions in protected structures are also essential for acclimatization of plants developed through biotechnological means. Furthermore, sanitation practices can also be ensured under protected structures for the establishment of disease free plants. It is very encouraging that Chinese Industries are producing low cost equipment, machinery, structures and other allied accessories making this technology accessible for farming community of the under developed nations of the world.

NEW METHODS OF FROST PROTECTION FOR HORTICULTURAL PRODUCTS IN IRAN

Hossein Hokmabadi[1] and Saeed Ahmad[2]*
[1]Sicentific Borad of Iran's Pistachio Resaerch Institiute, Shahid Hosseini Sq. Rafsanjan, P.O.Box:77175-435, Iran
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: hokmabadi@pri.ir

Because of global warming as higher levels of CO_2 concentration, climate changed nowadays. With climate change we can expect increased damage to orchard– such as increase winter and spring frost, summer drought, storm felling, and increased damage from fungi and insect attacks. It is particularly in the winter that we can expect a temperature increase, and the trees' natural annual rhythm will gradually fall further out of step with the climate of the region. Higher winter temperatures will reduce the hardiness and lead to an earlier growth start. The tree's mechanisms for avoiding such damage do not appear to be able to prevent this. First, trees can have problems with de-hardening in mild weather periods and frost damage in the subsequent cold

periods. Particularly unfortunate is fluctuations between above- and below-freezing temperatures (thaw-freeze cycles) for trees that are adapted to a continental climate. In south and west part of Iran, there has been a wide-spread and increasing problem with such damage over several years. Averagely 50% of pistachio was damaged by spring frost in last five years and as well as in other products such as almond, apricot and grape it was observed frost damage averagely 20-45% of yield. New method of frost protection was applied in last few years for controlling of frost damage in pistachio orchard in Kerman province. One of this method was designing and manufacturing of SIS (selective inverted sink) system and testing it in pistachio orchard. Results showed this system averagely can protect orchard and can increase temperature by 2°C. The other system was fogger machine. This system aslo designed and manufactured and tested in pistachio orchard too. The results of this system also showed 11.5% increase in relative humidity and 1.9°C increase in temperature of orchard. In this paper it was explained about new method of frost control in orchards in Iran and important of frost damage in horticultural plant in Iran will be discuses.

AN OVERVIEW OF VERTEBRATE PESTS DAMAGE AND THEIR MANAGEMENT STRATEGY FOR HORTICULTURAL CROPS OF PAKISTAN

Amjad Pervez*, Syed Muzaffar Ahmed and Syeda Azra Tariq
Vertebrate Pest Control Institute Southern-zone Agricultural Research Centre, Pakistan
Agricultural Research Council Karachi University Campus, Karachi-75270, Pakistan
*Email: umma_intelligent@yahoo.com

Horticultural crop such as fruit trees, vegetables and other medicinal plants are severly attacked by number of rodents and bird pests. The extent of damage varies according to species prevalence, climatic conditions of area, and time of crop harvesting etc. In northern areas, major fruit pests include Indian Giant flying squirrel, *Petaurista petaurista,* northern palm squirrel, *Fanamulas pennanti* and Murree vole, *Hyperaaius wynnei*. In Ziarat valley, Balochistan, Afghan Pika, *ochotona rufesens* is an important lagomorph pest of apple orchards, black cherry and vegetables. The yield losses to apple fruit by pika were estimated 21.21 million rupees in a single crop season. The Indian porcupine, *Hystrix indica* is a serious rodent pest of apple, wild pistacio, fig and cherry in Balochistan. In Sindh, different vegetables i.e. potato, carrot, pea and cauliflower etc are badly damaged by this pest. In coastal belt of Sindh, coconut fruit damage by house rat, *Rattus rattus* was found to be 12.5% at Coastal Agricultural Research Station, Malir, Karachi. Avian pests i.e. parakeet and sparrow are highly destructive to ripening citrus and guava fruit in the Punjab and Sindh. Parakeets inflict sizeable losses to oil seed crops. To manage fruit and crop losses, various control strategies including mechanical, chemical and bio-control are designed by the Institute that are successfully adopted by the end users.

THE EFFECT OF STORAGE PERIOD AND NATURAL ADDITIVE QARE-QAT ON IRANIAN TEA (*Camellia inensis*) QUALITY

Shahram Sedaghathoor
Islamic Azad University, Rasht branch, Rasht, Iran
Email: sedaghathoor@yahoo.com

Iranian tea industry problems caused to related section damage. Low quality of Iranian black tea and change in sense of consumers taste is one of the reasons. It is produced various teas to attract of consumer opinion. Permissible additives using is not usual in Iranian tea industry (before packaging). One of the natural additives of black tea (i.e. Qare-Qat) evaluated in this experiment. The experiment carried out by using a Split-Plot with two factors in three replications. Storage period was distributed in four levels (0, 2, 4 and 6 months) in main plots and added Qare-Qat fruit amount in subplots in four levels (0, 5%, 10% and 15%). Qualitative traits of tea including organoleptical tests (as made tea apparent, color, perfume, and flavor of tea beverage) and chemical tests (as measuring of theaflavin (TF), thearubigin (TR), total color (TC) and brightness (B) of tea) studied. Chemical tests results showed that "Tea + 5 and 10%Qare-Qat fruits" treatment has more TF, B and TF/TR ratio than control (pure tea) and this difference was significance in 1% level. However, taste tests did not revealed significance difference between control and tea + Qare-Qat blends.

ROLE OF PLANT BIOTECHNOLOGY WORK AT H.E.J RESEARCH INSTITUTE RELATED TO ECONOMIC PROSPERITY IN THE REGION

Saifullah Khan
Incharge Plant Biotechnology Section, International Center for Chemical and Biological Sciences,
H.E.J. Research Institute University of Karachi
Email: drsaif@super.net.pk

Plant Tissue Culture Section was established at ICCBS-H.E.J.R.I.C in 1998 with the prime objective of developing pilot scale micropropagation system for important indigenous and exotic plants of economical importance. Banana crop plays key role to turn the economic wheel in the rural community by producing high return, generating employment and ensure better nutritional diet among extremely poor farming community. The wide spread disease BBTVD caused by banana bunchy top virus has caused severe damage and completely wiped out the crop over a large area. There was an urgent need of continuous supply of disease free planting material to save the banana cultivation in the country. The Plant tissue culture section at H.E.J. soon after its establishment has developed viable and successful system for producing disease and virus free banana plants on a pilot scale. Disease indexing based on ELISA and PCR facilities and DNA fingerprinting (based on SDS-PAGE, RAPD-PCR, AFLP and Microsattlite markers) to ensure quality and genetic stability has also been establish and are being routinely use in this section. Since last three year hundred of thousand virus free banana plants has already been distributed all over the country, where these plant are bearing excellent results in both quality and quantity of fruits. In floricultural crops exotic plant such as Orchids Dendrobium and *Anthuriam andrenum* were chosen on the basis of their demand and commercial value. The twigs and plants both are being used as a symbol of status in the society. Countries like Netherland Thailand Singapore and USA are among the main producers and exporters of this beautiful floral crop and earn billion of dollar. With special interest of Prof. Atta ur-Rahman in this exotic floral crop plant optimization

work was started and complete protocols for micropropagation, acclimatization cultivation based on 100% indigenous technology was develop in this section and presently this section is maintaining first ever orchid and *anthuriam* farm in the country. There are more that 50,000 plant under soil less condition on bench and hydroponics condition raised successfully in our green net complex. Floral twigs are being supplied to five star hotels chains in Karachi and Islamabad who previously used to import these flower. Pakistan is considered fifth largest producer of date palm in the world and with the current developmental work carried out in Baluchistan coastal high way, There is a enormous potential for large scale plantation of date palm as it require less care and can tolerate extreme stress and drought condition. To achieve this very large number of quality planting material will be required, which can only be met using tissue culture technology. Although tissue culture technology for date palm is extremely difficult but our lab has establish successful protocols and establish hundred of local cultivars of Assel, Karbaline, Dhakki and two exotic varieties of Digletnoor, Medjol. Hundreds of cultures are under propagation and multiplication stage which will soon be transferred to green houses. A complete protocol for micropropagation of pineapple has also been optimized and more than 10,000 plants has already been shifted to our green house which are bearing fruits. More than 25 cell lines of medicinal food and ornamental plants has been established in this section for exploiting the potential of plant cell culture to execute useful and high value biotransformation. A variety of chemical compound are under study and in this area this year two research papers have been published in International journals and many more are under preparation. An overall review of work related to commercial importance will be presented.

EFFECT OF SALINITY ON GROWTH AND PRODUCTIVITY OF FRUIT CROPS

Muhammad Azher Nawaz*, Basharat Ali Saleem, Muhammad Azher Iqbal, Muhammad Asif Iqbal, Sadia Iqbal, Ghulam Ishaq and Majid Nawaz
Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: azher490@hotmail.com

Salinity is one of the major issues related to fruit production. At present 831 M ha (7%) area of world is salt affected whereas in Pakistan about 6.67 M ha area is salt-affected. High soil salinity causes nutrient imbalances which result in the accumulation of elements toxic to plants. Salinity not only reduces the growth of plants but yield and quality of the fruit is also seriously affected. Major fruits such as citrus, mango, apple, peach, plum, apricot and strawberry are highly sensitive to excess of salts than forage or field crops whereas, date palm, guava, olive and zizyphus are tolerant to salts. To combat the problem of salinity alongwith other approaches we have to move towards the selection of salt tolerant varieties and rootstocks for fruit crops. Moreover, genetic engineering can play vital role in creating novel genetic variation that can be used in breeding programs using marker assisted selection (MAS) to improve the salt tolerance in fruit crops. The objective of this manuscript is to summarize the prevailing state of knowledge about the effect of salinity on growth, productivity and quality of fruit major crops.

TRADITIONAL DATES PRODUCING COUNTRIES FACING CHALLENGES

Samir H. Al-Shakir
Al-Foah Palm Sector Development Co., Al-Ain, UAE
Email: alshakir1935@yahoo.com

Palms and dates sector have been facing many problems and obstacles at farm level, institutional level as well as national level. This study is focusing on various aspects of palms and dates starting with production, processing and marketing, including cost of production, varieties and quality. Harvesting methodologies and postharvest losses are at farm, during transportation and at receiving centers as well as at packing houses and processing plants. The study is dealing with the technical problems from the engineering point view and operational aspects covering pre-receiving phase preparation, manufacturing and packaging. The storage of the dates is done as raw material or finished products. The most important field is the issue of marketing regarding end products, pricing policy, standardization and the impact of the Globelization trends on the international trade.

DISEASE FREE CITRUS NURSERY PRODUCTION AND CERTIFICATION PROGRAM IN PAKISTAN

Khan, I.A*, Khan, M.M., Iftikhar, Y., Mughal, S.M., Jaskani, M., Abbas, M., Batool, A. and A. Nawaz
Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: iqrar@squ.edu.om

Deteriorating health and low quality fruit production due to citrus decline is a serious threat to Pakistan's citrus industry. The general decline attributed to prevalence of about 30 virus and virus-like diseases including citrus tristeza virus and bud mutations. A model citrus certification and establishment program for disease-free citrus nursery production was initiated with the aim to develop a certification system for the establishment of virus free true-to-type citrus nursery plants. An extensive survey was carried out in citrus growing areas of Punjab and NWFP province to set up a profile of citrus tristeza virus prevalence in citrus orchards. Results showed large number of orchards infested with this killer disease with the incidence of 26.94% and 35% in Punjab and N.W.F.P respectively. Consequently foundation block has been established which is free from tristeza virus for mass propagation. Biological and serological indexing techniques are being used for tristeza virus every year to maintain the foundation trees free from this lethal disease. Microbudding technique is practiced for early age propagation of citrus trees, where 60% and 50% success was recorded in Kinnow and Mousambi respectively. Presently the focus is to extend this certification model against other emerging disease threats for citrus groves.

RECOVERY OF HYBRIDS FROM INTER-SPECIFIC HYBRIDIZATION OF CITRUS

Ghulam Ishaq*, Muhammad Jafar Jaskani and Zahoor Hussain
Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: gishaqtayab786@yahoo.com

Cultivar improvement via sexual hybridization has been an important tool for tree fruit crops. Many citrus cultivars have been obtained through this process with improved internal and external fruit features. For the hybridization program three pollen parents namely Succari (*Citrus sinensis* L. Osbeck), Kinnow and Feutrell's Early (*Citrus reticulata* Blanco) were selected to hybridize with Chakotra (*Citrus grandis* (L.) Osbeck) as female parent. The highest rate of pollen fertility (83.3%) was examined in the crosses of Feutrell's Early but the highest final harvest (17.2%) was recorded in Kinnow. The pollen parents also affected the average fruit weight which was found 334.3 g in the crosses of Succari against 390 g of open pollinated Chakotra. Feutrell's Early yielded higher number (59/fruit) and weight (0.14 g/seed) of seeds as compared with other pollen parents. The embryos from these hybrid seeds were cultured on the MS medium supplemented with malt extract (500 mg l^{-1}), GA_3 (1 ml/L) and adenine sulphate (25 mg l^{-1}). Kinnow mandarin showed maximum (83.6%) embryo germination followed by Succari (68.4%) and Feutrell's Early (49.3%). Acclimatization and characterization of these hybrids is in progress.

PAKISTAN HORTICULTURE DEVELOPMENT & EXPORT BOARD NURTURING CITRUS EXPORTS IN THE GLOBAL TRADE

Babar Ehsan Bajwa
Pakistan Horticulture Development and Export Board (PHDEB), Lahore, Pakistan
Email: behsan@phdeb.org.pk

The Pakistan Horticulture Development and Export Board (PHDEB) estimate the size of the global horticulture market at US $85 billion. Out of this the fruits and vegetables constituted a $67 billion market while fruit and vegetable juices contributed $7 billion. The citrus fruits alone are contributing US $2.2 billion in the global trade. The share of Pakistan in this trade amounts to US$ 30 million. Pakistan has the potential to produce and export a wide range of citrus commodities in substantial volume and can earn enormous foreign exchange. However, there are a number of constraints that exist across the value chain due to which Pakistan horticulture exports could not achieve a higher market share. Pakistan's current exports of horticulture products including processed account for US$160 million. Although the main thrust is to put Pakistan in the high-end international markets through strong marketing efforts, but it involves integrated interventions and facilitation in all the sub-sectors of the value chain right from preharvest to post harvest activities, investment in infrastructure (cool chain), international marketing under established brand names, etc. The PHDEB encourages private sector participation in order to improve the responsiveness to the changing domestic and international markets conditions especially in ensuring product quality and consistency. The organization holds the vision stated as "*Vitalization of a dynamic, open and market driven horticulture sector, which would transform into a resilient and sustainable sector, equipped to meet the challenges of globalization by creating a niche in the international market, improve the quality of life through increased incomes and foster a sense of pride amongst the stakeholders"*.

