ABSTRACTS OF PAPERS

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I AGRICULTURE

001

GAPS IN OUR PLANT RESEARCHES AND THE URGENCY OF ADEQUATE INVESTMENT

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The achievement of plant scientists in Pakistan have neither been recognized nor their, failures accounted. This is evident by the fact that reaping of bumper harvest have been attributed to favourable climatic condition and the contribution of plant scientists in this regard has been looked upon with doubtful credibility. The constraints in achieving predictable production targets is often ascribed to the unfavourable climatic condition which are fair enough.

In 1980, Pakistan's agricultural GNP was estimated at Rs 66272 million and an investment in plant researches at modest rate of 1% would amount to Rs 662.72 million. Even 1% investment in agricultural sector would have gone a long way in carrying out research and in transferring the research findings to the fields. Most of the developed countries recycle about 2% of their agricultural GNP for achieving self sufficiency in food.

According to an estimate the present population of Pakistan is about 80 million and will be 145million by the end of the centuary. The plant scientists will have to find, in the next twenty years, food for the increasing population. We are, however, gradually becoming deficient in food. At its inception, Pakistan had a per capita potential crop land of about 0.47 ha which has now been reduced to 0.35 ha. due to the rise in population. With the further rise in population food shortages would be most cricital.

An all out effort for increasing food production is absolutely necessary but without adequate investment it is impossible to raise the agricultural output so as to meet the food demands of rising population. This should be a challenge for the Plant Scientists of Pakistan.

002

DELINEATION OF PADDY CROPPED AREA USING SATELLITE REMOTE SENSING DATA

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Satellite Remote Sensing (SRS) data is increasingly being used for monitoring spatial and temporal changes occurring during the base period (vegetative and reproductive phases) of the crop ontogeny. This new approach provides an improvement to other traditional/conventional analysis methods used for the purpose. A multitemporal classification procedure for identification and area estimation of field crops using SRS data is described and this technique applied to distinguish paddy-cropped areas. This approach involves the creation of crop signatures which characterize multispectral observations as a function of phenological growth stages. It has thus established a correspondence of these signatures with each of the vegetative growth stages of the paddy crop. The approach is quite suitable for identification and delineation of large paddy-cropped areas on the Landsat Imagery.

003

NEW WEED PROBLEM OF WHEAT CROP IN SIND

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During wheat growing seasons for 2 consecutive years (1979-81), a serious problem of weed in Sind was due to preponderence of *Anagalis arvensis* and *Aspargula pentandra.* These weeds in wheat crop have not been reported earlier. Ecological studies and methods for effective control will be discussed.

004

BRIDGING THE COMMUNICATION GAP BETWEEN AVAILABEL RESEARCH AND TECHNOLOGY IN AGRICULTURE

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In developing countries, a serious problem is lack of communication among research workers, and between them and those who implement their findings. Of particular concern is the lack of uptodate literature. It is necessary that the existing scattered research information be assembled and made available to all those concerned scientists, decision makers and the public. Also, research programmes should be mission oriented toward national needs.

005

IDENTIFICATION OF WHEAT CROP THROUGH ELECTRO-OPTICAL INTERPRETATION TECHNIQUE USING LANDSAT DATA

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Corp identification is carried out with the help of additive colour viewer using LANDSAT transparencies. The technique for crop detection is based on a) Selection of the satellite remote sensing data for required crop. b) Constitution of colour composites. c) Distinction between various colour tones appearing on the colour composite, and d) Detection of the desired crop. The SRS data required for a particular crop is pre-sown, mid-season and pre-harvest data. In case of wheat the data of 15 October to 10 November and for the month of January and April is required. LANDSAT bands 5 & 7 are used to prepare colour composite on colour additive viewer by using green, blue or red to discriminate the vegetation. The prominent tones which appear due to the above mentioned combination indicate different land use classifications. The tone indicating vegetation is thus watched using above three dates data of the same area to discriminate the wheat cropped area from the other vegetative area. Preliminary maps of the areas thus can be prepared to carry out ground truth survey to check the results.

