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Updated 4th June, 2013 (ordered alphabetically, unless in press)

🌱 Food

SPECIAL ISSUE: Tunisian fruit and vegetables. Guest Editor: Riadh Ilahy (Université 7 Novembre à Carthage, Laboratory of Biotechnology and Plant Physiology, National Agricultural Research Institute of Tunisia, Ariana, Tunis, Tunisia) ~ 2013

Chafik Hdidar, Riadh Ilahy, Imen Tlili (Tunisia), Marcello Salvatore Lenucci, Giuseppe Dalessandro (Italy) Effect of the Stage of Maturity on the Antioxidant Content and Antioxidant Activity of High-pigment Tomato Cultivars Grown in Italy (pp 1-7)

ABSTRACT

Original Research Paper: Lycopene has attracted much interest during the last few years because of its antioxidant activity against free radicals, suggesting protective roles in reducing the risk of several chronic diseases. Therefore, tomato cultivars, with increased lycopene content have been developed. However, a detailed assessment of their nutritional value remains scarce in literature. In this study, the effect of the stage of maturity on the antioxidant content and activity of six high-lycopene tomato cultivars ('Lyco 1', 'Lyco 2', 'HLY 02', 'HLY 13', 'HLY 18' and 'Kalvert') and one ordinary ('Donald') was determined. The pattern of change in lycopene and β -carotene was similar in all tomato cultivars, although quantitatively higher in high-lycopene tomatoes. In those cultivars, lycopene and β -carotene were respectively 1.68- to 3.7-fold and 2.11- to 2.48-fold higher during ripening compared to 'Donald'. The lipophilic antioxidant activity was well correlated to the lycopene and β -carotene contents. The pattern of change in total phenolic, flavonoid and total vitamin C was cultivars dependent. At the red ripe stage, 'HLY 13' showed the highest total vitamin C and flavonoid contents. However, 'HLY 02' showed the highest total phenolic content. The hydrophilic antioxidant activity was only well correlated to the phenolic and flavonoid contents.

Mehdi Trad, Wissal Dhifi, Brahim Marzouk, Messaoud Mars (Tunisia) Aroma Composition in Relation with Quality of 'Peento' Flat Peach during Fruit Development (pp 8-12)

ABSTRACT

Original Research Paper: 'Peento' flat peach (*Prunus persica* L.), increasingly encountered in Tunisian agrosystems, is characterized by tasty and flavoured fruit with a marked and specific aroma that develops when ripe. Volatile compounds of 'Peento' peaches were separated using liquid-liquid extraction with pentane and di-ethyl ether and analysed by gas chromatography/flame ionisation detection (GC/FID). Peach samples produced an average of 3674 μ g aroma/g fresh weight (FW) at full ripeness. Lactones was the major class of volatiles described with δ -dodecalactone as the main compound (18.4%) followed by δ -undecalactone (15.3%). Other constituents, including ketones (2), esters (1), alcohols (1), monoterpenes (1) and sesquiterpenes (1), were also identified. 'Elegant Lady' fruits, gathered during the same period, produced 2072 μ g aroma/g FW. Methyl isovalerate (13.0%) and δ -undecalactone (7.9%) were the major compounds identified. δ -Dodecalactone was less abundant in the fruit aroma (3.3%) compared to flat peaches. Changes in volatile composition showed a significant increase until maturity. Besides, volatile concentrations decreased. Lactones, the greatest contributors to the peachy note, continued to rise independently of total volatiles produced. The quality of 'Peento' flat peach is influenced by its aroma composition, in particular to the level of lactones in the parenchyma. The date of harvest seemed to be of great importance in preserving fruit quality attributes. Physiological maturity is considered to be the optimal time for harvest. Anticipated as well delayed harvest could result in a dramatic loss of scent and aroma developed by the fruit. The emission of volatile compounds appears to be a useful index for determining the physiological maturity of 'Peento' peaches in an orchard prior to harvest.