EXOGENOUS APPLICATION OF PLANT GROWTH REGULATORS IMPROVES LEAF AGE, FRUIT SET AND VEGETATIVE GROWTH OF SWEET ORANGE CV. BLOOD RED

Basaharat Ali Saleem* and Aman Ullah Malik
Postharvest Lab, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: basharatuaf@yahoo.com

Two plant growth regulators gibberellic acid (GA_3 and 2, 4-D) were exogenously applied in different concentrations alone and their combinations on Blood Red sweet orange trees during full bloom. The experiment was performed at Experimental Fruit Orchard (Square 9), Institute of Horticultural Sciences, University of Agriculture, Faisalabad; laid out according to RCBD with 13 treatments including control replicated thrice. A single tree was taken as treatment unit. Vegetative and reproductive behaviours of the treated trees were studied to evaluate the effect of exogenous application of plant growth regulators on leaf age, vegetative growth and final fruit set. The leaf drop was significantly reduced by all treatments compared with control. The mixture treatments at all concentrations retained maximum spring leaves ranging between 38.5% (20 ppm) to 58.38% (45 ppm). The control trees had negligible number of spring leaves (3.09%). Number of leaves per flush, flush length, number of male flowers and flower drop intensity had also significant differences among treatments but no linear trend could be determined. However fruit set was significantly affected by all GA_3 treatments individually as well as in mixture with maximum fruit set (32.32%) in 45 ppm GA_3 treated trees.

PROXIMATE ANALYSIS AND ECONOMIC ESTIMATION OF KINNOW (*Citrus reticulata* Blanco) PEEL OIL ON NINE ROOTSTOCKS

Waqar Ahmed*, M. Azher Nawaz, Muhammad Mumtaz Khan, Basharat Ali Saleem and Muhammad Azher Iqbal
Institute of Horticultural Sciences, University of Agriculture, Faisalbad, Pakistan
*Email: waqar99@gmail.com

A study was carried out to test the effect of the rootstocks on recovery of oil from peel of Kinnow mandarin (*Citrus reticulata* Blanco) alongwith economic analysis of the peel oil. Nine different rootstocks were used for this study viz-a-viz Citrumello (4475), Citrumello (1452), Volkamariana, Yuma citrange, Rough lemon, Mithi, Troyer citrange, Carrizo citrange and Brazilian sour orange. The results for peel oil recovery showed significant differences amongst the rootstocks while for the refractive index non significant differences were observed. The economic analysis showed premium value of Kinnow peel oil and it could be exported to international market to earn the foreign exchange so this project may have potential to could be taken as an enterprise.

RESPONSE OF DIFFERENT EXPLANT SOURCES OF KINNOW MANDARIN TOWARD REGENERATION

Ambreen Bhatti, Nadeem A. Abbasi and Ishfaq A. Hafiz*
Department of Horticulture, University of Arid Agriculture Rawalpindi, Pakistan
*Email: decenthafiz60@yahoo.com

Regeneration in *Citrus reticulata* cv. Kinnow Mandarine was studied by using different explants (shoot tip, epicotyle, stem, roots and shoot tip) of *in vitro* grown seedlings. Seeds were surface sterilized for 10 min. with different concentrations of Clorox 50, 60, 70 and 80, 90% v/v containing sodium hypochlorite (NaOCl 12.5%). Basal salts of MS (Murashige and Skoog, 1962) medium along with 3% sucrose, 0.7% agar and different combinations of 2,4-dichlorophenoxy acetic acid (0.0- 2.0 mgl-1) and Benzyl aminopurine (0.0- 1.5 mgl^{-1}) was used. The pH of the culture medium was adjusted at 5.8 before including the agar. Minimum level of necrosis (0.0%) and maximum survival (100%) was achieved with 50% Clorox (v/v). Higher frequency of regeneration (shoot tip (97.25%), epicotyls (80.55%) stem (65.60%), than that of root (21.33%) portion) was observed at 1.5 mg l^{-1} BAP and 0.5 mg l^{-1} 2,4-D. Regenerated plants were shifted on rooting media with different concentrations of both 2,4-D (0.0-0.5 mg l^{-1}). Optimum rooting was observed at 1.0 mg l^{-1} 2, 4-D.

INSIGHTS OF MANGO (*Mangifera indica* L.) GENETIC REPOSITORY: SEQUENCING OF CHLOROPLAST GENOME

Ishtiaq Ahmad Khan and M. Kamran Azim*
H.E.J. Research Institute of Chemistry, International Centre for Chemical and Biological Sciences, University of Karachi, Karachi-75270, Pakistan
*Email: kamran.azim@ics.edu

Mango is one of the most important fruit crops of Pakistan which contribute 8% to the global mango market. It is important to note that inspite of an exponential increase in the cultivation area of mango the average yield remained unchanged. To improve the quantity and quality of any fruit crop it is very important to know about its genetic repository and consequently applications of this knowledge. Chloroplast genetic engineering offers several unique advantages, including high-level transgene expression, multi-gene engineering in a single transformation event and transgene containment by maternal inheritance, as well as a lack of gene silencing, position and pleiotropic effects and undesirable foreign DNA. Chloroplast DNA represents an extra cellular capsule of genetic information, encoding essential structural and enzymatic proteins of this organelle. Chloroplast genome sequence analyses are at the heart of current plant phylogenetic studies and plant genetic engineering. Here we present the results of initiative taken to sequence the mango chloroplast genome. For this purpose we used ASAP technique (amplification, sequencing and annotation of the plastids). First of all chloroplast DNA was isolated from mango leaves. PCR primers were selected from the consensus parts of chloroplast genome sequences from database. DNA amplification was done by substantial PCR reactions. The amplified segments were then subjected to automated CEQ™ 8000 Genetic Analysis System for sequencing. The sequenced fragments were analysed using BLAST sequence searching software. The sequenced data was submitted to the GENBANK nucleotide sequence database at NCBI, USA. Mango chloroplast DNA sequence showed homology with *Vitis vinifera* (European grape) chloroplast genome. The assembling, annotation and gap filling of the sequenced data will be presented.

"AALISHAN" – A NEW MANGO VARIETY DEVELOPED THROUGH HYBRIDIZATION

Muhammad Ikhlaq Khan[1]*, Shafqat Ali Syed[1], Muhammad Zaman Awan[2], Muhammad Tariq Malik[1] and Abdul Ghaffar Grewal[1]
[1]Mango Research Station, Shujabad, Punjab - Pakistan
[2]Director, Horticultural Research Institute, AARI-Faisalabad, Punjab - Pakistan
*Email: sober003@hotmail.com

"*Aalishan*" – a mango hybrid has been developed at Mango Research Station, Shujabad by making cross between "Anwar Retaul and Sanglakhi" with the objective to produce such a mango variety to capture the international markets where the consumers are much conscious about the sugar contents and the fibers present in the pulp. It was aimed to have a hybrid with low sugar contents, scanty fibers and maximum quantity of pulp and pleasant aroma. The crossing work between the two varieties was done during the flowering season of 1997. Resultantly, the hybrid of mango (*Aalishan*) has given promising performance. It ripens during the end of July, fruit shape is ovatish round with average fruit weight of 250 g. Ventral shoulder of the fruit is higher than the dorsal with roundish back, shallow sinus, prominent roundish beak. Fruit color is creamish yellow and skin surface is smooth with cadmium yellow pulp color. It is aromatic with very scanty fibers. Stone of the fruit is roundish, thick, full having 29 g average weight. The sugar content of fruit is 22°Brix with 0.17% titrateable acidity. Conclusively, it has greatly been accepted by the expert's panel through organoleptic evaluation and recommended for the national as well as international markets.

EXPLORING THE POTENTIAL OF NEW PROMISING MANGO (*Mangifera indica* L.) VARIETIES OF PAKISTAN

Ishtiaq Ahmad[1], Khurram Ziaf[2], Raheel Anwar[2] and Aman Ullah Malik[2]
[1]University College of Agriculture, Bahauddin Zakariya University, Multan, Pakistan
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email:ishtiaqrajwana@yahoo.com

Pakistan is one of the major mango producing countries of the world. Mango has been under cultivation in this part of the world since time immemorial. Punjab alone contributes more than 60% to the total mango production in the country. More than 250 cultivars have been reported to exist, yet domestication has escalated the problem of genetic erosion. At present much of the mango orchard acreage is occupied by few ancient cultivars like Anwar Ratole, Chaunsa, Dusehri and Sindhri. This situation can lead to a serious epidemic problem. A study was designed to evaluate and characterize new potential germplasm to broaden the varietal spectrum from three mango growing districts of Punjab i.e. Khanewal, Multan and Muzaffargarh. Based on fruit characteristics and farmer's recommendations seventeen varieties were selected for detailed studies initially. In this study morphological, physico-chemical and DNA finger printing studies for some of the potential landraces will be discussed. The results of the study will help in mango improvement and breeding programs as well as application of intellectual property rights in the country under WTO era.

COMPARATIVE ANATOMY OF GENUS *Phoenix* (PALMAE) FROM THE FAISALABAD REGION

Asima Tahir[1]*, Mansoor Hameed[1], Adnan Younis[2] and Atif Riaz[2]
[1]Department of Botany, University of Agriculture, Faisalabad, Pakistan
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: drsaif@super.net.pk

Six species of genus *Phoenix* (Family Palmae) has been reported from Faisalabad and adjoining administrative districts. All of them are introduced in the region except *P. dactylifera* and *P. loureii.* Distribution region of *P. dactylifera* is widesperead, but *P. loureii* is restricted to sub-mountainous region of the Salt Range. Anatomical variations regarding root, rachis and leaves were considerably high and species specific. These characteristics have found to be significant in the taxonomic description of the genus.

CHILLING REQUIREMENT STUDIES ON FLOWER BUDS IN SOME MALE PISTACHIO GENOTYPES (*Pistacia vera* L.)

F. Nazoori[1]*, A. Talaie[1] and A. Javanshah[2]
[1]Department of Horticultural Science, University of Tehran
[2]Iran's Pistachio Research Institute, Rafsanjan-Iran
*Email: fatemehnazoori@yahoo.com

The effects of different chilling period were evaluated on growth and development of male seedling trees *(Pistacia.vera* L.). This study initiated on November 2005 to March, 2006.The aims of this research was recognition the best genotypes male coincident whit this area and introduce them to prevention from spring cold, study the effect of rootstock on chilling requirement and determination of responsible male genotypes to chilling treatment. Eight levels of chilling were applied to shoots of pistachio trees which increased by 100 hours (600-1300 hours), in fridge with temperature3±1c. The effects of chilling hours on floral bud break of four male pistachio genotypes, early flowering (P1, P6) and late flowering (P7, P10) were evaluated. The results indicated that the chilling requirement was different in the genotypes. The evaluation factors in this study i.e, the percent and rate of bud break, duration of flowering, growth and development of bud (length and width). Among the male pistachio genotypes, the best chilling hours (budbreak >80%) for P1, P6, P7 and P10 genotypes were 800,700,1100, and 1300 hours, respectively. P1 and P6 had minimum chilling hours requirement (700 hours) to initiate 50% budbreak than P7 and P10 (900, 800 hours). Increased chilling led to decreased heat unit requirements, resulting in greater overall growth and development. Chilling was a determining factor in floral budbreak for all genotypes, increasing chilling, produced greater bud break percentages. All genotypes required fewer heat units for budbreak as chilling increased. Increasing the chilling hours also increased the length and width of flower buds and decreased duration of flowering.

EFFECTS OF SPRAYING SOME CHEMICAL OILS ON FLOWER BUD DORMANCY OF MALE PISTACHIO TREES

A. Talaie[1], F. Nazoori[1]* and A. Javanshah[2]
[1]Department of Horticultural Science, University of Tehran
[2]Iran's Pistachio Research Institute, Rafsanjan-Iran
*Email: fatemehnazoori@yahoo.com

In order to determine the role of chemicals on compensating the chilling requirement, a research was done on four male genotypes of pistachio early flowering (P1, P6) and late flowering (P7, P10) in Iran's Pistachio Research Institute during 2006. In this experiment four seedling trees were selected. The chemicals used in this study were different components of mineral oil (voclk 4%), soybean oil (5%) and fatty acid (4%). Data were taken including of date of bud break and full bloom, period of flowering, quantity (mg) and quality (percentage of germination)pollen grains, length and width of buds(mm). Trees that were treated with chemical oils got to anthesis, 5-8 day earlier. Trees treated with soybean oil had a long period flowering than other treatment (2-5 day). But amount of production pollen grain in volck treatment had increased. Significant different between length and width of buds was not observed in any treatments. The duration of bud break was increased by 3 days (fatty acid) and 5 days (soybean) compared to control. In this experiment volk (4%) and soybean oil (5%) had more positive effects on male pistachio trees.

MANAGEMENT PROBLEMS OF CITRUS ORCHARDS AND THEIR POSSIBLE SOLUTION (PERSONAL EXPERIENCES)

Rana Muhammad Abbas[1]* and Niaz Ahmed[2]
[1]Agriculture Officer Extension, Multan
[2]Soil and Water Testing Lab, Multan
*Email: jamniaz@yahoo.com

Pakistan having a unique environment makes it possible to grow a variety of fruits. Citrus possesses number one position among all fruits both in area and production in this country. Citrus production is almost static, or even declining. According to our field experiences potential factors largely responsible for the low yields are: - uncertified private nurseries, improper use of root stocks, over and under irrigation, imbalanced and untimely use of fertilizers, low organic matter contents, salinity and water logging, intercropping in citrus orchards, inadequate as well as inefficient use of plant protection measures against pest and diseases, lack of proper pruning practices and alternate bearing etc. These issues of low yield of citrus can be tackled easily by adopting the efficient management practices such as selection of suitable root stock and scion, soil analysis before planting, judicious use of irrigation, balanced and timely use of fertilizers, avoiding intercropping, cutting and destroying water shoots regularly, pruning of dried, diseased and unwanted branches, use of integrated pest management programme to control pests and diseases etc. These practices call for only meager attention of owner. Then we will be able to compete the world in WTO regime.