006

PROSPECTS OF INCREASING MUNG-BEAN 6601 PRODUCTION

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A versatile mungbean variety 6601 has been developed that can very successfully be grown in spring, summer and fall. The salient features of the mungbean 6601 has been described as to plant type, growth, habit, yield potential, input requirements, seed quality, disease and pest resistance.

With the potentiality of mungbean production (700-2500 kg/ha), it can partly meet the deficiency of pulses. The hybridization/selection programme in hand to further improve the yield and other economic traits are discussed. The genetic diversity of the various lines is such that a major breakthrough in mungbean production can be achieved.

007

EFFECT OF VARIOUS MULCHING MATERIALS ON THE GERMINATIONS, GROWTH AND YIELD OF GINGER CROP

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Ginger *(Zingiber officinale)* is prized for its underground rhizome and is an important

condiment. Mulching after planting is very essential because it keeps the soil loose and moist, prevents water evaporation from soil surface and improves germination and growth of ginger. Three mulching materials viz. sawdust, sand, and sand + sawdust were applied @ 5 tons per acre to ginger crop sown under the shade of hareer trees *(Termanilia cheberla)* during the year 1979-80 and 1980-81 at the Vegetable Research Institute of Ayub Agricultural Research Institute, Faisalabad. Sawdust alone increased germination, height, tillers per plant and yield significantly followed by the sand and sawdust mixture.

II ALGAE

008

STUDIES OF THERMOPHILIC ALGAE AROUND KARACHI

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Thermophilic algae or thermal algae, were studied in hot water springs of Monghopir (48 – 55°C) and Pir Bukhari Dargah Pond at Drigh Road (35 – 40°C). At both the sites, nature of water is alkaline, pH varies from 7.5 – 8.5, sulphur is the main element present.

Studies of species composition showed that these ponds contained majority of species belonging to order Oscillatoriales of class Cyanophyceae.

009

LIGHT, SCANNING (SEM) AND TRANSMISION ELECTRON MICROSCOPIC (TEM) OBSERVATIONS OF FERTILIZATION AND EARLY ADHESION OF THE ZYGOTE OF *HORMOSIRA BANKSII* (TURNER) DECAISNE

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Sperms and eggs released from *Hormosira* plant in culture laboratory were mixed using filtered sea water as a medium. The attraction of sperms by the egg was considered to be a chemotactic response. The specificity of chemotaxis was examined using the attractants, fucoserraten extracted from *Fucus serratus* eggs; multifiden from *Cutleria multifida* (identified as hydrocorrbens). n-bexane was also used (possessing chemotactic properties). There was no clear spcecies specificity in chemotactic response in brown algae, though the substance form the phylogenetically closest seaweed, is the most potent.

Light and electron microscopic observations showed changes on the surface of the egg after penetration, consistent with the complete disappearance of the material which had been discharged prior to fertilization and the formation of a cell wall which became thicker and ridged with time after fertilization. The cell wall formation around the zygote was the result of some substance affecting adhesion within 3-4 h after fertilization. A

cell wall formation was observed correlated with a change in the golgi apparatus to the hypertrophied state. Histochemical test showed presence of aliginic acid in the cell wall of the egg before adhesion but fucoidin appeared at the time of adhesion and is therefore assumed to be the primary adhesive substance.

010
THE GENUS *OSCILILATORIA* FROM SOILS OF N.W.F.P.

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Soils, sampled at a depth of 1,2,3,4,5 and 6 inches, were cultured in IN BBM, 3N BBM and Soil Extract under 16 h photoperiod at room temperature in 125 ml flask containing 50 ml solution. Twenty three species of *Oscillatoria* viz., *O. acutissima, O. agardhii, O. amoena, O. amphibia, O. anguina, O. animalis, O. articulata, O. cortiana, O. curviceps, O. foreaui, O. formosa, O. laete-virens, O. lacustris, O. limosa, O. lutea, O. princeps, O. prolifica, O. quadripunctulata, O. rubescens, O. splendida, O. subbrevis, O. tenuis, O. terebriformis* were isolated from soils of N.W.F.P. Peshawar soils had the maximum number of species. The highest number of plants occurred in the top most soil which decreased with the increasing soil depth. In respect of fields, sugarcane fields had the maximum number of plants followed by the field of rice plants.