Mounira Harbi, Imen Tlili, Rym Bouhlal, Sami Fattouch (Tunisia) Sugars and Total Phenolic Contents in Different Fractions of Autochthonous Grape Varieties Grown in Tunisia (pp 13-16)

ABSTRACT

Original Research Paper: Grapes (*Vitis vinifera* L.) is one of the economically important fruit in the world and the important quality determining parameters of it are sweetness related compounds and antioxidants. In this experiment, reducing sugar, total sugar and phenolic contents were quantified in different parts (peel, pulp, and seeds) of 15 grape varieties: ('Muscat de RafRaf', 'Rafrafi', 'Boukhasla', 'Farrani', 'Bith El H'mem', 'Hammémi', 'Kohli', 'Chaâraoui', 'Vieux Beldi', 'Razzégui', 'Farranah', 'Bith El H'mem Rose', 'Essifi', 'Marsaoui' and 'Bézoul El Khadem'). Significant differences were found between grape varieties within different parts in total sugar, reducing sugar and phenolic contents. 'Muscat de RafRaf' variety showed the highest amount of total sugar (12.28 g 100 g⁻¹ FW), reducing sugar (7.43 g 100 g⁻¹ FW) and phenolic contents (28.33 mg EAG g⁻¹ FW). The pulp of grapes showed high reducing and total sugar contents. The total phenolic content varied between 0.47 and 80.93 mg EAG g⁻¹ FW. Seeds had a greater phenolic compound content, between 18.09 and 80.93 mg EAG g⁻¹ FW, which was higher than those of other fruit parts.

Imen Henan, Imen Tiili, Riadh Ilahy, Thouraya Rhim, Hager Jebari (Tunisia) Evaluation of Qualitative Parameters and Physicochemical Properties of Local Varieties of Muskmelon (*Cucumis melo* L.) Grown in Tunisia (pp 17-21)

ABSTRACT

Original Research Paper: The quality characteristics, carotenoids and total phenolic contents of muskmelon cultivars (*Cucumis melo* L.) were investigated. Four local muskmelons varieties ('Maazoul', 'Galaoui', 'Stambouli', and 'Fakkous') were evaluated for their agronomic characteristics, total carotenoids and total phenolic contents. Significant differences were found between muskmelon varieties in carotenoid and phenolic contents. Total carotenoid content ranged from 1.15 in 'Maazoul' to 12.82 mg kg⁻¹ FW in 'Galaoui'. The highest phenolic value (474.42 mg kg⁻¹ FW) was shown by 'Galaoui'. Generally, highest content of carotenoid and total phenolics were obtained for 'Galaoui' variety. In fact, total carotenoid content obtained in 'Galaoui' was more than 12-fold higher than those obtained in 'Maazoul'. This study demonstrates that carotenoid and total phenolic contents were greatly influenced by genotype emphasizing the need to evaluate the muskmelon biodiversity in order to improve its nutritional value.

Imen Tiili, Chafik Hdider, Riadh Ilahy, Thouraya R'him, Hager Jebari (Tunisia) Effect of Growing Period on the Agronomic Characteristics and Phenolic Content of Different Watermelon (*Citrullus lanatus* (Thunb.) Mansfeld) Cultivars Grown in Tunisia (pp 22-26)

ABSTRACT

Original Research Paper: Besides some agronomic characteristics, total phenolics and flavonoid contents of different watermelon cultivars (*Citrullus lanatus* (Thunb.) Mansfeld), as influenced by two growing periods, were investigated. Fruits from plants grown under low plastic tunnel and open-field conditions were collected. Five watermelon cultivars (four commercial cultivars namely 'Crimson Sweet', 'Dumara', 'Giza', 'Aramis', and a new selection 'P503' produced by the National Agricultural Research Institute of Tunisia) were compared. The growing period significantly influenced yield, soluble solids, total phenolics and flavonoid contents of all investigated watermelon cultivars. The total phenolics in the watermelon cultivars ranged from 122.81 to 200.69 mg GAE kg⁻¹ FW in early and full seasons, respectively. The flavonoid content ranged from 150.60 to 226.44 mg RE/kg FW in early (January - May) and full (March - July) seasons, respectively. The mean total phenolics and flavonoid contents of the five cultivars was 62 and 66% higher, respectively, in full season than in early season. This study indicates that the total phenolics and flavonoid contents of watermelon can vary considerably with changes in environmental conditions.