REACTION OF DIFFERENT CITRUS SPECIES AGAINST CITRUS CANKER (*Xanthomonas axanopodis* pv. Citri) AND EFFECT OF DIFFERENT ENVIRONMENTAL FACTORS ON DISEASE DEVELOPMENT

Muhammad Inam-ul-Haq*, R. Mahmood, Muhammad Bashir Ilyas and S. Mehmood
Department of Plant Pathology University of Agriculture Faisalabad, Pakistan
*Email: minamhaq@yahoo.com

Studies showed the disease severity data of citrus canker on eight species of citrus namely, rough lemon, sweet lime. Lemon, Kinnow, Feutrell's Early, Succari and grapefruit in department of Plant Pathology University of Agriculture Faisalabad which were inoculated artificially by pin prick method. All of the species are susceptible to citrus canker disease, although the disease severity was more on rough lemon followed by grapefruit, Succari, Kinnow, lemon, Feutrell's Early, Blood Red and sweet lime. The disease severity on rough lemon was 3.38%, grapefruit 3.19%, Kinnow 3.12%, Succari 3.12%, lemon 3.07%, Feutrell's Early 3.05%, Red Blood 2.79% and sweet lime 2.69%. Correlation of environmental variables (maximum and minimum temperature, relative humidity, rainfall, wind speed and clouds) with the development of citrus canker was determined. Maximum and minimum temperature had significant correlation with disease severity. With favorable meteorological variables (maximum, minimum temperature) for citrus canker development, disease intensity increased. Multiple regression models were developed individually for relative humidity, rainfall, clouds, and wind velocity. These multiple regression models gave better prediction of citrus canker than model consisting of all environmental variables.

CITRUS ROOT NEMATODE, *Tylenchulus semipenetrans* POPULATION ASSOCIATED WITH 15 CITRUS ROOT STOCKS

Nazir Javed, Makky Javed, Safdar Ali Anwar* and Riaz Ahmad Chohan
Department of Plant Pathology, University of Agriculture, Faisalabad, Pakistan
*Email: safdar_uaf2006@yahoo.com

The host status of 15 citrus rootstocks including Carrizo citrange, Bitter Sweat Orange, Sachton Citrumelo, Gadha Dahi, Brazilian Sour Orange, Sour Orange, Citrumelo-1452, Saveage Sitrange, Yuma citrange, Keen sour orange, Rough lemmon, Yuma citrange, Kherna khatta Citron, and Chakotra against citrus root nematode, *Tylenchulus semipenetrans* was determined based on the population magnitude of second stage juveniles (J2) in 100 cm^3 soil and feeding females per g roots. A collection of various naturally nematode infested citrus rootstocks maintained by Institute of Horticultural Sciences in the experimental area were sampled. The rhizoshere soil and roots consisting of 3 cores were collected from each rootstock separately. The soil of each rootstock was mixed thoroughly and a composite sample of 100 cm^3 soil was placed on the funnel and allowed to extract the J2 for 5 days. The roots were carefully washed and two 20 g root mass samples were taken, one for staining the adhering females with acid fuchsin and other one to determine the J2 population. The J2 and females were counted under stereobinocular microscope and female per g of root was calculated. The 5 citrus rootstocks including Carizo citrange, Sachton Citrumelo, Gadha Dahi, Citrumelo-1452, and Keen sour orange were ranked resistant as there was no nematode infestation. Other 10 rootstocks were found poor to good host depending upon the nematode population. Brazilian Sour Orange, Saveage Sitrange, and Yuma citrange were poor as the J2 and female population was below 200 and 100, respectively. All other 7 rootstocks were

good host of this nematode as J2 and female population was higher than 100. Rootstock, Bitter Sweat Orange was found the most susceptible to *T. semipenetrans*. Our findings provide information for the gardeners and scientists to mange the citrus root nematode by using the desired rootstock.

MANAGEMENT OF CITRUS NEMATODE, *Tylenculus semipnetrans,* BY INTEGRATION OF *Paecilomyces lilacinus* WITH PLANTS AND THEIR EFFECTS ON GROWTH VARIABLES

Tariq Mukhtar[1]*, Muhammad Shakeel Ahmad[2], Riaz Ahmad[2], Nazir Javed[2], Hafeez Ullah Khan[3] and Muhammad Arshad Hussain[4]
[1]Department of Plant Pathology, University of Arid Agriculture, Rawalpindi, Pakistan
[2]Department of Plant Pathology, University of Agriculture, Faisalabad, Pakistan
[3]Pakistan Science Foundation, Islamabad, Pakistan
[4]Regional Agricultural Research Institute, Bahawalpur, Pakistan
*Email: drtmukhtar@uaar.edu.pk

The effects of water extracts of neem (*Azadirachta indica*), Ak (*Calotropis procera*) and datura (*Datura alba*) alone and in combination with *Paecilomyces lilacinus* were seen on the larval mortality of citrus nematode (*Tylenchulus semipenetrans*). The results were highly significant and revealed that of the three test plants; neem gave the maximum larval mortality followed by Ak and datura. The standard extracts were more toxic to *Tylenchulus semipenetrans* larvae than other concentrations. Similarly, maximum mortality was recorded after 48 h of exposure followed by 24 and 12 h. When the standard extracts of leaves of the test plants were applied in pots on *Citrus jambhiri*, growth variables were enhanced to the maximum by neem followed by Ak and datura. On the other hand significant reductions were recorded in nematode populations and rate of multiplication in treatments where extracts were applied as compared to control. The combined effect of *P. lilacinus* and plant extracts showed best results as compared to their individual effects. *A. indica* + *P. lilacinus* reduced the nematode population by 65.52% in soil and 62.30% in roots. *D. alba* + *P. lilacinus* reduced the nematode population in soil by 55.63% and in roots by 54.11% while *C. procera* + *P. lilacinus* reduced 52.30% nematode population in soil and 52.62% of female nematode in roots.

FIELD SURVEY ON PREVALENCE AND EXTENT OF CITRUS DIEBACK IN NWFP

M. Matloob Khan[1]*, M. Ashraf[1], Munawar Raza[2], Faisal Sohail Fateh[2], Noor Islam[1] and Iftikhar Ahmad[1]
[1]Department of Plant Sciences, Quaid-i-Azam University, Islamabad
[2]National Agricultural Research Center, Islamabad, National IPM Program, Peshawar, NWFP
*Email: mmatloob@bs.qau.edu.pk

Pakistan is blessed with diversity of agro-climatic and soil conditions that lead to a variety of horticultural crops. Citrus production has major share about 40% among the horticultural crops. However, citrus dieback has become one of the challenging biological factors that are devastating the production potential of the citrus in Pakistan. Hence, a survey of three citrus growing tehsils in Haripur district of NWFP province was conducted as a prologue to

identify field symptoms, causes, cultural practices, extent and prevalence or frequency of occurrence of the disease. Besides this, field survey, detailed meetings and interviews were also carried out with different stakeholders i.e. farmers, agricultural extension officials, nursery and field operators regarding citrus farms. Detailed observations on cultural and management practices, history of trees and soil terrain were conducted in ten large farms, more than 10 hectares orchid area, and fifteen small farms, less than 10 hectares orchid area. Observations indicated that the problem exists in almost 100% orchids, significant in 70%, with variable intensity, minimum 4% and maximum 13%, excluding one exception of more than 40%. In general orchids of 5 to15 years were more frequently and severely affected. Kinnow mandarin and sweat orange were more inclined to show the symptoms than the other citrus cvs. Symptoms study revealed that it begins from apex; leaves become yellow, narrow and fall down; fruit size exceptionally small and color changes to yellow orange, fissures appear at bark in the affected areas of the stem or twigs and finally separated from the wood. This leads to partial or full destruction of the plant in few, one to two, years. Snail colonies were abundantly present in soil and on the affected plants regarding specific site observations. Moreover, erroneous nursery operations, inappropriate rootstock, intercropping, poor management practices, heavy weeds and shortage of water seem responsible for the predicament.

ASSOCIATION OF BACTERIA AND PHYTOPLASMA CAUSING CITRUS DECLINE IN PUNJAB

Khurshid Burney[1]*, Rashad Ali[1], Shahid Hameed[1], Anjum Munir[1] and Hafeez ur Rehman[2]
[1]Crop Diseases Research Programme, Institute of Plant and Environmental Protection, National Agricultural Research Center (NARC), Islamabad
[2]Horticultural Research Institute, National Agricultural Research Center (NARC), Islamabad
*Email: faisalmyname@gmail.com

During a survey of citrus growing areas in Punjab the presence of pathogens associated with citrus decline has been recorded on the basis of both field and laboratory studies. The current papers deals with the incidence of Bacteria and Phytoplasma on citrus. The leaves samples collected during survey to observe the Phytoplasma and bacterial pathogens showed that citrus canker (*Xanthomonas compestris* pv. *citri*) is the most prevalent bacterial pathogen. Its incidence was as high as 50% in Jhang, 17.24% in Sahiwal while no incidence was found in districts of Faisalabad, Toba Tek Singh and Kasur. Citrus canker is more prevalent in Kinnow. Phytoplasmal disease of citrus (*Spiroplsma citri*) were found to be 27.58% in Sahiwal 15.62% in Toba Tek Singh while it was not encountered in Jhang district.

FUNGI ISOLATED FROM CITRUS TREES SHOWING DIE BACK SYMPTOMS

M. Matloob Khan[1]*, M. Ashraf[1], Faisal Sohail Fateh[2], Munawar Raza[2] and Tahir Majeed[3]
[1]Department of Plant Sciences, Quaid-i-Azam University, Islamabad, Pakistan
[2]Institute of Plant and Environmental Protection, National Agriculture Research Center (NARC), Islamabad, Pakistan
[3]Soil Chemistry Department, Ayub Agricultural Research Institute Faisalabad, Pakistan
*Email: mmatloob@bs.qau.edu.pk

Citrus Dieback has become a serious threat to citrus industry in Pakistan as well as in the world. Symptoms start from top of the canopy with yellowing and falling of leaves subsequently. Fruits not gaining the proper size and suffer discoloration; fissures appear at bark in the affected areas of the stem or twig and finally separated from the wood. This leads to partial or full destruction of the plant in few, two to three, years. The pathological studies were carried out of soil and plant samples to study pathogens. The soil and plant samples were transferred to 90 mm plates containing PDA medium under sterilized conditions. The samples yielded fungi *Nattrasia* spp. and *Fusarium* spp. The role of these fungi will be further studied by practicing the Koch's postulates.

INVESTIGATION OF FUNGI ASSOCIATED WITH CITRUS DECLINE IN PUNJAB

Khurshid Burney[1]*, Rashad Ali[1], Anjum Munir[1] and Hafeez ur Rehman[2]
[1]Crop Diseases Research Programme, Institute of Plant and Environmental Protection,
[2]Horticultural Research Institute, National Agricultural Research Center (NARC), Islamabad
*Email: faisalmyname@gmail.com

During a survey of citrus growing areas in Punjab the presence of fungal pathogens associated with citrus decline has been recorded on the basis of both field observation and laboratory studies. It is observed that fungal pathogens which are causing decline are *Fusarium, Phytophthora, Diplodia* and *Nattrassia* spp. The *Fusarium sp* was found to be 100% in Faisalabad and Jhang while 91% in Kasur and least in Sargodha which was 25%. The *Phytophthora* and *Diplodia* were only observed in Sargodha distt which is 5 and 8.33% respectively. The *Nattrassia sp* was observed in 17.24% in Sahiwal and not found in Kasur, Faisalabad and Jhang distt. These fungal pathogens alone or in a combination cause high losses in citrus growing areas of Punjab.

ROLE OF GENERAL MANGO ORCHARD MANAGEMENT IN DISEASE DEVELOPMENT

Munawar Raza Kazmi[1]*, Faisal Sohail Fateh[2] and Arslan Jabeen[2]
[1]Institute of Plant and Environmental Protection, NARC, Islamabad
[2]Department of Plant Pathology, University of Arid Agriculture, Islamabad
*Email: faisalmyname@gmail.com

Mango (*Mangifera indica* L.) belongs to family *Anacardiaceae* and is the fruit of excellence of Subcontinent Pakistan is the third largest exporter of mango in the world. Due to lack of knowledge and proper guidance, growers do not give attention to proper irrigation of

mango orchards. Non availability of water also affects the tree vigor. Mostly, mango orchards are owned by small growers who lack enough facilities to use modern techniques for cutting, pruning, sanitation and fertilizer application. Growers lack capital to build infrastructure for proper storage and grading of their products. Same alarming conditions prevail in pre harvest period. The post harvest losses of mango are more only because of unawareness and insufficient information. Farmers do not use scientific methods for fruit picking. They give no attention towards proper washing and handling of fruit as a result, the epiphytes and other microbes remain on the surface of fruit which lead to severe post harvest and storage losses by causing rottening. There is an extensive use of pesticides in mango orchards. Small growers especially do not know that how much quantity of pesticides should be used and what is the suitable time for its application. They also have lack of information about suitable chemicals for their crop as they have no contact with research organizations. Lack of proper knowledge about time and recommended quantity of chemicals leads to heavy loss of money in respect of pesticides. Training programs should be held especially in mango growing areas of Pakistan so that, proper and adequate training about cultural practices, pre harvest and post harvest techniques can be given to growers to avoid severe losses. Post harvest losses include improper handling, immature fruit harvesting and inadequate transport and storage facilities. Mangoes are perishable features so, it needs to be sold and used early. Despite this, 75% of mango dealers in Pakistan use traditional methods of packing which carries a lot of chances for damage. Apart form using mud pitchers, the traditional methods for storage by using local chemicals are used for quick ripening. Contractors often harvest immature fruit in early season and over mature at the end of season to obtain higher prices. Careless harvesting and rough handling bruise and devalue the fruits, reducing its quality and market price.

MANGO DEATH SYNDROME: A THREAT TO HORTICULTURAL INDUSTRY IN PAKISTAN

Faisal Sohail Fateh[1]*, Munawar Raza Kazmi[1] and Arslan Jabeen[2]
[1]Institute of Plant and Environmental Protection, National Agricultural Research Center, Islamabad
[2]Department of Plant Pathology, UAAR, Islamabad
*Email: faisalmyname@gmail.com

Mango (*Mangifera indica* L.) is an important horticultural crop and enjoys second position after citrus in Pakistan. Soil and climatic conditions of Pakistan enhance its importance for mango cultivation. The production of mango is mostly in Sind and Punjab provinces of Pakistan over an area of 151535 hectares with production of 1671155 tonnes during 2004-05. Mango has been suffering from different declining diseases which have been misidentified and taken as a single disease. The attack of these fungal diseases on mango resulted in reduced yield as well as heavy losses in term of foreign exchange because due to less and substandard production, sufficient production of mango is not available not only for consumers but also for the processing industry resulting in less development of mango processing products industry in Pakistan. Mango death syndrome consists of different declining diseases i.e. dieback, quick die back and sudden death. Simply dieback can also be called as slow decline of mango. In this disease there is gradual drying of twigs from upside downward of the canopy. Usually the pathogen responsible for this disease is considered as a fungus *Lasiodiplodia theobromae*. Quick dieback is another form of mango death syndrome. In this disease the trees usually lose form. The leaves show chlorosis and massive leaf drop. The tree trunk produces gums of different colours. On scrapping the branches reveal browning of the phloem tissues. The fungus *L. theobromae is considered responsible for this disease also*. The most concerned form of mango death syndrome is sudden death phenomenon. The tree shows symptoms all of a sudden and no more alive. The leaves droop turn

leathery greenish brown, remain attached with the tree. Frequent gummosis in some cases of different forms and shapes. On scraping the trunk shows dark brown streaks on xylem tissues. Further exposing of the trunk results in oozing of dark brown liquid. Different fungi have been reported from trees facing this disease including *Ceratocystis fimbriata*, *Nattrasia mangiferae*, *Botryodiplodia* theobromae and *Fusarium oxysporum*.