011
A PRELIMINARY SURVEY OF BROWN ALGAE FROM PARADISE POINT, KARACHI

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A survey of littoral and drifted algae was carried out at paradise point, Karachi. In collections made during October 1981 - February 1982; 20 spp belonging to 9 genera of Phaeophyta were collected and their morphological and anatomical characters studied. The dominant brown algae present in this coastal area were: *Dictyota dichotoma, Sargassum enerve, S. peronii, S. longifolium, Culeria multifida* and *Spathoglossum variabile.*

012
A PRELIMINARY SURVEY OF RED ALGAE FROM KARACHI COAST AT PARADISE POINT

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A preliminary survey of littoral and drifted algae was made at Paradise Point, about 20 km. south-west of Karachi from October 1981 to February 1982. Of the 60 species

belonging to 15 genera of benthic Rhodophyta *Scinaia indica, Laurencia pinnatifida, Gracilaria pygmea, Botryocladia leptoda, Coelarthrum muelleri* and *Champia plumosa* were the dominant red algae in this coastal area.

013
STUDIES ON BANGIOPHYCEAE (RHODOPHYTA) FROM THE COAST OF KARACHI

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Marine benthic algae collected during 1973 – 1981 from the coast of Karachi and the adjacent areas have been recorded. The study deals with a taxonomic description and ecological note of 7 species including 6 new records from the coast of Pakistan, of which 3 species belong to Goniotrichaceae, 2 to Erythropeltidaceae and 2 to Bangiaceae. *Bangia fuscopurpurea* (Dillw.) Lyngb., *Bangiopsis subsimplex* (Mont.) Schmitz and *Porphyra vietnamenis* Tanaka et Ho are new records from Karachi coast.

III CYTOLOGY, GENETICS AND PLANT BREEDING

014
EVALUATION OF POSSIBLE MUTAGENICITY AND RECOMBINOGENECITY OF BETEL NUT IN DIPLOID YEAST

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A relationship between the habitual chewing of "betel quid" and the incidence of the oral cancer has been established. Betel nut is a major constituent of betel quid. However, its conclusive role in the induction of oral cancer remains to be established experimentally. Due to the close relationship between the carcinogenesis and mutagenesis, it was decided to evaluate the betel nut for its possible mutagencity and reccombinogenicity in diploid yeast. The aqueous extract of betel nut was tested for the induction of mitotic gene conversion, crossing over and reverse mutation in diploid strains *D4* and *D7* of *Saccharomyces cerevisiae.* The tests were performed with the stationary as well as lag-phase cells. In stationary-phase tests, the cells were treated at two different pH levels: 5.91 and 8.05. The results indicate that betel nut without any further metabolic activation was non-mutagenic. It failed to increase significantly the frequency of convertants, mitotic recombinants, and revertants in diploid yeast. Moreover, no significant cell killing or inhibition of cell division was observed. EMS, used as a positive control, exhibited recombinogenic and mutagenic activity.

015
EFFECT OF COLCHICINE ON SOME CYTOMORPHOLOGICAL CHARACTERS OF *ZEA MAYS* L.

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The application of aqueous solution of colchicine in various concentrations (0.01, 0.1 and 0.5%) at different timings (12, 24 and 48 hrs) on *Zea mays* L. cv. desi, induced changes in the shape of microsporocytes (PMCs) and position of spindle during meiosis. Moreover, the quartets, pentads, hexads and linear tetrads were also recorded. Plant height, flag leaf length, tassel length and number of spikelets per plant were significantly reduced ($P > .01$) whereas PMC diameter at different meiotic stages was generally increased by various colchicine concentrations. General decrease in all the morphological traits with increasing dose and time could be attributed to the increase in completing mitotic and meiotic cycles during growth and development. The anomalous meiotic behaviour could be due to the interaction of colchicine with B-chromosomes that occur invariably in *Zea mays* L.

016
STATUS OF HOST PLANT RESISTANCE IN COTTON PEST MANAGEMENT

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The research work on the resistance of cotton to insect pests in Pakistan is comperhensively reviewed and suggestions made will help in planning an effective cotton pest management programme. It is proposed that levels of inherent resistance in different cotton mutant strains/varieties could be utilized. It is also proposed that certain morphological characters imparting resistance to certain insect pests of cotton could be exploited in breeding for insect resistant cotton.