Thouraya R'him, Riadh Ilahy, Imen Tiili, Khamassy Nouri, Jebari Hager (Tunisia) The Effect of Salinity on Some Growth and Yield Parameters of Three Pepper (*Capsicum annum* L.) Varieties Grown in Tunisia (pp 27-31)

ABSTRACT

Original Research Paper: Pepper is one of the main vegetable crops grown and consumed in Tunisia and is therefore of economic importance. Interest in the selection of salt-tolerant crop is increasing due to the decrease of water irrigation quality worldwide. Therefore, some growth and yield parameters of three pepper cultivars 'Baker', 'Marconi' and 'Jrid' commonly grown in Tunisia and with different pungency were determined under three different salinity levels (S1=35, S2=70 and S3= 120 mM of NaCl) with regard to a control irrigated with tap water. All the growth and yield parameters varied significantly among the studied salinity levels. No statistical differences were found in stem thickness, plant height, shoot fresh weight and root fresh weight under all the studied salinity levels and for all the studied pepper cultivars. Under (S3) salinity level, yield was decreased by

75% in 'Jrid', by 81% in 'Baker' and by 100% in 'Marconi'. The blossom-end rot increases with increasing salinity levels in 'Baker' and 'Marconi' however no rotted fruit were observed in 'Jrid' under all the studied salinity levels. This study has demonstrated the variability in the responses of some pepper cultivars commonly grown in Tunisia to different salinity levels. This result can help the growers to choose such varieties in salt-rich fields or when only saline water should be used for crop irrigation. Nevertheless, there is a need to focus on the effect of these salinity levels on the nutrient, non nutrient, anti-nutrient compounds accumulation and the antioxidant activity in such cultivars.

Riadh Ilahy, Thouraya R'him, Imen Tlili, Jebari Hager (Tunisia) Effect of Different Shading Levels on Growth and Yield Parameters of a Hot Pepper (*Capsicum annuum* L.) Cultivar 'Beldi' Grown in Tunisia (pp 32-35)

ABSTRACT

Original Research Paper: Pepper is one of the main vegetable crops grown and consumed in Tunisia and is therefore of economic importance. In Tunisia, 19400 ha were dedicated to this crop and its production amounted to 304000 t in 2010. Pepper production (crop yield and quality) in some Mediterranean regions is negatively affected by the high radiation, temperature and relative humidity particularly during spring-summer harvesting period. The use of shading screen is thought to be an efficient solution to overcome this problem and to improve pepper growth and yield. Therefore, the aim of this study was to evaluate the effect of different levels of shading on growth and yield parameters of the hot pepper (*Capsicum annuum* L.) cv 'Beldi'. For this reason, two shading levels were evaluated in order to attain 50% and 100% shading which compared to open field conditions (control 0% shading). The 50% and 100% shading levels, respectively increased total plant height by 15% and 30%, internode length by 31% and 47%, leaf area by 30% and 40%, and plant yield by 5% and 24% relative to non-shaded conditions. However, 50% and 100% shading decreased the incidence of blossom end rot by 30% and 69%, respectively relative to non-shaded pepper plants. A microclimate may have been created by the shading conditions, particularly under 100% shading, during the hottest summer period (June, July and August), has improved the vegetative growth and by extending plant physiological activity.

Leila Radhouane, Sami Fattouch, Imen Tlili, Riadh Ilahy (Tunisia) Antioxidant and Polyphenol Oxidase Activity of Some Tunisian Pearl Millet (*Pennisetum glaucum* (L.) R.Br.) Ecotypes (pp 36-40)

ABSTRACT

Original Research Paper: Pearl millet is a rich source of various phytochemicals, including phenolic acids. Natural compounds in food are an important health-protecting factor. In Tunisia, many autochthonous pearl millet ecotypes have generated interest because their nutritional qualities. In order to provide information on the composition of pearl millet grown under local conditions, seven ecotypes were analyzed to evaluate their nutraceutical and antioxidant properties. The nutraceutical properties were determined by evaluating the total phenolic while the antioxidant properties were studied using the DPPH free radical scavenging activity. The results showed that the total phenolic varied widely between ecotypes (from 198 to 323 mg GAE/100 g). The DPPH radical scavenging activity of all the ecotypes was relatively high. The antioxidant activity of pearl millet flour significantly varied among ecotypes and ranged from 62.5 to 86.4%. Fractionation of phenolic extracts by HPLC showed 3 major peaks and several minor peaks: *Trans*-cinnamic (486 to 677 µg/g of extract), protocatechic (127 to 452.4 µg/g of extract) and hydroxybenzoic (253.5 to 437.6 µg/g of extract) were the most important. Identifying ecotypes growing under local agricultural conditions with significant levels of beneficial factors could not only provide health benefit to consumers but also promote the value-added cultivation and stimulate industrial and economic growth.