MANGO DECLINE: ETIOLOGY AND ITS MANAGEMENT

Saleem Shahzad* and Mohammad Ali Khanzada
Pest and Disease Research Lab., Department of Agriculture, University of Karachi, Karachi-75270, Pakistan
*Email: saleemshahzad_pk@yahoo.com

Since past few years, mango cultivation in sindh province suffered from a disease of unknown etiology. The affected trees show wilting, gummosis, dieback, bark splitting and drying of whole trees. In order to find out the etiological agent of this disease, a survey of mango growing areas of sindh province was carried out and samples from affected trees were collected. Isolation and subsequent pathoginicity test conformed that *Laisodiplodia theobromae* is the etiological agent of the disease. Among the various fungicides tested *in vitro* and *in vivo*, Carbendazim followed by Topsim-M were found to be highly effective against this disease. Incorporation of proper cultural practices gave optimum control of the disease and enhanced plant growth and fruits setting.

EFFECT OF FOLIAR AND SOIL APPLICATION OF FUNGICIDES AND MICRONUTRIENTS ON MANGO DECLINE

Muhammad Nafees*, Moazzam Jamil, Naveed Aslam Mulgani and Muhammad Sarwar Yaqoob
College of Agriculture and Environmental Sciences, The Islamia University of Bahawalpur, Pakistan
*Email: nafeescaes@googlemail.com

In a three year field experiment, drenching of selected declined mango trees was done with different concentrations of Topsin-M, Elitte and Redomel in combination with CuSo4.Moreover, application of these fungicides along with different doses of Fe, B, Zn and Cu on foliage was also monitored. The degree of necrotic leaves and rotten roots in treated trees was significantly less as compare to that in control ones. Moreover, treated trees bared lush green vegetative growth with leaves having more NPK contents. Application of Topsin-M at higher rates was efficient with recovery of infected mango trees.

ETIOLOGICAL STATUS OF SUDDEN DEATH OF MANGO PLANTS IN PAKISTAN

Muhammad Tariq Malik[1]*, Sultan Mehmood Khan[2], Altaf Ahmad Dasti[3], Muhammad Zaman Awan[4], Munawar Raza Kazmi[5] and Shafqat Ali Syed[1]
[1]Mango Research Station, Shujabad, Pakistan
[2]Department of Plant Pathology, University of Agriculture, Faisalabad, Pakistan
[3]Institute of Pure and Applied Biology, Bahauddin Zakariya University, Multan, Pakistan
[4]Horticultural Research Institute, Ayub Agricultural Research Institute, Faisalabad, Pakistan
[5]National Agricultural Research Council (NARC), Islamabad, Pakistan
*Email: sober003@hotmail.com

Amongst different decline disorders of mango a disorder commonly known as quick decline/sudden death is becoming very destructive in Pakistan since 1998. Sufficient work has already been done in the country regarding its etiology (causal organism), but from other countries like Brazil and Oman, a fungus i.e., *Ceratocystis fimbriata* was being reported as main cause of this disease. The study was reviewed to confirm the association of this fungus with quick decline of mango in Pakistan. Isolations were made from xylem and phloem tissues of primary root, collar and stem portion of the mango plants cv. Chaunsa. The samples collected from xylem tissues of all plant parts yielded the fungus i.e., *Ceratocystis fimbriata* by 100% infection frequency. This fungus is being reported first time in Pakistan. Further such a high percentage of infection frequencies in the present study confirm the possible role of this fungus in sudden death of mango. Other fungi like *Lasiodiplodia theobromae, Fusarium oxysporum, Rhizoctonia solani* and *Dothiorella mangiferae* were isolated only from phloem tissues of the symptomatic plants with different frequencies, which might be having a role of endophytes and one of the major predisposing factors of this malady. In management strategy, the scratching of infected portion followed by the injection of Topsin-M (Thiophenate methyl) @ 1 g/ml in the main trunks rejuvenated the diseased plants showing less than 50% disease severity. The healthy plants also showed less mortality rate when the same fungicide was injected as preventive measure.

IN VIVO RESPONSE OF INOCULATED FUNGUS *Botryodiplodia theobromae* Pat. IN DIFFERENT VARIETIES OF MANGO IN PAKISTAN

Shafqat Saeed*, Nazim Hussain and Ijaz Khan
University College of Agriculture, Bahauddin Zakariya University, Multan
*Email: shafqatsaeed@yahoo.com

To find out the response of *Botryodiplodia theobromae* against the quick decline of *Mangifera indica*, a frield study were carried out at University College of Agriculture, Bahauddin Zakariya University, Multan. There were nine varieties i-e. Sindhri, Kala Chaunsa, Fagri, Langra, Dusehri, Chaunsa, Ratol-12 and Desi. Healthy nursery of two years old plants was established and plants were maintained for 6 months. Three plants from each variety were inoculated with *B. theobromae* and two plants as control. The data of gummosis, bark splitting, leaf colour, marginal necrosis on leaves and defoliation was recorded fortnightly. All the plants of varieties, Ratol-12, Sindhri, Summer Bahisht and Fajri showed the bark splitting symptoms but the remaining plants of other varieties did not exhibit this symptom of disease. Similarly the plant from most of the varieties showed the gummosis either in control or in the treated plants except Summer Bahisht and white Chaonsa. With the progress of disease severity, stem rottening and then turning of leaf

colour into yellow occurred. Ultimately the marginal necrosis, leaf curling and defoliation occurred. By counting observed symptoms of plants, 50% disease symptoms were found on treated plants of Sindhri and black Chonsa similarly on untreated plants of Ratol-12 with 75% disease symptoms. No difference was observed in the treated and untreated plants of white Chonsa showing 38% disease symptoms of quick decline. It is suggested that the disease symptoms appeared might not be only due to *Botryodiplodia theobromae* as a causal organism. There may be other causal organisms responsible for causing quick decline symptoms in all varieties of mango tree.

POPULATION STUDIES OF PLANT PARASITIC NEMATODES ASSOCIATED WITH MANGO AND THEIR INTERACTION WITH OTHER SOILBORNE PATHOGENS

K.H. Wagan*, M.A. Pathan, M.M. Jiskani and M.I. Khaskheli
Department of Plant Pathology, Sindh Agriculture University Tandojam
*Email: khwagan@hotmail.com

Plant parasitic nematodes isolated from soil and root samples were *Xiphinema index, Helicotylenchus dihystera, Pratylenchus semipenetrans, Hoplolaimus indicus* and *Longidorous africans*. Maximum inoculum density of *Xiphinema index* was observed in Horticulture garden (2.80) followed by Moosa Khatian (2.71), Darya Khan Nahiyoon (2.68) and minimum at Latif farm (1.70). Relative density of *X. index* was highest at Darya Khan Nahiyoon (31.68%), Moosa Khatiyan (31.40%) followed by Tando Qaisar (30.03%) and lowest at Latif farm (22.52%). Naturally parasitization of nematodes varied from 5.67-11.40%. Greater increase in root and shoot length was recorded in Desi variety with *Fusarium oxysporium* inoculated one week before nematode inoculation (22.567 and 22.700 cm) as compared to the fungus and nematode inoculated together (12.567 and15.833 cm) and fungus inoculated alone and in combination with *Rhizoctonia solani.* Similarly population of larvae and female were also decreased with *F. oxysporium* inoculated one week before nematode inoculation (161.66 and 72.33) as compared to fungus inoculated one week later (203.33 and 111.66) than *R. solani* inoculated one week before and after nematode inoculation.

ISOLATION, IDENTIFICATION AND PATHOGENICITY OF THE FUNGUS CAUSING MALFORMATION OF MANGO (*Mangifera indica* L.)

M.I. Khaskheli*, M.A. Pathan, M.M. Jiskani, K.H. Wagan and S.P. Goswami
Department of Plant Pathology, Faculty of Crop Protection, Sindh Agriculture University, Tando Jam, Sindh, Pakistan
*Email: mikhaskheli@yahoo.com

Fungi isolated from malformed parts were *Fusarium nivale, F. oxysporum, F. moniliforme, F. semitectum, Alternaria alternata* and *Aspergillus niger. F. nivale* proved to be the dominant fungus from the samples collected in all the four districts. Desi, Almas, and Dusheri showed 83.0-95.0% infection in Mirpur Khas while in Hyderabad (81.33-93.5%). Comparatively less infection of 35.25-36.30% was observed in tissues of Fajari in Mirpur Khas and Hyderabad districts. Maximum infection frequency of 82.08% was obtained by *Fusarium nivale* colonizing

985 out of 1200 tissues as compared to other fungi. Pathogenicity results revealed that malformation intensity was highest in Desi (60.0-76.47%) followed by Dusheri (47.36-76.47%), Almas (31.88-64.70%) and that was lowest in Swarnarika (10.0-22.72%).Maximum malformation was observed on detached inflorescence of Desi (68.0%) following Dusheri (62.50%), Almas (59.09%) as compared to Chaunsa (52.38%) and Sindhri (52.63%), respectively. In field inoculation, disease incidence was highest in Desi (44.44-83.33%) followed by Almas (30.0-66.66%) and Dusheri (27.77-61.11%).

PATHOTYPING OF *Fusarium mangiferae* ISOLATES CAUSING MANGO MALFORMATION DISEASE GLOBALLY

Zafar Iqbal[1]*, Altaf Ahmad dasti[2] and Ahmad Saleem[3]
[1]University College of Agriculture, University of Sargodha, Sargodha, Pakistan
[2]Institute of Pure and Applied Biology, Bahauddin Zakaria University, Multanm, Pakistan
[3]Plant Protection Institute, Faisalabad, Pakistan
*Email: zafarrohils@yahoo.com

Mango malformation has assumed an alarming position due to increasing losses day by day in the orchards of Pakistan. The problem is intensified due to dearth of reliable information and introduction of absurd and intricate notions. Convoluted citations have led to misconceptions regarding cause and control. The present studies were planned to characterize different pathotypes of fungus *Fusarium mangiferae*. PCR assay revealed scorable polymorphism amongst isolates of ecological proximity or different national origins. Artificial inoculations by viable culture of twenty fungal isolate on two host differentials, grafted and ungrafted classified three distinct pathotypes viz. Pathotype I, II and III. Pathotype III proved to be the most aggressive manifesting symptoms on both host differentials. The present studies elucidate different pathotypes prevailing in the mango orchards of Pakistan and their possible role in causation of mango malformation disease.

ISOLATION OF FUNGI FROM THE STONES OF HEALTHY LOOKING MANGO FRUITS

Arslan Jabeen[1]*, Munawar Raza Kazmi[2], Faisal Sohail Fateh[2] and Irfan Ul-Haque[2]
[1]Department of Plant Pathology, University of Arid Agriculture, Rawalpindi, Pakistan
[2]Institute of Plant and Environmental Protection, NARC, Islamabad
*Email: faisalmyname@gmail.com

Mango (*Mangifera indica* L.) belongs to family Anacardiaceae and considered as the king of fruits. Mango has prominent position among the commercial fruits of Pakistan. Its varieties have been known for the attractive colors, savoring smell, delightful taste and high nutritive value. A mango fruit contains 10-20% sugar, an important source of vitamin A, C and B, small amounts of proteins, iron, calcium and phosphorus. Ripe fruits are mainly eaten fresh but are also utilized in preparing squashes, jams and other preserves. Young and unripe fruits are used in pickles. Pakistan is exporting mango fruit to different countries of the world like Afghanistan, Bahrain, Dubai, Kuwait, Saudi Arabia, UK, France, Malaysia and Singapore and is earning foreign exchange. This delicious fruit crop is facing a severe disease problem called as mango

sudden death syndrome. The disease is getting severity in the mango growing orchards. A lot of research has been carrying out to know about the spread and epidemiology of disease. As the propagating material such as root and scion stocks and seeds of mango plant are the source of plantation in mango orchards of Pakistan, the current study was carried out to check the presence of any fungus associated with disease on the stones of healthy looking fruits. For this purpose, the stones of healthy looking fruits were sterilized with 10% Clorox and then were inoculated on PDA. The plates were incubated at 25°C.The inoculated pieces of skin and stone of fruit showed the growth of *Nattrasia* spp., *Penecillium* spp. and *Rhizopus* spp. the study shows that the propagating material especially stones can be an important source of disease spread.

POSTHARVEST LOSSES IN CITRUS FRUITS DURING TRANSPORT

C. Ahmad Khan*, Muhammad Bashir Ilyas, Muhammad Aslam Khan and Muhammad Usman Ghazanfar
Department of Plant Pathology, University of Agriculture, Faisalabad
*Email: usmanghazanfar1073@yahoo.com

The losses of Feutrell's Early transported from Kallurkot, Bhalwal and Jauharabad to Faisalabad market during the month of November were found to be 16%, 17% and 16%, respectively. The losses in orange transported from Kallurkot, Bhalwal and Jauharabad in the months of December and January accounted for up to 20%, 19% and 20%, respectively. The losses in the case of Kinnow transported from Kallurkot, Bhalwal and Jauharabad during the months of January and February were found to be 22%, 21% and 27%, respectively. The fungi isolated from citrus fruits (Feutrell's Early, orange and Kinnow) were *Alternaria citri, A. tenuis, A. tenuissima, A. fumigatus, Aspergillus flavus, A. niger, Botryodiplodia theobromae, Collectotrichum gloeosporioides, Fusarium solani, Geotrichum candidum, Penicillium digitatum, P. italicum, Phomopsis citri* and *Rhizopus nigricans,*and *A. citr.* The fungi *A. tenuis B. theobromae, C. gloeosphriodies, G. candium, P. digitatum, P. italicium, Phomopsis citri and R. nigricans* were found pathogenic both on injured and uninjured fruits.