017
COMPLEXITIES OF INTERGENERIC HYBRIDIZATION IN SOME TRITICEAE

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Intergeneric hybrid combinations of *Agropyron* sp., *Elymus* sp., *Hordeum vulgare*, *Secale cereale*, *Triticum turgidum* and *T. aestivum* have been produced. The cytological

information obtained from these hybrids and backross 1 (BCI) progenies is presented, including amphiploidy, mitotic variations in BCI progenies, meiotic restitution, somatic doubling, apomixis and haploid production. The practical significance of these observations in intergeneric hybridization and wheat, *T. aestivum*, germplasm improvement is discussed.

018

EFFECT OF SODIUM AZIDE ON SOME CYTOMORPHOLOGICAL CHARACTERS OF *ZEA MAYS* L.

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The application of aqueous solution of Sodium azide in various concentrations (0.001, 0.0005 and 0.0001%) on seeds of *Zea mays* L. cvs. desi and J-1, inhibited the germination considerably particularly at higher concentration. However meiosis proceeded normally and the parameters like PMC diameter and volume were not significantly different within and between cultivars, except for prophase-I in cv. desi. The plant height and flag leaf area displayed significant ($P > .05$) increase at higher concentration. 2% and 5% Sodium azide proved lethal for both cultivars. Cytologically only the initial stages of meiosis (prophase-I) are prone to Sodium azide compared to PMCs at any other stage of meiosis. Sodium azide appears to distrub the physiological and biochemical processes of plants. In the light of above observations low does (0.001%) and higher dose (0.01%) can be recommended to obtain taller and shorter plants respectively.

019

DIFFERENTIAL RESPONSE OF BASMATI RICE (*ORYZA SATIVA* L.) CULTIVARS TOWARDS SODIUM AZIDE MUTAGENSIS

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Dormant seeds of three Basmati rice cultivars were treated with different concentrations (1.5-3.5 mM) of sodium azide. Differences were found in their physiological sensitivity to mutagenic treatment with highly significant interactions. On the basis of seed germination and reduction in seedling height, Basmati-370 and Basmati 198 appeared to be more sensitive to mutagenic treatment. Relatively high frequency of chlorophyll deficient mutations was observed in Basmati 198. Sodium azide concentration of 0.5 mM seems to be more effective in Basmati-370. Factors underlying the differential response of the three varieties towards sodium azide are discussed.

020

INCIDENCE OF UNIVALENT SHIFT AND ASSOCIATION OF SYNAPTIC GENES WITH SAT-2 OF *AVENA SATIVA* L.

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Monosomic parents of the cultivar Borreck (GM1-1), its F_1 and $BC_1 - BC_4$ to Sun II were selfed and 40-chromosome individuals of their progenies were analysed cytologically for meiosis. Partial asynapsis was recorded in three plants. Satellite chromosome 2 of *A. sativa* was found to be responsible for the monosomic condition in GM1-1. Incidence of asynapsis and normal 20-bivalent forming nullisomics along with dimonosomic plant ($2n - 1 - 1 = 40$) among the F_1 hybrids provided an example on 'Univalent shift'. The results are discussed in relation to the association of synaptic genes with Sat- chromosome 2 of *A. sativa.*

021

MEIOTIC BEHAVIOUR OF A UNIVALENT IN SOME MONOSOMIC DERIVATIVES OF *AVENA SATIVA* L.

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The pollen mother cells (PMCs) of the monosomic derivatives of three cultivars – Garry, Borreck and Manod of *Avena sativa* L. were analysed cytologically. The univalent showed different behaviour compared with bivalents during the various stages of meiosis. In many cases the univalent/ its chromatids after the division were not incorporated in the dyad/tetrad nuclei and manifested themselves as micronuclei. The odd chromosome or its division product was very much retarded in its movement owing to the absence of homologous partner thus bringing about its exclusion from the dyad and/or tetrad nuclei.

022

CYTOMOPHOLOGICAL EFFECTS OF COLCHICINE ON PLANTS OF WHEAT (*TRITICUM AESTIVUM* L.)