Hatem Ben Mohamed, Ahlem Zrig, Habib Khemira (Tunisia) Effect of Date of Spraying CPPU (Sitofex®) on Fruit Quality of 'Meski' Table Grapes (pp 41-43)

ABSTRACT

Short Communication: The objective of this study was to evaluate the effect the synthetic cytokinin forchlorfenuron, most commonly known as CPPU (Sitofex®), on fruit quality of 'Meski' table grape grown in central Tunisia. Application of 1% CPPU was performed at 1 (A), 2 (B) and 3 (C) weeks following full bloom. All treatments enhanced berry size, berry weigh and bunch weight by at least 10, 17% and 20% respectively, while bunches length improved slightly ($P = 0.15$). In addition, the number of berries per bunch was increased only by treatments A and B. Yet, these two treatments significantly increased fruit set which produced very compacted and unmarketable bunches. On the other hand, CPPU application reduced °Brix and pH of bunches juice and then delayed maturity which can be advantageous in fresh market fruit. In conclusion, the best results with regard to

fruit size and quality of 'Meski' table grape were obtained when CPPU was sprayed at 1% (v/v) three weeks after full bloom. However, early applications will be more advantageous if combined with a growth regulator that allowed better growth of the rachis.

Chafik Hdider, Riadh Ilahy, Imen Tlili, Nasr Abdelaali (Tunisia) Agronomic Characteristics and Physicochemical Properties of Selected *Citrus* Cultivars Grown in Tunisia (pp 44-46)

ABSTRACT

Short Communication: *Citrus* is a popular horticultural crop. Interest in assessing agronomic and bioactive compounds with antioxidant capacity and potential health benefits in *Citrus* is increasing. Besides some agronomic characteristics, the variability in total carotenoids and lycopene contents of ten *Citrus* cultivars (five oranges including the pigmented cultivars 'Moro', 'Tarocco', 'Sakasli', and 'Maltaise', 'Demi Sanguine' and the blond cultivar 'Maltaise Blonde'; two mandarins 'Fortune' and 'Minneola'; one citron 'Marsh'; one pomelo 'Star Ruby'; and one Clementine 'Hernandina' were investigated. The results showed significant differences in total carotenoids and lycopene contents between *Citrus* cultivars. Total carotenoid content ranged from 5.33 mg/kg FW in 'Hernandina' to 23.66 mg/kg FW in 'Star Ruby'. Lycopene content ranged from 0.27 mg/kg FW in 'Maltaise Blonde' to 17.93 mg/kg FW in 'Star Ruby'. Therefore, the highest total carotenoids and lycopene values were shown by the pomelo 'Star Ruby'. This study demonstrates that the amount of total carotenoid and lycopene was influenced by genotype, emphasizing the need to evaluate *Citrus* biodiversity in order to improve its nutritional value and to contribute towards increasing the intake of antioxidants.

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Chris O. Ojiewo (Tanzania/Malawi), Omary Mbwambo, Ignas Swai, Silvesta Samali, Mansuet S. Tilya, Ruth N. Mnzava, Leon Mrosso, Ruth Minja (Tanzania), Mel Oluoch (Malawi/Nigeria) Selection, Evaluation and Release of Varieties from Genetically Diverse African Nightshade Germplasm

ABSTRACT

Original Research Paper: Leaf yields of African nightshades are lower than their optimal potential, partly due to lack of improved varieties. Field evaluation of selected African nightshade lines was conducted in Arusha, Tanzania to identify superior lines for variety release, registration and promotion. Three field trials were carried out from August 2007 to January 2008, April to October 2008, and August 2008 to January 2009. Lines SS52 and BG16 had significantly higher leaf yields in trial 1 with 33 and 30 t/ha and in trial 2 with 14 and 17 t/ha, respectively; while in trial 3, lines BG 16 and BG 21 had the highest leaf yields of 24 and 15 t/ha, respectively. These results were confirmed with earlier studies and nine promising lines were selected and subjected to multilocational trials across four Agroecological zones in Tanzania between 2008 and 2010. In year 2011, lines BG 16 and SS 49 were officially released and registered as "Nduruma" and "Olevolosi", respectively based on their superior yield and acceptability. "Nduruma" is late flowering and produce large succulent leaves, which accumulate photoassimilates leading to high leaf yields during the vegetative phase and high seed yields during the reproductive phase. It is also sweet tasting. "Olevolosi", on the other hand, is mildly bitter and is most preferred by communities in Tanzania which associate bitterness with medicinal value.