POSTHARVEST TECHNOLOGIES FOR EXTENDING THE MARKET LIFE OF SATSUMA MANDARIN

David H. Picha
Department of Horticulture, Louisiana State University Agricultural Center, Baton Rouge, Louisiana U.S.A
Email: dpicha1@lsu.edu

The satsuma mandarin is a cold tolerant specialty citrus becoming increasingly popular in niche markets in the U.S. This easy-peel seedless citrus fruit is also widely grown and marketed in Japan and has a strong market presence in the U.K. and other European countries. Potential exists for the development of a commercial satsuma industry in Pakistan and extended fruit availability over many months, using well-adapted cultivars and appropriate postharvest technologies. The most important fruit quality parameters which influence market acceptability are size, peel color, firmness, sugar content, and acidity. The postharvest research efforts in Louisiana are focused on technologies to maintain satsuma fruit quality and extend the marketing period. Postharvest de-greening tests were conducted to determine the appropriate methods and protocol for enhancing

peel coloration of early season harvested satsumas. An atmospheric ethylene concentration of ≥5 ppm for ≥24 hours at 29° C provided optimal de-greening. Submersion of the fruit in 500 ppm ethephon for 30 seconds also provided optimal peel de-greening. Refrigerated storage at 4° C allowed for at least 3 months of high quality fruit after harvest. Preliminary low oxygen/high carbon dioxide controlled atmosphere (CA) storage studies indicated an additional several months of market quality fruit can be provided beyond the conventional refrigerated storage period. De-greening of the early season fruit coupled with optimal storage conditions for the late season fruit allows for up to an 8-month satsuma marketing period.

EVALUATION OF PACKAGING AND FRUIT RIPENING METHODS IN MANGO (*Mangifera indica* L.)

Raheel Anwar[1]*, Aman Ullah Malik[1], Abdul Rahim Khan[2]
[1]Postharvest Lab., Institute of Horticultural Sciences, University of Agriculture Faisalabad
[2]Postharvest Research Center, Ayyub Agricultural Research Institute, Faisalabad
*Email: raheelanwar65@yahoo.com

In Pakistan, unprocessed wooden crates as packaging material together with calcium carbide (CaC_2) as ripening agent are commercially used during postharvest management of mango. These are the two important issues that impart significantly negative effect on cosmetic look and ripening behaviour of fruit. Wooden crates are mostly from unknown sources and can become source for introduction/spread of pests and diseases together with causing serious physical injury to fruits. On the other hand, CaC_2 may adversely affect human health due to carryover of toxic materials like arsenic and phosphorus along with danger of explosion. Therefore, replacement of currently used wood packaging and CaC_2 based ripening method is imperative. Keeping in view importance of these issues, two experiments were conducted. In first experiment, fruits were harvested from Multan, packed in different packaging materials (wooden crates, cardboard boxes and open crates) and transported to processing unit at Karachi in open top trucks. Fruits packed in cardboard boxes and open crates showed no physical pressure compared with fruits packed in wooden crates (9.5%). Percentage of fruit with sapburn injury (15.5%) and softness (20.8%) due to physical pressure was observed minimum in cardboard packed fruits compared with fruits packed in wooden and open crates. In second experiment, fruits were sourced from a commercial orchard in Multan, packed in corrugated cardboard boxes and transported to Postharvest Lab., Institute of Horticultural Sciences, University of Agriculture Faisalabad. At arrival, fruits were either packed in wooden crates along with treatment with CaC_2 (2 g kg^{-1} of fruit) until fully ripened or packed in cardboard boxes with application of C_2H_4 (100 ppm, 20°C, 48h) and ripened at ambient temperature. Significant development in fruit color, softness, TSS (31.3°Brix), total sugars (23.1%), total carotenoids (133.5 µg g^{-1}) while lower ascorbic acid (27.8 mg $100g^{-1}$) and TTA (0.11%) in wooden crate packed fruits revealed that wood packaging promotes fruit ripening as compared to cardboard packaging. However, higher fresh fruit weight loss (8.7-12.5%) in wood packaging is a demerit. Cardboard packaging was found more suitable for extending fruits' shelf life. Exogenous C_2H_4 application seems to be dependent on concentration, exposure time and temperature.

FUNGICIDES AND HOT WATER TREATMENTS REDUCE POSTHARVEST DISEASES AND DISORDERS IN MANGO

Abdul Jabbar, Aman Ullah Malik* and Mehdi Maqbool
Postharvest Lab., Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: malikaman1@yahoo.com

Mango export to China requires a hot water treatment (HWT) of fruits (48°C-60 min) for fruit fly disinfestation. However, mango fruit still requires treatments for postharvest diseases control for maintaining fruit quality and reducing postharvest losses. This research experiment was conducted to develop a protocol to control different postharvest diseases of mango during storage. Different fungicides and hot water treatment (HWT) separately as well as in combination were applied to mango fruit cv. Chaunsa. Treated fruits were air dried and stored (13±1°C, RH 85%) for 21 days. Fruits treated with Sodium hypochlorite (NaOCl) @ 2.5 g/10L (field dip) (1 min) + HWT (48°C-60 min) and Topsin-M @ 1.0 mg l^{-1} (field dip) (1-2 min) + HWT (48°C-60 min) particularly showed lower incidence of anthracnose compared to others. No stem end rot was observed in fruits treated with NaOCl @ 2.5 g/10L (field dip) (1 min) and Topsin-M @ 1.0 mg l^{-1} (field dip) (1-2 min) + HWT (48°C-60 min). Minor hot water damage was observed in fruits treated with NaOCl @ 2.5 g/10L (field dip) (1 min) + HWT: 48°C-60 min compared to fruits treated with Topsin-M @ 1 mg l^{-1} (field dip) (1-2 min) + HWT (48°C-60 min). These results suggest that there is a need of developing a standard protocol of HWT and disease control for mango export.

EFFECT OF CALCIUM AND MAGNESIUM ON SOFT NOSE DISORDER AND QUALITY OF MANGO CV. SAMAR BAHISHT CHAUNSA

Muhammad Amin*, Aman Ullah Malik, Abdul Jabbar and Nawab-u-Din
Postharvest Lab., Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: amin_uaf@yahoo.com

Calcium (Ca) and magnesium (Mg) are essential plant nutrient involved in a number of physiological processes concerning membrane structure and function, and enzyme activities. However, the potential role of these two nutrients in quality and shelf life improvement and internal breakdown disorders of mango fruits needs to be explored. This study was undertaken to investigate the effect of pre and postharvest application of different calcium (Ca) and magnesium (Mg) salts on postharvest quality and soft nose disorder of mango (*Mangifera indica* L.) cv. Samar Bahisht Chaunsa. For preharvest treatment aqueous solutions of different concentrations of Ca and Mg were sprayed on the mango trees in an orchard fifteen days prior to harvest and for postharvest application, fruits were dipped for 10 minutes in various concentrations of Ca and Mg. The fruits were harvested at the mature green stage and stored at 12+1°C and 85-90% RH for 15 days followed by 2 days storage at room temperature (25+1°C, 75-80% RH). This paper reports the effect of treatments on soft nose disorder and physical, biochemical and organoleptic characteristics of fruits.

POSTHARVEST LOSSES IN APPLE AND BANANA DURING TRANSPORT AND STORAGE

Muhammad Bashir Ilyas, C. Ahmad Khan, Muhammad Aslam Khan and Muhamad Usman Ghazanfar*
Department of Plant Pathology, University of Agriculture, Faisalabad, Pakistan
*Email: usmanghazanfar1073@yahoo.com

Total losses in the apple transported from Murree, Swat and Quetta to Faisalabad market in the months of August, September and November were found to be 25%, 20% and 23%, respectively. In apples kept under the conditions of cold storage for 22 weeks, losses were found to be 28 percent. The fungi isolated from apple were *Aspergillus niger*, *A. fumigatus, Alternaria tenuis*, *A. tenuissima, Cladosporium hebarum, Helminthosporium tetramera, Mucor racemosus, Penicillium expansum, P. itlalicum, Rhizoous nigricans.* The fungus *A. niger* and *A. tenuis* were found pathogenic both in the case of injured and uninjured fruits. Total losses in banana transported from Nawabshah, Mirpur khas and Hyderabad to Faisalabad market in the months of December, February and March amounted to 37%, 39% and 43%, respectively. The fungi isolated from banana were *A. fumigatus, A. tenuis, Fusarium moniliforme, Verticillium theobromae*. All the fungi expect. *A. fumigatus* were found to be pathogenic both in care of injured and uninjured fruits.

VEGETABLE PRUNING AND COMMERCIAL BENEFITS

M.S. Yaqub[1]*, R. Aslam[2] and M. Nafees-ud-din[1]
[1]College of AgricultureandEnvironmental Sciences, The Islamia University of Bahawalpur, Pakistan
[2]M.Sc Biochemistry, University of Agriculture Faisalabad, Pakistan
*Email: citsyk@yahoo.co.in

Pruning has direct impact on plant growth. Most of the vegetables have short shelf life.At peak season usually there is glut in the market and farmer do not get higher price.Vegetables cannot be kept fresh for long time after harvesting. Raddish and Turnip were severely pruned six weeks after sowing , only central leaves up to 3 cm length were left. Due to decreased leaf area photosynthetic activity also decreased and food storage phenomenon slowed down.As a result harvesting time delayed up to four weeks. Due to this practice a farmer can get, fodder for his animals, good price for his produce and he can save at least one irrigation.

STATUS AND POTENTIAL OF VEGETABLE PRODUCTION IN PUNJAB

Abdul Rashid* and Khalid Mahmood
Vegetable Research Institute, Ayyub Agricultural Research Institute, Faisalabad, Pakistan
*Email: director_vegetables@yahoo.com

Varied Agro-climate conditions in Pakistan made it possible to grow a wide variety of vegetables. Punjab shares 47% in area and 55% in production. The vegetable production in Punjab

has increased from 1.4 million tonnes during 1970-71 to 4.2 million tonnes in 2005-2006. Among vegetables, winter season vegetables share 74% in area and 76% in production, while the rest comes from summer vegetables. Among winter vegetables, potato is occupying maximum area followed by onion. Among summer vegetables, melons are grown on 40 thousand acres followed by chillies. The farmers of the Punjab are also adopting plastic tunnel technology to grow summer vegetables in winter season. This technology has already been adapted on about 1000 acres and it is expanding at high rate due to high production and better market price of produce. In the near future increased vegetable production will be facing global challenges under the new scenario of WTO regimes. This may result in lowering the market price of vegetables. To overcome this threat, the vegetable production must be transformed to demand pulled production. The quality standards under SPS of WTO will have to be followed to compete in the international market; especially the use of pesticides and their residues in the products need to be curtailed. However, the diverse Agro-Climate conditions of the province will help in fetching new markets and growing exotic vegetable under contract production system. This will help in increasing farm incomes and reducing poverty from the rural communities. Urban businesses will also flourish as vegetable production and processing has a long chain of activities starting from seed industry to Post Harvest processing, value addition, packing and marketing of by products etc. No other crop has more benefits than growing vegetables.

GROWING OF VEGETABLES IN POTS IN URBAN AREAS

M.S. Yaqub[1]*, C.M. Ayub[2] and R. Aslam[3]
[1]College of Agriculture and Environmental Sciences, The Islamia University of Bahawalpur.
[2]Institute of Horticultural Sciences, University of Agriculture Faisalabad
[3]MDepartment of Biochemistry, University of Agriculture, Faisalabad, Pakistan
*Email: citsyk@yahoo.co.in

Pakistan has tremendous potential for the expansion of vegetable industry due to suitability of climatic conditions for vegetable production.Any break through in the production of vegetables will have a direct impact on the urban life.But major problem of urban life is scarcity of land for agricultural purpose.Therefore some vegetables like Fenugreek,Brassica,Peas and Spinach were studied to ascertain their adaptability in the pots placed on the roof.Pots used for experiment purpose were of the following size: top diameter (8 inch) , height (8 inch) and bottom (3.5 inch). Average yield per pot of Fenugreek, Brassica, Peas and Spinach was found 28 g, 22 g, 19 g and 41.3 g, respectively. No Pesticide was used during production period.Number of pots may be adjusted according to family requirements.

SCREENING OF 54 EXOTIC TOMATO GERMPLASM LINES FOR ADAPTATION IN OMAN

Khalid Al-Farsi*, Fahad Al-Said and Iqrar Khan
Department of Crop Science, College of Agriculture and Marine Science, Sultan Qaboos University, P.O. Box 34, AlKhoud 123, Oman
*Email: faalsaid@squ.edu.com

Tomato is the major vegetable crop grown in Oman. The production is entirely depended on imported hybrids and these are not met by any regulatory mechanism leading to exploitation of

farmers. The production is restricted to mild winter months of the year while most summer remains untapped due to lack of heat tolerant cultivars. There is a need to develop indigenous breeding program for evaluation and release of exotic germplasms (hybrids and pure lines) as well as to develop local hybrids. Fifty four genotype of tomato were acquired from AVRDC, Taiwan and evaluated for their adaptation in Oman. They were categorized as fresh market tomato, cherry tomato, and high lycopene tomato. The experiments were conducted in two locations, Sultan Qaboos University, Al-Khoud, and in Agricultural Research Center, Barka. Filed evaluation was conducted through two seasons 2004-2005, and 2005-2006. The experimental design was CRD with five replications. Data were collected on fruit number, fruit size, fruit shape, total yield and TSS. Results showed significant variation for yield, fruit number, fruit shape and TSS within varieties and locations. For fresh market CLN2498E, CLN2498D, CLN2413R, CLN2418A, and BL1176 showed good results over other accessions in relation to yield and fruit number over years and locations. Most of the accessions had TSS between 4 to 6.5%. For cherry tomato, the variation in yield and fruit number was observed within varieties and location. However, CHT1050C, CHT1050SB, CHT1050SG and CHT1050SA were the highest yielding accessions within this category. The fruit number and fruit size were varied within accessions and in locations. The TSS of cherry tomato ranged between 6 to 8.5%. In high lycopene tomato, the high yielding and large fruited accessions were CLN2366B, CLN2071C and CLN2366A. Fruit size was varied between accessions. The TSS ratio in this category ranged from 4 to 6%. Results of the evaluation experiments showed adaptation of some accession to the local condition.

PHYSIOLOGICAL ENHANCEMENT OF TOMATO SEEDS BY HORMONAL PRIMING WITH POLYAMINES

Shahzad Maqsood Ahmad Basra[1], Chaudhary Muhammad Ayub[2], Fahad Munir[2], Irfan Afzal[1]* and Aamir Nawaz[3]
[1]Department of Crop Physiology, University of Agriculture Faisalabad, Pakistan
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[3]Collegge of Agriculture, Bahauddin Zakariya University, Multan, Pakistan
*Email: irita76@yahoo.com

Fresh seeds of two tomato cultivars (Roma and Nagina) were treated with polyamines (50 mg l^{-1} spermine, 50 mg l^{-1} spermidine, and 50 mg l^{-1} putrescine) for 24 h to break primary dormancy, enhance germination, emergence and seedling vigor. All the priming treatments were not cultivar specific. Hormonal priming with 50 mg l^{-1} spermine and 50 mg l^{-1} spermidine resulted in improved germination, emergence and seedling vigor by breaking the dormancy of both cultivars as compared to nonprimed seeds. However, hormonal priming with putrescine failed to improve germination and seedling vigor of both cultivars. Results indicated that polyamines (spermine and spermidine) have obvious effect in enhancing germination rate and better seedling stand of tomato cultivars. It is a vulnerable tool to get thicker and well-developed seedlings in rootstock tomato seedling production.