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Colchicine was applied in concentration of 0.05%, 0.1 and 0.05 percent for 4,8,16,

24 and 36 hours at the growing points of tillers of wheat. The plants thus treated exhibited numerous morphological and cytological effects. The variants had dark green leaves and earing was delayed. A decrease in plant height, number of florets, number of tillers, number of leaves, length of ear, ear density, seed setting percentage, number of seeds per spike and 100-grain weight was observed. Long awned and partially sterile plants with greenish streaks on glumes were also obtained. Meiotic irregularities, chromosomal breakages, aberrations and aneuploidy were also evident. The treatments with higher concentrations (0.1, 0.15 percent concentration) for longer duration were more effective, while 0.05 percent least effective.

023

INTERRELATIONSHIP OF POLYGENIC TRAITS AFFECTING GRAIN YIELD IN *TRITICUM AESTIVUM* L.

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Assessment of polygenic factors influencing grain yield of wheat cultivar Nayab was examined in a field trial through the study of phenotypic corelation, path cefficient, multiple correlation and partial regression analysis. Highly significant positive correlations of yield per plant with all metrical traits were observed. Path coefficient analysis revealed that seeds per spike exerted preponderant effect upon yield per plant. The direct effects of spike length and yield per spike were negative and negligible. These results are cofirmed by partial regression analysis in which seeds per spike have shown highest significant effect on yield per plant. It is concluded that seeds per spike is the most effective parameter influencing grain yield in wheat cultivar Nayab.

024

CYTOMORPHOLOGICAL STUDIES OF COLCHICINE INDUCED MUTANTS IN PEAS (*PISUM SATIVUM* L.)

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For the study of the effect of Colchicine on cytomorphological characters in peas (*Pisum sativum* L.) aqueous colchicine solutions of 0.05, 0.1, 0.15 percent concentrations were applied to the apical shoot bud for 4, 8, 16, 24 and 36 hours durations. All the treatments produced variants having dark green leaves,medium thick stem, decrease in plant height, pod length and number of seeds per pod; pod formation was also delayed. Cytological mutants like chromosomal breakage with 1-4 fragments were obtained with 0.15 percent aqueous colchicine for 36 hours duration

025

LACK OF MUTAGENICITY AND RECOMBINOGENICITY BY FOOD DYES IN DIPLOID YEAST

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The mutagenic and possibly carcinogenic potential of a number of food colour was assessed. They were tested for the induction of mitotic gene conversion, mitotic crossing over and reverse mutation in diploid strains *D4* and *D7* of *Saccharomyces cerevisiae.* The tested dyes included Methyl Red, Rose Bengal, Orange G, Congo Rjd, Phloxine B, Eosin Y, Amaranth, Tartrazine, Sunset Yellow FCF, Ponceau 4R, Ponceau 6R, Blue VRS, Bixine, Patent Blue V, Raspberry Red, Apple Green, Metanil Yellow, Egg Yellow, Cherry Red and Diazolrein Blue 6B. The results indicate that all the 20 tested dyes were non-mutagenic and recombinogenic without any further metabolic activation. They failed to induce mitotic recombination and mutation in diploid yeast under the experimental conditions. Moreover, no significant cell killing or inhibition of cell division was observed with any of the tested dyes. The positive control, EMS, exhibited mutagenic and recombinogenic activity.

026

HYBRIDISATION STUDIES INTHE GENUS *SILENE* L. SECTIONS *SIPHONOMORPHA* OTTH AND *AURICULATAE* (BOISS.) SCHISCHKIN

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Twelve species from the genes *Silene* section *Siphonomorpha* and 3 species from section *Auriculatae* were crossed to test infraspecific, interspecific and intersectional crossability. Hybridisation showed cross-incompatability in all interspecific crosses in section *Siphonomorpha.* One species was crossed at a variety level, which showed compatability and fertile hybrids were produced. The hybrids showed floral characters which were intermediate between the parental varieties.

In section *Auriculatae, S. vallesia* L. and *S. boryi* Boiss., showed crossability and moderately fertile hybrids were produced. Both species are morphologically distinct in floral and vegetative characters, are geographically isolated and are not known to hybridise in nature. Both species were found to be tetraploids.