Terkula J. Maga, Michael I. Uguru, Peter E. Ogonna (Nigeria) Variability and Association Studies on Yield and Yield Characters in Aromatic Nsukka Yellow Pepper (*Capsicum annum* L.)

ABSTRACT

Original Research Paper: Two field evaluations were conducted at the Teaching and Research Farm of the Department of Crop Science, University of Nigeria, Nsukka, during the 2009 and 2010 cropping seasons to determine the pattern of genetic variability and character association in Nsukka yellow pepper (*Capsicum annum* L.). A population of Nsukka yellow pepper was assembled from the farmers and sorted into 18 families which were evaluated in 2009 season in progeny rows. Forty nine promising genotypes selected from 2009 study formed the experimental materials evaluated in 2010 season for seven metric characters namely, fruit length, fruit girth, number of fruits per plant, single fruit weight, plant height, number of leaves per plant, and fruit yield per plant. The descriptive analysis revealed a considerable variability in the population that could warrant initiating a selection programme for its improvement. The simple correlation analysis showed that number of fruits per plant correlated significantly ($P = 0.01$) with fruit yield, while the association of fruit yield and other traits were positive but non-significant in 2009.

In 2010, correlation analysis showed that number of leaves per plant (0.405**), fruit girth (0.477**), single fruit weight (0.683**) and number of fruits per plant (0.745**) were highly correlated with fruit yield, while plant height (0.129) and fruit girth (0.08) had positive but non-significant correlation with fruit yield. This result implied that selection of breeding lines based on number of fruits per plant, single fruit weight, fruit length, number of leaves per plant would significantly increase yield. The results of the path coefficient analyses implicated the number of fruits per plant for exerting the highest direct effects on fruit yield, followed by single fruit weight in both years. Thus, number of fruits per plant and single fruit weight could serve as criteria for selection of yield improvement in *Capsicum* species.

Reem Ahmad AL AbdAlhadi, Samir AL Ahmad, Ammar AL-Mansour (Syria) Combining Ability in Grain Yield and Other Related Traits of Sweet Corn (*Zea mays sacharata* L.) in Syria

ABSTRACT

Original Research Paper: This study aims to estimate the combining ability and heritability of traits such number-of-days-to-50% silking, plant height, ear height and yield per plot through half diallel cross among five sweet corn inbred lines in two locations (Damascus and Tartous) in the Syrian Arab Republic. Highly significant mean square among hybrids at Damascus and Tartous location and over locations in all studied traits has been indicated via analysis of variance. This analysis of variance of the diallel crosses indicated highly significant estimates ($p < 0.01$) of General Combining Ability (GCA) and Specific Combining Ability (SCA) for all traits. The dominance degree showed that non-additive gene action has played the major role in the inheritance of studied traits in each location and over locations; however, additive gene action effects has also played an important role in the inheritance of yield per plot. Then, results revealed that a low narrow-sense heritability value for number-of-days-to-50% silking, plant height and ear height suggested that the effective selection of these traits must be through the late generations (S_5 , S_6), on the other hand the value has been moderate in yield per plot.

Aninda Mandal, Sudha Gupta, Animesh K. Datta (India), Jaime A. Teixeira da Silva (Japan), Siraj Datta (India) Pollen Morphology of Eight *Corchorus* spp. (Tiliaceae) and How Their Interrelationships Aid Efficient Breeding

ABSTRACT

Original Research Paper: A comparative study of the pollen morphology of 8 *Corchorus* (jute) species (Tiliaceae; $2n=14$) namely, *C. capsularis* L., *C. olitorius* L. (cultivated), *C. aestuans* L., *C. fascicularis* Lamk., *C. pseudocapsularis* L., *C. pseudoolitorius* I. and Z., *C. tridens* L. and *C. trilocularis* L. (wild) was performed based on light microscopy (acetolysis technique) and scanning electron microscopy. Pollen grains were found to have the following characteristics: prolate-subprolate; tricolporate, medium sized (24.96 ± 1.31 to $41.28 \pm 1.74 \mu\text{m}$); colpi long (22.41 ± 0.98 to $33.14 \pm 1.12 \mu\text{m}$), extending up to poles, rare often fused, linear and symmetrical or wide and asymmetrical; pore diameter varied from 0.7 to 6.0 μm ; exine thick (2.0 to 3.8 μm), reticulate, reticulation not uniform in size, becoming smaller towards the colpi margin; lumen area ranging from 0.08-1.03 to 0.20-2.03 μm^2 , mostly polygonal, rarely irregular; muri 0.28 to 0.50 μm thick. A key to the identification of the species has been prepared. Statistical methods (principal component analysis and cluster analysis by UPGMA) were employed taking into consideration 28 discrete variables, which revealed distinctiveness between *C. capsularis* and *C. olitorius* which is a hindrance to efficient breeding. However, relatedness among/between species was also studied that may be explored to enhance genetic diversity in *Corchorus* as well as to incorporate desirable trait(s) from wild to cultivated members. An unrooted phylogenetic tree suggested a divaricated mode of evolution of *Corchorus*.