PHYSIOLOGICAL BASIS OF SEED DETERIORATION IN TURNIP SEEDS

Ahmed Al-Maskri*, M.M. Khan, M. Abbas and R. Waseem
*Department of crop science, College of Agriculture, Sultan Qaboos University, Oman
Institute of Horticultural Sciences, University of Agriculture, Faisalabad
*Email: maskri99@squ.edu.om

Study was carried out to evaluate the physiological and enzymatic activities in stored turnip seed. Seeds stored for two years at 5°C were compared with freshly harvest seed lot. Significant increase in enzymatic activity (α-amylase, β-amylase, peroxidase and catalase) was observed in stored seeds, where as in fresh seeds enzymatic activity was at low level. Physiological studies for storage behaviour showed that germination was 88% and 89% for stored and fresh seeds, respectively. Storage environment significantly affect the radical and plumule length. Decrease in fresh and dry root shoot was also observed in stored seeds. It is concluded that storage environment increase the enzymatic activity which significantly affect the seed vigour.

AUGMENTATION OF GERMINATION AND SEEDLING GROWTH OF TOMATO CULTIVARS BY PRE-SOWING SEED TREATMENTS

Chaudhary Muhammad Ayub[1], Shahzad Maqsood Ahmad Basra[2], Fahad Munir[1] and Irfan Afzal[2]*
[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[2]Department of Crop Physiology, University of Agriculture, Faisalabad, Pakistan
*Email: irita76@yahoo.com

Tomato seeds from freshly harvested seed lots often fail to germinate due to presence of dormancy which resulted in erratic and unacceptable seedling emergence causing problems for tomato production all over the world. Seed enhancements like seed priming are known to improve seed vigor and breaking dormancy. The objective of this study was to assess the effect of different pre-sowing seed treatments on germination and seedling vigor of two tomato cultivars i.e. Roma and Nagina. Seeds were subjected to hydropriming, hardening and pre-sowing chilling treatment (-19°C) for 24 h. All the pre-sowing seed treatments resulted in better germination, emergence and seedling vigour of both cultivars as compared to nonprimed seeds. Among all pre-sowing treatments, hardening proved to be the most effective seed treatment in breaking dormancy of tomato seeds.

EFFECT OF DROUGHT STRESS ON GROWTH, QUALITY AND VIGOUR OF PEA SEEDS

Muhammad Irfan Ashraf*, Muhammad Aslam Pervez and Qumer Iqbal
Institute of Horticultural Sciences, University of Agriculture Faisalabad
*Email: irfanflorist199@yahoo.com

Physiological quality of pea *(Pisum Sativum L.)* seed depends on various factors affecting the plant, including water supply, the effect of which has not been fully characterized. Seed yield, quality and vigour were studied in pea crop subjected to water stress during flowering and pod

filling. Early water stress during the period from the start of flowering to the start of seed filling and late water stress during seed filling was compared with no water stress. Pea seed vigour was assessed by germination, field emergence, electrical conductivity and cold test. Rainfall was measured on both years at the reproductive stage of pea crop. In 2005 the rainfall was high during the reproductive stage and there was no difference in seed yield and quality between treatments. Water stress during flowering or pod filling reduced seed yield but did not affect the seed size consistently. Water stress during flowering period did not reduce seed quality more than control and reduced seed yield only slightly. Water stress during seed filling decreased seed yield but the affect on seed vigour was not significant. Pea seed yield was closely related to pod number per unit area, which was strongly related to water stress. The number of peas per pod was unaffected by water stress. Changing irrigation strategies for pea seed production by irrigating during seed filling may improve the vigour of seed lots without decreasing the seed yield.

EFFECT OF PHOSPHORUS APPLICATION ON GROWTH AND SEED YIELD OF LETTUCE CULTIVARS

Muhammad Amjad, Qumer Iqbal, Shahjahan, Muhammad Muzammil Jahangir* and Khurram Ziaf
Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan
*Email: muzammil_jahangir@hotmail.com

Lettuce (*Lactuca sativa* L.) is an essential salad crop for the human diet. The objective of the study was to evaluate yield and quality of two lettuce varieties romaine and Grand Rapids in responses to different phosphorus levels. Phosphorus was applied at 0, 60, and 80 kg/ha as single super phosphate. Overall studies indicated that highest crop and seed yield was obtained with phosphorus applied at 80 kg/ha. However among the two varieties Grand Rapids exhibited superiority over Romaine. No significant difference was observed in terms of storage behaviour.

DESIGNING TECHNOLOGY FOR THE PRODUCTION OF ONION DURING SCARCITY PERIOD IN PUNJAB

Akhtar Saeed and Abdul Rashid*
Vegetable Research Institute, Ayyub Agricultural Research Institute, Faisalabad
*Email: director_vegetables@yahoo.com

Onion (*Allium cepa*) belonging to the family Amaryllidaceae can be successfully grown at temperature between 10 to 30°C. Normally, onion bulbs have poor storability at high temperatures. It also starts sprouting at temperatures below 20°C. In Pakistan, the sowing and harvesting season of onion is different in different provinces due to diverse environments. Sindh produce 43% of the total onion production in Pakistan and its production is marketed in the country from November to April. Balochistan, which produces about 27%, market its onion produce during the months of October and November. Punjab produces only 17% and its produce comes to the market in May, June and July. Similarly, NWFP produces about 13% and its production comes to the market during the months of August to November. The onion supply in Pakistan markets during the months of November, December and January is always risky and it mostly depends on the Sindh crop sown during the months of July and August. The sowing of this crop is often hampered by the heavy rains received during the monsoon season. An off-season onion crop in Punjab can fill this gap but due to high temperatures and rains during the months of

July and August, nursery production is a problem and hindrance in large scale adoption of this off-season onion production practice. Research studies were made and a new onion production technology for this off-season was designed. In this technology, onion nursery is planted during December and it is ensured that the plants in the nursery are not too dense. The nursery is allowed to grow at the same place till May/June. The harvested bulblets are stored in airy space at room temperature till July, when these are planted in the field during 2nd fortnight of July. These bulblets start to grow and a good crop is ready to harvest during the months of November/December.

SEX EXPRESSION AND LEVEL OF PHYTOHORMONES IN MONOECIOUS CUCUMBER AS AFFECTED BY PLANT GROWTH REGULATORS

Hidayat Ullah[1]*, A. Bano[2] and K. M. Khokhar[1]
[1]Vegetable Crops Research Programme, Horticulture Research Institute, National Agricultural Research Center Islamabad, Pakistan
[2]Department of Biological Sciences, Quaid-e- Azam University Islamabad, Pakistan
*Email: hidayatu_2003@yahoo.co.uk

The cucumber *Cucumis sativus* cv. Sialkot Selection is a commercially grown monoecious cultivar of Pakistan which has a strong tendency towards maleness. The main factor limiting yield of this cultivar is the production of relatively low pistillate flowers resulting in a high ♂ to ♀ sex ratio. Present investigation was aimed to study the effects of 2-chloroethylphosphonic acid (ethrel), gibberellic acid and maleic hydrazide on sex expression in cucumber concomitant with the changes in endogenous level of GA and IAA in order to understand the sex ratio as affected by the critical level of GA and IAA. Seeds of cucumber cv. Sialkot selection were sown in the field and the above mentioned growth regulators were applied in different concentrations at 2- leaf stage and endogenous phytohormones level in cucumber were investigated with high performance liquid chromatography. The greatest increase in female flower production, lowest ♂ to ♀ sex ratio, highest number of fruits/plant and ultimately fruit yield/plant was recorded when MH was applied at 450 µM/L compared with control. Ethrel significantly lowered the ♂ to ♀ sex ratio in cucumber. Lower GA:IAA ratio was associated with the female tendency. Endogenous GA level had a positive significant correlation with the number of pistillate flower/plant, fruit set percentage and negative significant correlation with sex ratio.

RELATIONSHIP OF MORPHOLOGY AND ANATOMY IN *Asparagus* SPECIES AND CULTIVARS

Waqar-u-Nisa[1]*, Mansoor Hameed[1], Adnan Younis[2] and Atif Riaz[1]
[1]Department of Botany, University of Agriculture, Faisalabad
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad
*Email: drsaif@super.net.pk

Several species and cultivars of *Asparagus* had been introduced in Faisalabad and adjoining districts, however, one species, *A. adscendens,* is native to the region. Most of them are new records in the region. Comparative anatomy of roots, stem and cladodes of *Asparagus* species and cultivars showed significant variations. These variations were species specific and, therefore, can be used as an excellent tool for the taxonomic description of the genus.

THE INFLUENCE OF VERMICOMPOST TEA EXTRACTED FROM EARTHWORM-PROCESSED COW MANURE ON THE GROWTH AND YIELD OF TOMATOES

K. Hussain[1]*, S. Saeed[2], N. Ahmed[1] and I. Ahmed[1]
[1]Agriculture Officer Soiland Water Testing Lab., Multan
[2]University College of Agriculture, Bahauddin Zakariya University, Multan
*Email: jamniaz@yahoo.com

Efect of vermicompost Tea, derived from earthworm (Eisenia fetida) processed cow manure on growth and yield of tomatoe (cv.Roma) Solanum esculentum was evaluated. The treatments consisted of control only NPK (fertigation), NPK (fertigation) + vermicompost–Tea @ 1:100 (fertigation), NPK (fertigation) + vermicompost–Tea @ 1:100 (foliar spray) and ½ NPK (fertigation), + vermicompost Tea @ 1:100 (foliar spray) to tomato seedlings grown in the pots. Tomato seedlings were watered according to their requirement. Treatments were applied after every ten days. The application of treatments was repeated six times during the growth period. The treatment increased the growth of tomato plants significantly, including plant height, number of leaves plant-1, number of branches plant-1, and number of fruit per plant. Shoot and root dry weight also increased significantly over control. The response in case of fertigation was superior to that of foliar. These growth responses were most probably due to hormone-like activity of vermicompost-Tea or could have been due to plant growth hormones. The mineral contents of diagnostic leaves and root were also determined using standard test methods.

SUPPRESSIVE EFFECTS OF COMPOSTS ON *Pythium aphanidermatum* OF TOMATO

Raoudha Khanfir[1]*, Rabiaa Haouala[1], Mohamed Ali Triki[2], Belgacem Henchi[3]
[1]Institut Supérieur de Biotechnologie de Monastir, Tunisie
[2]Institut de l'Olivier, Sfax
[3]Faculté des Sciences de Tunis
*Email: bjnkh@yahoo.fr

Pytium aphanidermatum is a fungus responsible for the damping-off of the most of greenhouse-grown crops. The difficulties of the physical and chemical controls have promoted scientists to search for biological alternatives that are efficient, reliable and safe for environment. Our work consists of studying the suppressive effect of three composts and their extracts on this pathogenic fungus. The composts used in this study are composed of posidonia (*Posidonia oceanica*), poultry droppings and olive mills. To evaluate this suppressive effect, seedlings of tomato (*Solanum lycopersicum*) were inoculated by watering with a solution of 10^3 oospores.ml^{-1} of *P. aphanidermatum*. The results show that, 25 days after their inoculation, the seedlings grown on the substrates containing the composts and sprinkled with their corresponding extracts resist to the pathogen and have higher percent-seedling stands. Indeed, in the inoculated control, the percent-seedling stands are 10% whereas in the presence of the composts and their extracts these values vary from 55 to 80% according to the composition of the composts.

STABILITY OF POTATO GENOTYPES FOR YIELD AND BIOTIC STRESS IN PUNJAB

Muhammad Iqbal and Abdul Rashid*
Vegetable Research Institute, Ayyub Agricultural Research Institute, Faisalabad, Pakistan
*Email: director_vegetables@yahoo.com

Potato has paramount importance due to its high nutritive value and productivity. It is used in chipping and processing Industry as well. Potato crop is grown through out Punjab, However it grows well in the climatic conditions where temperature falls in between 20-25°C. Potato crop is sensitive to various viruses, diseases, frost incidence and environment for its yield potential. It has also been observed that different genotypes showed different response for yield and biotic stresses at different localities. Potato yield potential is the result of interaction between genotypes and environment. Vegetable Research Institute has a continuous programme to develop potato genotypes through crossing at Murree and test their yield potential, tolerance to diseases and viruses at different localities. Keeping in view, 13 genotypes were planted at four localities i.e. Vegetable Research Institute, Faisalabad, Punjab Seed Corporation, Sahiwal, Farmer's Fields at Chiniot and Faisalabad for two years to check the stability. Among these genotypes FD-4-2 shows more stability alongwith FD-1-8 and FD-8-1 over the year and localities.

SOMATIC EMBRYOGENESIS AND PLANT REGENERATION IN CUCUMBER CULTIVARS

Zahoor Hussain, Muhammad Usman*, Bilquees Fatima and Muhammad Mumtaz Khan
Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan+
*Email: muhammadusman30@yahoo.com

Different explants from *in vitro* raised cucumber (*Cucumis sativus* L.) seedling were excised and cultured on MS media containing various levels of plant growth regulators (PGRs) to establish plant regeneration. Among cultivars, Bethalpha gave highly embryogenic callus that regenerated in to somatic embryos as compared to Marketmore. Cotyledon explant derived calli showed higher embryogenic response on MS medium supplemented with 2,4-D and developed somatic embryos upon transfer to medium devoid growth hormones. Shoot regeneration responses were found in leaf disc derived calli on MS medium containing NAA. Lowering the growth hormone concentrations established roots in the excised shoots. The regenerated plantlets were transplanted in pots containing soil for hardening and were shifted to the greenhouse.

IN VITRO MULTIPLE SHOOT INDUCTION IN TOMATO CULTIVARS

Bilquees Fatima*, N. Anjum, Zahoor Hussain and Muhammad Mumtaz Khan
Institute of Horticultural Sciences, University of Agriculture Faisalabad
*Email: fatimausmanhort@gmail.com

Different tomato cultivars were explored for multiple shoot induction using MS medium supplemented with different growth hormones and their combinations. Among cultivars, Moneymaker was found better for multiple shoot induction from hypocotyl explant derived calli in medium containing NAA in combination with BAP (1 and 2 mg l^{-1}, respectively) as compared to cv. Roma and Nagina. The excised shoots were rooted in medium without growth hormones and

the regenerated plants were transferred to greenhouse after acclimatization. The protocol could be helpful for clonal propagation of the hybrid tomato cultivars.