With the limited experimental evidence it was evident that polyploid species showed less or no crossability barriers, as had also been observed by previous experimentalists working on the polyploid North American *Silene* species. On the other hand most of the diploid species (mostly European) showed strong genetic barriers to crossing. Evidently

these species have undergone a vast genetic divergence and have established themselves as 'good' species. It was also shown that species with overlapping distribution range, selection and survival cause genetic barriers to build up between them, whereas in those species where differentiation occurred in isolation, fertility in artificial crossing remained.

027

GENE ACTION EFFECTS IN WHEAT UNDER DIFFERENT SOIL FERTILITY LEVELS

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A 4x4 diallel cross involving wheat varieties, Mexipak 65, C273, Chenab 70 and LU75, was evaluated for gene action effects for various agronomic characters both in F1 and F2 grown under two different soil fertility conditions.

The Vr/Wr/ graphs showed that the genes controlling, kernels per spike, 100-kernel weight and grain yield expressed both additive and non-additive effects varying over a range of soil fertility condition. Significant interaction of genotypes with environments suggested to develop a number of genotypes suited to different fertility regimes.

028

GENETIC ANALYSIS OF VARIETAL DIFFERENCES IN VARIOUS CROSSES OF *ORYZA SATIVA* L. UNDER TWO DIFFERENT SOWING (TRANSPLANTING) DATES

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A 5x5 diallel cross experiment involving 5 varieties of rice *Oryza sativa* L. viz; Basmati 370, Mushkan 41, PK 177, IR6 and IR24 under two sowings (transplanting) dates viz; D_1 (10.7.1979) and D_2 (25.7.1979) with three replications in each treatment was carried out in the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad during 1977-79, to have genetic information on the control of response to different sowing (transplanting) dates.

From Vr/Wr graphs it was concluded that genetic mechanism controlling final plant height, number of tillers per plant and panicle length and number of panicles per plant

presented additive type of gene action. Moreover, the dominance relationship of array points for almost all the characters studied changed with the change in sowing (transplanting) dates. Furthermore, non-allelic interaction of genes was observed in all the trials except plant height.

029

COMPARATIVE PERFORMANCE OF SOYBEAN GENOTYPES DURING SUMMER AND SPRING

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Soybean varieties of medium maturity are adapted to the local conditions during summer. Commercial feasibility of raising spring crop in this area has been investigated and varieties of shorter duration have been found to perform better than longer duration varieties. Outstanding early maturing varieties tested for two years have generally yielded equal across seasons. Response to photo period in two seasons, as determined from initiation of flowering was similar and no significant differences were observed in maturity period as well. Thus these varieties prove to be insensitive to photo period, as against longer duration varieties which have strongly reacted to differing photoperiods. Slow initial growth due to lower temperatures resulted in reduced plant height during spring compared with summer season. Increase in temperature towards seed formation and maturity stages during spring seriously reduces the seed viability.

030

CYTOGENETIC STUDIES OF VARIABILITY INDUCED THROUGH HYBRIDIZATION AND GAMMA IRRADIATION IN *PENNISETUM AMERICANUM*

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Four varieties of *Pennisetum americanum* (Awn selected, Ex-Borneo, Japan bajra, and B-18) were treated with different doses (0,5,10,15,20,25,30 and 35 KR) of gamma rays. The results provide significant evidence of induced genetic variability for may plant characters in the M_2 generation. In variety Awn selected, Japan bajra and B-18 plant height increased significantly in the population derived from 20KR compared with control. In the same population significant decrease in number of tillers was observed as compared with control. In variety Ex-Borneo, and B-18 significant increase in number of tillers derived from 15KR, 20KR, 25KR & 30KR compared with control was noted. The results are discussed with reference to exploitation of mutations for genetic improvement of pearl millet.

031

ESTIMATION OF HETROSIS IN F-1 OF COTTON CROSSES

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For the improvement of cotton crop (*Gossypium hirsutum*), hybridization programme was undertaken to study the heterotic effect in the inter-varietal crosses. Out of the eight crosses seven crosses and five crosses showed increased vigour for plant height as compared to their respective mid-parent and better parent values. Maximum increase of 53.70% and 48.50% was recorded in cross K-68-9 x MNH -81 against mid-parent and better parent values respectively. The heterotic effect was recorded in six crosses and five crosses for cotton boll numbers per plant as compared to their mid-parent and better parent velues. Maximum increase of 81.60% and 77.90% was found in cross K-68-9 x MNH 80 against mid-parent and better parent values, respectively.