Gurpreet Singh Batth, Hitesh Kumar, Vikas Gupta, Parmjit Singh Brar (India) GGE Biplot Analysis for Characterization of Garlic (*Allium sativum* L.) Germplasm Based on Agro-Morphological Traits

ABSTRACT

Original Research Paper: A breeding strategy in any crop improvement depends upon line selection, either for future varieties or for useful parents for hybridization, must be based on multiple breeding objectives (or traits). It is hypothesized that varieties cannot have any major defects, while parents must have outstanding levels in at least one trait. The objective of this paper is to propose a comprehensive multi-trait selection procedure that coherently combines independent selection. The present study was carried out to characterize a germplasm collection of 25 garlic (*Allium sativum* L.) genotypes representing the Indian collection from different garlic-growing regions, maintained at Punjab Agricultural University, Ludhiana. GGE biplot analyses were used for multi-trait selection to identify accessions on the basis of collective desirable trait combinations in an individual genotype. Seven genotypes (AC-50, AC-200, JG-03-263, PG-17, PG-1, PG-18 and RAUG-5) having combinations of desirable

morphological variation were identified. A trait association study indicated three traits viz. plant height, bulb length and number of cloves per bulb, to be the main determinants of bulb weight. Bulb length and clove length exhibited a maximum positive correlation. Ranking on the basis of overall performance and trait stability analysis of genotypes for the studied traits led to the identification of one genotype PG-18, having a balanced performance for all traits and high yield potential. In addition, PG-1, PG-19, PG-17, NRCWG-2, PG-32, JGL-96-198, PG-30 and NRCRG-1 were also identified as desirable genotypes for the studied characters. This study indicates an extensive range of variability for various desirable traits and would help breeders to select various characters responsible for most of the variation to develop better varieties. Those cultivars possessing desirable traits can be further exploited for securing high yield as well as in targeted breeding.

Arup Chattopadhyay, Sibsankar Das, N. Pandia Rana, Tania Seth, Subrata Dutta (India) Estimation of Genetic Parameters, Inter-Relationships and Genetic Divergence of Vegetable Amaranths

ABSTRACT

Original Research Paper: In the present study, 11 genotypes of vegetable amaranths collected from different places in the country were evaluated for different horticultural traits for genetic variation, character association, cause-effect analysis and genetic diversity. All nine characters under study differed significantly among the genotypes. High to moderate GCV and PCV values were found for shoot weight per plant, green yield per plant, shoot-leaf ratio, leaf weight, numbers of leaf per plant and plant height. Higher estimates of broad sense heritability coupled with higher genetic advance were observed for green yield per plant, shoot weight per plant, leaf weight per plant, shoot-leaf ratio, numbers of leaf per plant and plant height. Association studies revealed that genotypic correlation coefficients were higher than their phenotypic correlation coefficients in most cases. From the correlation and path analysis, it can be concluded that emphasis should be given to shoot weight per plant, stem diameter and leaf-shoot ratio for selecting high yielding genotypes. Based on the degree of divergence the genotypes were grouped into two clusters. The top two characters which contributed most towards genetic divergence were shoot weight per plant and leaf weight per plant. Genotypes belonging to Cluster I could be regarded as useful sources of gene for improving green yield of vegetable amaranths.