EFFECT OF ORGANIC AMENDMENTS ON PLANT GROWTH AND MANAGEMENT OF *Meloidogyne incognita,* CAUSING ROOT KNOT DISEASE IN EGGPLANT

B.K. Karmani*, M.M. Jiskani, M.A. Pathan, K.H. Wagan and G.B. Poussio
Department of Plant Pathology, Sindh Agriculture University, Tando Jam
*Email: bhesham_23@hotmail.com

Effect of different organic amendments was studied on plant growth and management of *Meloidogyne incognita*, causing root-knot disease in eggplant. The buffalo, cow, goat, poultry and sheep manures were used alone and as mixture of all. One month old seedlings were planted in earthen pots, containing 1.5 kg steam sterilized soil and amended with manures at 5, 10 and 15% of soil. All the tested manures significantly increased eggplant growth and decreased root knot disease severity. All the manures used at maximum dose (15%) found to be best followed by medium and minimum (10 and 5%) doses. Poultry and goat manures found more efficient followed by cow, mixture of all tested manures, sheep and buffalo. Significantly minimum plant growth and maximum root knot index was recorded in inoculated and un-amended soil.

EFFECT OF DIFFERENT FUNGICIDES AGAINST ROOT ROT OF OKRA CAUSED BY *Macrophomina phaseolina* UNDER AGRO-ECOLOGICAL CONDITIONS OF TANDOJAM

G.B. Poussio*, M.M. Jiskani, M.A. Pathan, K.H. Wagan, M.I. Khaskheli and B.K. Karmani
Department of Plant Pathology, Sindh Agriculture University, Tando Jam, Pakistan
*Email: danishgul_bahar@yahoo.com

Root rot of okra caused by *Macrophomina phaseolina* is one of the major diseases. The survey showed 35 to 51% disease incidence under natural conditions. The minimum 35% incidence was recorded at Hyderabad followed by 40% at Tandojam, whereas, maximum 51% incidence was recorded at Mirpurkhas followed by 44% at Tando Allahyar. The effect of different fungicides against root rot of okra was studied under agro-ecological conditions of Tandojam. The fungicides were used two times through drenching at 15 days interval and data was recorded 15 days after 2nd application. Significantly increased plant height (cm) was recorded in Benlate (15.00), Copper oxychloride (14.50) and Topsin-M (14.25) followed by Chestnut compound (12.75) and the height was significantly decreased in control (10.87). The maximum increase over control in plant height was recorded in Benlate (27.53%), followed by Copper oxychloride, Topsin-M and Chestnut compound (25.03, 23.71 and 14.90%), respectively. Benlate found to be best fungicide with reference to minimum (1.50 with 33.75%) disease incidence, followed by Copper oxychloride (2.50 with 12.5%), Topsin-M and Chestnut compound (2.75 with 13.75%). Significantly maximum (6.75 with 33.75%) incidence was recorded in control. Similarly, Benlate also significantly found to be best fungicide with reference to minimum (0.75 with 3.75%) mortality, followed by Copper oxychloride (1.25 with 6.25%), Topsin-M (1.50 with 7.5%) and Chestnut compound (2.00 with 10%). The maximum reduction over control in disease incidence and mortality was recorded in Benlate (77.77 and 83.33%), followed by Copper oxychloride (62.96 and 72.22%), Topsin-M (59.25 and 66.66%) and Chestnut compound (59.25 and 55.55%).

BIOACTIVITY OF CULTURE FILTRATES OF SOME SOILBORNE FUNGI ON HATCHING AND MORTALITY OF LARVAE AND EGG PARASITIZATION OF TOMATO ROOT-KNOT NEMATODE, *MELOIDOGYNE INCOGNITA*

M.M. Jiskani*, S.M. Nizamani and M.A. Pathan
Sindh Agriculture University Tandojam, Pakistan
*Email: mithaljiskani@yahoo.com

Bioactivity of culture filtrates of some soil borne fungi such as *Paecilomyces lilacinus*, *Fusarium oxysporum*, *Macrophomina phaseolina*, *Rhizoctonia solani*, *Verticillium albo-atrum* and *V. dahliae* was studied. The fungi were isolated from infected tomato roots, soil samples and eggmasses of root-knot nematode, *Meloidogyne incognita* samples, collected from various tomato fields of Hyderabad, Mirpurkhas, Badin, Thatta, Nawabshah, Larkana, Shikarpur, and Khairpur districts of Sindh. The fungi multiplied on potato-dextrose agar medium. The data was recorded after 72 hour exposure and analyzed through 'Student edition of Statistix^{R}'. *P. lilacinus* caused 100% mortality of *M. incognita* larvae at STE and 1:10 time dilutions followed by 99.25% at 1:100 solutions. *F. oxysporum* showed 39.50 to 76.00% mortality followed by *M. phaseolina* (35.00 to 65.50%). The least mortality was recorded in case of *V. dahliae* and *V. albo-atrum* (27.00 to 44.75 and 28.00 to 45.75%) followed by *R. solani* (33.50 to 53.25%), respectively. On an overall, STE found highly effective followed by 1:10 and 1:100 times dilutions resulting 55.25, 47.14 and 37.67% mortality of larvae, respectively. *P. lilacinus* caused maximum mortality (99.75%) of *M. incognita* larvae followed by *F. oxysporum* (57.92%) and *M. phaseolina* (49.92%), whereas *V. dahliae* and *V. albo-atrum* showed least mortality (36.42 and 37.50%) followed by *R. solani* (43.83%) as compared to control (distilled water) 1.50% mortality. The minimum hatching (84.00 larvae) was observed with *P. lilacinus* as compared to *F. oxysporum* (117) followed by *M. phaseolina* (130). The maximum hatching was recorded in control (299) followed by *V. dahliae* and *V. albo-atrum* (144 and 142) and *R. solani* (138). The higher egg-parasitization was recorded with *P. lilacinus* (81.25) followed by *F. oxysporum* (69.0) and *M. phaseolina* (62). The minimum egg parasitization was recorded in *V. dahliae* and *V. albo-atrum* (16.25 and 19.25) followed by *R. solani* (26.0), respectively.

DEVELOPING POSTHARVEST AND MARKETING SYSTEMS FOR SWEETPOTATO

A. Westby[1]*, D. Rees[1], K.I .Tomlins[1], C. Owori[2], A. Bechoff[1] and M.U. Cheema[1]
[1]Natural Resources Institute, University of Greenwich, Central Avenue, Chatham, Kent ME4 4TB, United Kingdom
[2]Kawanda Agricultural Research Institute (KARI) P. O BOX 7065, Kampala, Uganda
*Email: a.westby@gre.ac.uk

Sweet potato is an important food security and income generating for many people in Asia and Africa. The development of orange-fleshed varieties with high contents of beta-carotene offers the potential for use of the crop as a nutritional intervention to overcome vitamin A deficiency. Postharvest and marketing systems development is important for reducing losses and increasing the value of the commodity. This paper summarises recent research work carried out at the Natural Resources Institute and in collaboration with partners to (a) understand the factors controlling shelf life of roots including the role of dormancy, (b) reduce handling and marketing

losses and (c) develop low technology storage techniques to enable out of season marketing. In addition, approaches developed by the HarvestPlus Challenge Program to develop product development and marketing systems for orange-fleshed sweetpotato will be described including preliminary results of the impact of drying on beta-carotene retention and sensory acceptability of orange-fleshed varieties in communities that are only used to consuming white fleshed cultivars.

PROSPECTS OF FLORICULTURE INDUSTRY IN PAKISTAN

Muhammad Aslam Khan* and Adnan Younis
Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: rana25_pak@hotmail.com

In the flower industry, significant changes are occurring in the competitive relationships worldwide. A number of traditional markets are displaying signs of saturation and at the same time, new markets developing in some parts of the world. It is expected that per capita consumption and production will go up worldwide. This is a dilemma in obtaining clear insight into the prospects for the floriculture industry. Landscape trees, shrubs and ground cover are also very promising and have wider scope for the environment. Pakistan is a country of small farming households, where, floriculture is the best option for enhancing the income of the under privileged. Introduction of Floriculture crops could be an important intervention in this regard where the farmer can earn much more by exploiting available natural resources more efficiently. We have favorable climate and cheap labor for growing these crops whereas they need much less land and water for their production. These crops also give premium prices almost round the year and there is no need to wait for a long time as in the case of other routine crops. Net profit against the investment is much higher from these crops compared with other conventional crops. The products are in high demand all over the world. Flower based industry is also going to start in a rapid pace. It is the need of the time to produce skilled personals and explore new means to ensure survival of our farmers and explore marketing to save our economy as well increases our export.

GENETIC DIVERSITY IN LOCAL FENNEL (*Foeniculum vulgare* Mill) GERMPLASM BASED ON OIL CONTENTS

Najma Yousaf Zahid* and Nadeem Akthar Abbasi
Department of Horticulture, University of Arid Agriculture, Rawalpindi, Pakistan
*Email: honey_neema2003@yahoo.com

Fifty accessions of Fennel (*Foeniculum vulgare* Mill) germplasm collected across the country were sown in an augumented design at university of Arid Agriculture, Rawalpindi. The crop was evaluated for various morpho-agrronomic characters viz., days to flowering, plant height, stem girth, nodal distance, umbel diameter, number of umbels per plant, days to harvesting, seed yield and harvest index. Then 5 g of seed in powder form from each accession was used for oil extraction through soxhlet's distillation apparatus. Hexane was used as solvent and oil was analyzed by GC-MS method. The samples from fifty local accessions were different in their oil contents 0.04%-0.56%. The essential oil was characterized by the presence of 20 different compounds out of which α–pinene, α-phellandrene, limonene, fenchone, methylchavicol and trans-anethole were the main compounds. Fifty accessions of fennel differed strongly in their morphological traits and agronomic yields. The accessions with more height (120-129 cm),

MP00164, MP00183, MP00280, MP00293, MP00307, MP00526, MP00557, MP00769, MP0001061 and MP00483 were found to have high oil contents and more number of umbels mainly due to a considerable presence of secondary inflorescence. The same accessions were also characterized by more biomass and a higher percentage of umbels. The relation among the different characteristics evidenced that fennel with high oil contents could be identified with a type characterized by a tall plant with numerous umbels and late flowering stage as correlation of oil contents with morphological characters showed. The difference observed can be mainly attributed to genetic factors.

PROMOTING THE GERMINATION OF *Zinnia elegans* SEEDS BY PRIMING WITH HYDROGEN PEROXIDE

Irfan Afzal[1]*, Shahid Ashraf[2], Muhammad Qasim[2] and Aamir Nawaz[3]
[1]Department of Crop Physiology, University of Agriculture, Faisalabad, Pakistan
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[3]Collegge of Agriculture, Bahauddin Zakariya University, Multan, Pakistan
*Email: irita76@yahoo.com

Hydrogen peroxide (H_2O_2) promotes seed germination of cereals and several mechanisms have proposed for its action. The present study was conducted to investigate the possible role of H_2O_2 on the rate of germination and seedling growth of *Zinnia elegans* (cv. Dahlia flowered formula) seeds. Seeds were imbibed by soaking in aerated solution of H_2O_2 (80, 120 and 140 µM) for 24 h and were dried back to their initial moisture contents. Seeds subjected to various concentrations of H_2O_2 significantly enhanced seedling vigor by reducing days to 50% germination, mean germination time and increasing final germination percentage, fresh and dry weight of seedlings. Among all the seed treatments, priming with 140 µM H_2O_2 proved to be the most effective seed treatment in triggering germination. These findings indicate that H_2O_2 plays an important role in oxidation of germination inhibitor(s) present in the pericarp of the seed.

EFFECT OF DIFFERENT CORM SIZES ON THE PERFORMANCE OF *Gladiolus grandiflorus* CVS. RED MAJESTY AND WHITE FRIENDSHIP

Shoaib-ur-Rehman*, M. A. Khan, Karim, A. and Karim Yar Abbasi
Institute of Horticultural Sciences, University of Agriculture Faisalabad
*Email: shoaib_rehman217@yahoo.com

The effect of corm sizes on the performance of *Gladiolus grandiflorus* cvs. Red Majesty and White Friendship were studied by using the combination of corm sizes (1.0-1.5, 2.0-2.5 and 3.0-3.5 cm). Corm sizes have significant influence in all parameters studied. As for as growth characteristic is concern large corms (3.0-3.5 cm) took shorter time to complete 96.67% in Red Majesty 93.52% in White Friendship variety but Sprouting percentage increased with increase in corm size and in case of plant height and number of leaves plant^{-1} maximum plant height and number of leaves were found in (3.0-3.5 cm) which were 56.02 cm and 7.720 leaves plant^{-1} which were found in Red Majesty. Plant height and number of leaves were increased with increased in corm size. In case of flower characteristic less number of days required for flowering with maximum intact life were found in corm sizes (2.0-2.5 cm) which were 109 days for flowering

with 22.12 days intact life whereas maximum number of spikes, thickness of spike, length of spike and number of florets plant^{-1} were found in corm size (3.0-3.5 cm) witch were (1.0 spike, 1.023 cm thick, 47.55 cm long and 8.317 florets plant^{-1}) in both the varieties but a clear trend was found that all these parameters increased with increased in corm size. Similarly for corm characteristics maximum number of cormels (8.767 cormels plant^{-1}) with (5.9 cm) diameter corm size were found in corm size (3.0-3.5 cm) in both the varieties but corm size also increased in treatments (1-1.5 and 2.0-2.5 cm).

CARNATION CUTTING ROOT INITIATION EVALUATION, PLANTED IN POTS, POLYETHYLENE TUNNEL AND UNDER HYDROPONIC ENVIRONMENT

M.S. Yaqub[1]*, R. Muhammad Iqbal[1] and M.J. Jaskani[2]
[1]College of AgricultureandEnvironmental Sciences, The Islamia University of Bahawalpur, Pakistan
[2]Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan
*Email: citsyk@yahoo.co.in

Carnation plants were evaluated for their root initiation under different environmental conditions .In one experiment cuttings were planted in pots and placed in open area. In second experiment cuttings were planted in medium height tunnel. In third experiment cuttings were planted in low height tunnel. In fourth experiment cuttings were planted in glass containers of four different colors i.e, black, blue, green and colorless. Maximum root initiation was found in low height tunnel. Poor root initiation was observed in pots and medium height tunnel. Black color showed good root initiation, Green and blue medium and colourless poor in hydroponic environment.

INDUCTION OF EARLY FLOWERING IN LILIUM AND ITS SCOPE

M.S. Yaqub[1]*, R.M. Iqbal[1] and Waqar Ahmad[2]
[1]College of Agriculture and Environmental Sciences, The Islamia University of Bahawalpur
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: citsyk@yahoo.co.in

Lilium species are true lilies.They are native to the islands south of Japan. Lillies command the spring- flower market and are called Easer lilies. Asiatic hybrids derived mainly from Chinese species. Thousands of hybrids have been produced by American and Dutch. Some hybrids were purchased from local market for the evaluation of their flowering in winter .After planting in pots they were placed in the open in October. Flowering started in the month of January and remained available up to first week of February. In the peek season one lilium cut flower stick sales for Rs. 150 whereas early produce may give higher price due to shortage of other flowers during January.