Tamene T. Tolessa, Gemechu Keneni, Tadese Sefera, Mussa Jarso, Yeneneh Bekele (Ethiopia) Genotype × Environment Interaction and Performance Stability for Grain Yield in Field Pea (*Pisum sativum* L.) Genotypes

ABSTRACT

Original Research Paper: Fourteen field pea genotypes were evaluated at 16 environments in Ethiopia during 2007 and/or 2008 main cropping seasons. The objective of the study was to determine the magnitude of genotype × environment interaction and performance stability in the field pea genotypes. The study was conducted using a randomized complete block design with 4 replications. Genotype × environment interaction and yield stability were estimated using the additive main effects and multiplicative interaction and site regression genotype plus genotype × environment interaction biplot. Pooled analysis of variance for grain yield showed significant ($p < 0.01$) differences among the genotypes, environments and the genotype × environment interaction effects. This indicated that the genotypes differentially responded to the changes in the test environments or the test environments differentially discriminated the genotypes or both. Environment accounted for 74.3% of the total yield variation, genotype for 4.2% and genotype × environment for 16.4%, indicating the need for spatial and temporal replication of variety trials. The first five bilinear terms of AMMI were found to be significant. The first two multiplicative component terms sum of squares, with their cumulative degrees of freedom of 52, explained 69.1% of the interaction sum of squares. No single variety showed a superior performance in all the environments but genotype EH02-036-2, followed by Coll.026/01-4, demonstrated top ranking at five of the sixteen environments. The application of AMMI and GGE biplots facilitated the visual comparison and identification of superior genotypes, thereby supporting decisions on variety selection and recommendation in different environments.

Asfakun Siddika, A. K. M. Aminul Islam, M. Golam Rasul, M. Abdul Khaleque Mian, Jalal Uddin Ahmed (Bangladesh) Genetic Variability in Advanced Generations of Vegetable Pea (*Pisum sativum* L.)

ABSTRACT

Original Research Paper: An experiment was undertaken to study genetic variability and character association in 26 advanced lines of vegetable pea (*Pisum sativum* L.) based on eight characters. Among twenty six advanced lines twelve obtained from the cross between Edible Podded Pea and IPSA Motorsuty-1, nine obtained from the cross between Local White

and IPSA Motorsuty-3 and five parental lines were included to measure genetic variability. The field experiment was conducted at the research farm, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh. Analysis of variance showed significant differences among the genotypes for all characters. Phenotypic coefficients of variation (PCV) was close to genotypic coefficients of variation (GCV) for all the characters except branches per plant, seeds per pod, pods per plant, 100-seed weight and seed yield per plant. High heritability associated with high genetic advance was observed for plant height, pod length and seed yield per plot. Significant positive genotypic and phenotypic correlation between seed yield per plant and days to 50% harvest, pod length, pod breadth and seeds per pod were observed. Path coefficient analysis revealed that days to 50% flowering, days to 50% harvest, number of branches per plant, pods per plant, seeds per plant and 100-seed weight had positive direct effect on seed yield per plant.

Mohammed K. Hossain, Nazmul Alam (Bangladesh), Jaime A. Teixeira da Silva (Japan), Bhabendra K. Biswas, Gazi M. Mohsin (Bangladesh) Genetic Relationship and Diversity Based on Agro-Morphogenic Characters in Yard Long Bean (*Vigna sesquipedalis* L. Fruw) Germplasm

ABSTRACT

Original Research Paper: Fifty six genotypes of yard long bean (*Vigna sesquipedalis* L. Fruw) were investigated to understand the extent of genetic diversity through 20 agro-morphogenic characters. Analysis of variance revealed significant differences for each character among all 56 genotypes. Mahalanobis' D^2 analysis established the presence of wide genetic diversity among these genotypes through the formation of nine clusters. Cluster V had the maximum number of genotypes (12) while none of the clusters were solitary. Genotypes of different sources fell into the same cluster, indicating that genetic diversity was not concurrent with geographical diversity. The genotypes in cluster I diverged genetically from the genotypes in cluster IX, thus, selection of parents from clusters I and IX would produce progeny which may show homeostasis over changing environments. The biggest cluster V had the highest intra-cluster distance (3.059) and the highest cluster mean for number of pods/plant (3.215), hence, hybridization between genotypes within cluster V could be used to increase the number of pods/plant. The highest cluster mean for yield/plant was recorded in cluster IX (920.050 g). Therefore, genotype BD-1564 from BARI and genotype YB-549 from China appeared as outstanding genotypes in terms of improved yield potential of yard long bean. Among the 20 characters, number of pods/plant contributed most (15.29%) to the total divergence followed by number of racemes/plant (13.13%). Therefore, these characters would respond better under selection. The character, 100-seed weight, contributed least (0.19%) and the contribution offered by yield/plant was also minimum (0.51%) to total divergence. Based on mean performance, genetic divergence and clustering pattern, few genotypes (BD-1595, Tender Green, BD-1564 and YB-549) were considered as potentially important for further breeding programs of yard long bean.

Olaniyi Ajewole Oyatomi, Iyiola Fawole, Babasola Daniel Adewale, Omena Bernard Ojuederie (Nigeria) Genetic Variability in Seed Dormancy, Germination and Germination Enhancement of Some Cassava (*Manihot esculenta* Crantz) Genotypes

ABSTRACT

Original Research Paper: The sustainability of cassava production for food security and agro-industrial demands amidst the growing population and changing global environmental conditions is an interest for breeding programs. The response of cassava seeds to dormancy and germination is a prerequisite for the choice of parents for eventual hybridization. A screen-house experiment was carried out to investigate variations in the dormancy and germination of cassava seeds at the International Institute of Tropical Agriculture (IITA) Ibadan. The study involved a preliminary germination test of seeds of 30 cassava genotypes. Four genotypes ('TMe359', 'TMe1700', 'TMe1747' and 'TMe1945') were selected for a test of probable differential responses to two temperature regimes (45 and 55°C) at three continuous intervals of 5, 10 and 15 days. There were significant differences in the genotypes ($P \leq 0.05$) in days to germination and percentage of germination. Significant differences ($P \leq 0.05$) also existed among the genotypes at different temperatures for days after planting. Each of the four genotypes demonstrated unique quadratic trend response to imbibition in hot water. Wet heat treatment appropriately aided imbibition in the four genotypes studied. Genotypic variation in germination as observed in this study could be a guide for cassava breeders for selection of genotypes with low dormancy as a maternal parent for crosses.

Md. Rahimul Alam, Anil Chandra Deb, Md. Abdul Khaleque (Bangladesh) Joint Regression Analysis of Some Quantitative Characters of F_1 Sugarcane Genotypes

ABSTRACT

Original Research Paper: To determine the magnitude of the genotype-environment ($G \times E$) interaction and stability in sugarcane (*Saccharum officinarum* L.), 10 randomly selected F_1 genotypes were evaluated for two years at three locations in the North-Western zone of Bangladesh. Genotypes were developed from the crosses of North Carolina Design-I at the Bangladesh Sugarcane Research Institute. A joint regression analysis of variance for all the characters showed highly significant genotypic (G) and environment (E) items and their interaction. In most cases, both linear and non-linear regression accounted for the $G \times E$ interaction and the heterogeneity of regression showed non-significance for all characters. The $G \times E$ interaction was due to the slopes of non-linear relationship. Significant remainder but non-significant heterogeneity items makes the situation complex; non-linear type of component like linkage, epistasis etc are played important role in this interaction. The regression analysis of stability showed that genotypes 'G1' and 'G3' for germination percentage, 'G1' and 'G2' for leaf length, 'G5' for number of millable canes per clump, 'G6', 'G7' and 'G8' for leaf breadth, 'G2' and 'G5' for Brix % and 'G4' and 'G9' for cane yield per clump character were the stable genotypes. These might be considered as stable genotypes to the changing environments. Regarding non-significant deviation mean squares (DMS, or $S^2_{d_i}$) and higher or lower regression coefficient (b_i) values some of the genotypes for different characters were recommended for favourable environments or poorly adaptable to all environments. Other genotypes were unpredictable due to their significant DMS values.

Abdelghani Nabloussi (Morocco), Leonardo Velasco, José Maria Fernandez-Martinez (Spain) Cross Pollination of Safflower (*Carthamus tinctorius* L.) under Moroccan Environmental Conditions

ABSTRACT

Short Communication: Safflower crop has a good potential in semiarid areas of Morocco. The knowledge of cross pollination rate in our local environment is of a great interest for designing optimal breeding strategies. No investigation has been carried out before neither in Morocco nor in other north-African countries. Thus, a study was carried out in 2009 at Allal Tazi (Kenitra province) to estimate the rate of cross pollination in safflower using high oleic acid as a biochemical marker. Plants of the high oleic acid cultivar 'CR-6' were surrounded by plants of the cultivar 'Rancho' with standard oleic acid content. The observed average outcrossing rate was 26.6%, ranging from 8.3 to 53.0% at the plant level, and from 0 to 79.2% at single-head level. According to our results, bagging safflower heads before flowering is of paramount importance to ensure self-fertilization in genetic studies and pedigree breeding.