MORPHO-ANATOMICAL VARIATIONS IN *Dracaena* AND *Cordyline* SPECIES AND CULTIVARS IN RELATION TO TAXONOMY

Mansoor Hameed[1]*, Rashida Perveen[1], Atif Riaz[2] and Adnan Younis[2]
[1]Department of Botany, University of Agriculture, Faisalabad
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad
*Email: drsaif@super.net.pk

Several species and cultivars of *Dracaena* (Dracaenaceae) and *Cordyline* (Asteliaceae) have been introduced in the Faisalabad region in the recent years; however, identification of this material is relatively difficult and confusing. Anatomical tools were used in an attempt to resolve this complexity in taxonomy of both *Dracaena* and *Cordyline*. Anatomical variations provided some solid solutions for the identification and categorization of these complex groups. Many anatomical characteristics were specific for species, and even for cultivars.

MAXIMIZATION OF GLADIOLUS (*Gladiolus alatus*) CORMS PRODUCTION THROUGH SOIL AMENDMENTS

Nadeem A. Abbasi, Abdul Rehman Khan, Ishfaq A. Hafiz* and Touqeer Ahmad
Department of Horticulture, University of Arid Agriculture, Rawalpindi, Pakistan
*Email: decenthafiz60@yahoo.com

A research project was executed to find the suitable method of soil amendment for maximization of gladiolus corms production at Horticulture Research Farm of the UAAR. As Gladiolus is a bulbous crop which requires well drained and loose soil, so the clayey soil of was amended with sand and Farm Yard Manure to facilitate the corm development or cormel formation. The results showed that maximum numbers of cormels were produced with CV1 and S_{13} (FYM +Sand @ 24 +36 tonnes acre^{-1}). The maximum weight of corms was also recorded with CV1 and S13 (FYM + Sand @ 24+36 tonnes acre^{-1}). The maximum leaf area was recorded with S_{13} (FYM + Sand @ 24+36 tonnes acre^{-1}). The maximum number of flowers per plants was observed in S_{13} (FYM +Sand @ 24+36 tonnes acre^{-1}). The maximum weight of cormels was obtained with S_{13} (FYM +Sand @ 24 +36 tonnes acre^{-1}). The combination of treatments giving the best results can be recommended to follow at farmer field for good production of gladiolus cormels. Minimum levels of all parameters were recorded from the plants grown in the plots where no soil amendment (FYM or sand) was added. It leads to conclude that soil amendment in clayey soils is essential for good production of gladiolus bulbs.

EFFECT OF VARIOUS SUCKER SIZES AND PLANTING TIMES ON GROWTH AND FLOWER YIELD OF CHRYSANTHEMUM

Aamir Nawaz, Shaeena Gul, Muhammad Akbar Anjum* and Farrukh Naveed
Department of Horticulture, University College of Agriculture, Bahauddin Zakariya University, Multan-60800, Pakistan
*Email: anjumbzu@yahoo.com

Small and large sized suckers of *Chrysanthemum morifolium* were planted on four different dates, i.e. 18th February, 18th April, 17th June and 16th August to find out their effect on growth and flower yield. Plants resulting from small sized suckers produced significantly higher number of

primary and secondary branches and leaves per plant. However, plant height, leaf area, number of suckers produced, biomass (fresh plant weight), juvenile period and flower yield per plant were not affected by the sucker sizes. As the planting was delayed, plant growth and flower yield was reduced. Early plantings resulted in increased plant height, more number of branches and leaves per plant, greater biomass, prolonged juvenile period and higher flower yields but in reduced leaf area as compared to late plantings. On the basis of these results, it was concluded that for raising chrysanthemum, small size suckers performed better when planted out in early spring.

SUCCESSFUL CULTIVATION OF *ROSA CENTIFOLIA* UNDER FAISALABAD CLIMATIC CONDITIONS

Muhammad Tariq Iqtadar*, Muhanmmad Saeed and Muhammad Yunus
Horticultural Research Station for Floriculture and Landscaping, Faisalabad, Pakistan
*Email: horticulturistaari@yahoo.com

There is great scope of conversion of raw materials of floricultural commodities into prepared items for value addition of the farmers' net returns. *Rosa centifolia* is one of such crop that can serve the purpose of value addition nicely. Its flowers can be successfully utilized for essential oil extraction as well as for making other by products like rose water and Gulkand in addition to other medicinal uses. Thus small and big land holders can equally benefit themselves from the cultivation of this crop. Its cultivation is also meant to exploit the indigenous resources of flowers grown in open thus minimizing dependency upon foreign resources. Some years back this crop was not much popular among farmers due to lack of knowledge. But now this is gaining popularity owing to its many fold benefits. In this regard some studies were carried out in Faisalabad climatic conditions in two systems of irrigation, viz. drip and flood. Month wise data were collected on plant height, number of flowers per plant, and fresh weight of flowers. Number of flowers per plant was 448.04 and 496.32 in drip and flood irrigation systems and plant height was 136.78 cm and 145.60 cm respectively. The fresh weight of flowers varied from 1.51 gram to 2.19 gram in different months. Overall performance of the crop was quite encouraging.

QUALITATIVE AND QUANTITATIVE RESPONSE OF TWO MARIGOLD CULTIVARS (*Tagetes erecta* AND *Tagetes patula)* FOR DIFFERENT LEVELS OF NITROGEN

Karim Yar Abbasi*, Malik, A. U. Naveed M and Shoaib ur Rehman
Medicinal and Aromatic Plants Section Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan
*Email: karimyar2003@gmail.com

From medicinal point of view, both leaves and flowers of marigold are equally important. Leaf paste is used externally against boils and carbuncles. Leaf extract is good remedy for ear ache and fungicidal effect. High levels of dietary lutein from marigold extract can inhibit mammary tumor development and increase immunity against cancer in BALB/c mice. The dried flower petals are used externally in oils and in ointments in the treatment of wounds and old scars. There is growing interest in cultivation of medicinal crops; however, production technology packages for good yields of high quality produce are not available. A field experiment was carried out at the Herbal Garden of University of Agriculture, Faisalabad, to study the effects of different nitrogen levels on growth, yield and quality of marigold (*Tagetes erecta)* cultivars. The experiment was

laid out in randomized complete block design (RCBD) by using three replications and four treatments. Experiment comprised of four nitrogen levels (0 kg ha^{-1}, 56 kg ha^{-1}, 112 kg ha^{-1}, 168 kg N ha^{-1}) and two cultivars viz, *Tagetes erecta and Tagetes patula.* The application of nitrogen at 112 kg ha^{-1} significantly increased plant height, fresh weight, leaf/stem ratio, leaf + flower/stem ratio, flowers quality and herbage (biomass) yield of both cultivars. All the collected data analyzed statistically by using the Fisher's analysis of variance technique and LSD at 5% probability to compare the differences among treatments means.

EFFECT OF DIFFERENT LEVELS OF NITROGEN AND PHOSPHORUS FERTILIZERS ON GROWTH AND YIELD OF FENNEL (*Foeniculum vulgare*)

Karim Yar Abbasi*, Farooq M, Naveed M and Aman Ullah Malik
Medicinal and Aromatic Plants Section, Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan
*Email: malikaman1@gmail.com

Fennel is a very important medicinal crop which is used in folk medicine as a stimulant, antibacterial, diuretic and carminative. Fennel is also considered as a spice due to terpenic compounds isolated from its fruit's volatile oil. A field experiment was carried out at the Herbal Garden of University of Agriculture, Faisalabad, to study the effects of different levels of nitrogen and phosphorus on growth and yield of fennel. The experiment laid out in randomized complete block design (RCBD) by using four replications and five treatments. Experiment comprised of five combinations of nitrogen and phosphorus levels ($N_0 P_0$, $N_{30} P_{120}$, $N_{60} P_{90}$, $N_{90} P_{60}$ and $N_{120} P_{30}$ kg ha^{-1}). The application of 90 kg ha^{-1} nitrogen and 60 kg ha^{-1} significantly increased plant height, shoot length, no flowers of shoot/root ratio and fruit size. All the recorded data analyzed statistically by using the Fisher's analysis of variance technique and LSD at 5% probability to compare the differences among treatments means. This paper provides complete account of above studies.

PRODUCTIVE AND QUALITATIVE RESPONSE OF MARIGOLD TO DIFFERENT LEVELS OF NITROGEN AND PHOSPHOROUS FERTILIZERS

Muhammad Irfan Ashraf*, M. Aslam khan and Tahir Saeed
Institute of Horticultural Sciences, University of Agriculture Faisalabad
*Email: irfanflorist199@yahoo.com

Effect of nitrogen and phosphorous was studied on growth and flowering of Marigold Cultivar (Double Super Giant). Urea and SSP in different combinations showed significant results on plant height, number of branches per plant, number of leaves per plant, number of flowers per plant and quality of flowers as compared to single and control. Size of flowers was significantly increased by the application of Urea with the combination of SSP in proper amount while Urea and SSP did not affect the size of flowers when used singly.

IMPROVEMENT OF *Trigonella maritima* L. GERMINATION BY POLYPLOÏDISATION

Rabiaa Haouala*, Saloua Ouerghemmi and Mohamed Béji
Higher Institute of Biotechnology of Monastir, Tunisia
*Email: rabiahaouala@yahoo.fr

The germination is a very important stage in the development of plants. Several methods tried to improve the germination of seeds. In this study, we tried to see the effect of the polyploïdisation by colchicine on the germinal power of the seeds of *Trigonella maritima*. Plantules of *T. maritima* is immersed in a solution of colchicine at 0.05% during 4 hours then planted in pots in the natural conditions. The seeds of these plants are recuperated and were compared with the seeds of plants untreated. The results show that the colchicine provokes a significant increase of the size and the weight of seeds. The percentage and the kinetics of the germination are significantly improved. The percentage of germination of the seeds of plants myxoploïdes is 95% compared with that of the seeds of diploid plants which is only 30%.

DOES HALOPRIMING IMPROVE GERMINATION AND SEEDLING VIGOR IN MARIGOLD (*Tagetes* spp.) SEEDS

Muhammad Qasim[1], Shahid Ashraf[1] and Irfan Afzal[2]*
[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[2]Department of Crop Physiology, University of Agriculture, Faisalabad, Pakistan
*Email: irita76@yahoo.com

Marigold is one of the important annual flowers grown for commercial purposes in Pakistan. There is a rapid decline in vigor and viability of marigold seeds under ambient storage conditions, from April to October in Pakistan. Little information has been reported on seedling development of marigold subsequent to priming. A laboratory study was conducted to investigate the influence of various priming strategies with osmotica (50 mM $CaCl_2$, 50 mM NaCl and 50 mM KNO_3) on germination and seedling growth of African and French marigold seeds. During germination test, halopriming with 50 mM $CaCl_2$ for 24 h maximally increased final germination percentage, germination index, fresh and dry weights of seedlings of both marigold species as compared to all pre-sowing seed treatments including control. Seeds of both marigold species primed with 50 mM $CaCl_2$ for 24 h significantly reduced mean emergence time and days to 50% emergence, increased emergence uniformity, and final emergence percentage, however, halopriming with NaCl and KNO_3 for 24 h failed to improve seedling growth of both marigold species. The findings of this study will be important in understanding the direct physiological effect of $CaCl_2$ in enhancing seed vigor and stand establishment in marigold.

STUDIES ON DISTRIBUTION, INTENSITY AND POPULATION OF PLANT PARASITIC NEMATODES ASSOCIATED WITH ORNAMENTAL PLANTS

S.P. Goswami, M.A. Pathan, M.M. Jiskani, K.H. Wagan and M.I. Khaskheli*
Department of Plant Pathology, Faculty of Crop Protection, Sindh Agriculture University, Tando Jam
*Email: mikhaskheli@yahoo.com

Six species of plant parasitic nematodes viz. *Meloidogyne incognita, M. javanica, Hoplolaimus galeatus, Helicotylenchus dihystera, Xiphinema brevicolle* and *Trichodorus christiei* were isolated from soil and root samples of different ornamental plants. Maximum disease prevalence of *M. incognita* and *M. javanica* was observed at Hyderabad (80.15 and 40.55%) followed by Hala (65.35 and 25.15%), and Tandojam (62.30 and 30.15%), while minimum for *M. incognita* at Rashidabad (52.5%) and that for *M. javanica* at Tando Jan Muhammad (50.40%). Inoculum density of juvenile of *M. incognita* was highest at Hyderabad (2.80), Hala (2.15) and Tandojam (2.10) and lowest at Rashidabad (1.40), and that for *M. javanica* was highest at Tando Jan Muhammad (1.70). Relative density of *M. incognita* and *M. javanica* was also increased at Hyderabad (17.85 and 10.50). Population density of *M. incognita* and *M. javanica* increased on croton (91.67 and 21.44) followed by rose (51.33 and 13.82), Aklifa brown (45.81 and 55.89) and Nazboo (40.80 and 51.32). The intensity of *Hoplolaimus galeatus* and *Helicotylenchus dihystera* was also increased at Hyderabad and decreased at Rashidabad. Population of *Hoplolaimus galeatus* also highest on croton in soil and root samples (81.42 and 76.39) as compared to rose (56.87 and 49.76), Aklifa (44.72 and 34.01) and Nazboo (30.23 and 26.99), respectively.

INVESTIGATION ON FUNGAL CONSTRAINTS OF CARNATION IN PUNJAB, PAKISTAN

Salik Nawaz Khan* and Tariq Riaz
Department of mycology and plant pathology, University of the Punjab Quaid-e-Azam Campus, Lahore-54590
*Email: salik_nawaz@yahoo.com

Consumption of cut flowers is going to increase day by day in Pakistan. It is related with the rising living standards, education and electronic media that have promoted this business recent years. Carnation (*Dianthus caryophylium* L.) is cultivated as cut flower as well as potted plant in Punjab. It is frequently used in bouquet throughout the Province. Most of the grower cultivates red and white color varieties for their beautiful cyme inflorescence. But due attention on their biotic and abiotic constraints in production and quality is still a dilemma A field survey was conducted during the November 2005 to November 2006 to find the fungal problems of this economically floral crop. *Fusarium oxysporum* and *Botrytis cinerea* were found to be effective fungal pathogens. *Fusarium oxysporum* cause wilting that results collapse of floral petals and *Botrytis cinerea* produces leaf spots and causes bud rot if conditions are relatively humid. Ten to Twelve percent losses were recorded when field was attacked by any of these pathogens.