032

MORPHOLOGICAL AND QUALITY TRAIT STUDIES IN WHEAT GENETIC MATERIAL

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Wheat genetic materials sown in crossing block during 1977-78, 1978-79 and 1979-80 were tested for their morphological, agronomic characters and disease reactions viz., growth habit, plant height,•grain colour, grain texture, yellow rust, leaf rust and stem rust. The physio chemical traits viz., 1000 grain weight, protein content and dye binding capacity (DBC) value were studied to identify varieties for use as genetic sources for high protein content combined with high DBC value (i.e. high lysine). Correlation coefficients of protein content with DBC, 1000 grain weight and plant heigh and DBC with 1000 grain weight and plant height were also estimated.

Protein content ranged from 9.35 – 20.96%; 11.45 – 14.45% and 9.04 – 15.79% during 1977, 1978 and 1979 respectively, indicating the existence of genetic difference among wheat varieties. The variety showing 20.96% protein in 1977 had however somewhat shrivelled grains (1000 grainweight as 21.96% g). The 1000 grain weight varied from 21.97 – 51.65, 27.62 – 53.82 and 29.88 to 58.77 g for 1977, 1978 and 1979 respectively. The variation in DBC value was found to range from 32.00 – 42.75 and 29.15 – 40.75 mg dye bond per g of sample for 1978 and 1979, respectively.

Correlation studies revealed that protein content of tested genetic material in1979 was somewhat postively associated with DBC value (r=+0.280) while it was loose for

1000 grain weight (r=+0.084) and plant height (r=+0.424). The DBC value had also shown positive but weak relationship with plant height (r=+0.150) but it was negatively related with 1000 grain weight (r=–0.25).

On the basis of desirable economic and quality traits, 15 genotypes were singled out during the 1979-80 for use in the hybridization programme. Out of these 15 varieties the line with C.B. No. 66,94, 97, 98, 105, 220, 270 & 272 had better field resistance against yellow rust, leaf rust and stem rust diseases, while C.B.No. 105, 108 & 187 had short stature. The line with C.B. No. 1, 2, 97, 105, 220, 270 & 272 had higher protein content (> 13%) higher DBC (> 36.0) and higher grain weight (> 38.0 gms). Further these studies suggest that some of the selected line having high protein and relatively high DBC value and grain size may prove useful to improve the protein content and quality.

IV ECOLOGY AND POLLUTION

033
PHYTOECOLOGICAL STUDIES OF DIAMER DISTRICT, PAKISTAN

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Five plant communites were worked out phytoecologically. They are *Artemisia maritima,* 2) *Quercus ilex* 3) *Cedrus deodara – Pinus wallichiana – Sorbia tomentosa* 4) *Juniperus polycarpos – Pinus gerardiana* 5) *Juniperus communis – Polygonum affine.* The importance of each habitat type has been discussed from wildlife, range management, drug plants and tree regeneration point of view.

034
THE ALLELOPATHIC POTENTIAL OF *EUCALYPTUS TERETICORNIS* SM.

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The allelopathic potential of *Eucalyptus tereticornis* Sm., an introduced species, was assayed by using aqueous extracts from leaves, flowerbuds and bark against *Sorghum vulgare* var. Dale, *Sorghum vulgare* var. Wiay, *Phaseolus mungo, Brassica chinensis, B. campestris, Sisymbrium irio, Nigella sativa, Raphanus sativus* and *Setaria italica* in filter paper bioassays. The germination and radicle growth of various species was invariably reduced by aqueous extracts, especially by leaves and flower bud extracts followed by bark. *Sisymbrium, Nigella* and *Brassica* were more susceptible than other species. The

phytotoxicity depended upon the part assayed, and test species used with an independent effect on germination and growth. Aqueous extracts through soaking is one of the suggested routes for releasing phytotoxins in this plant. Further study is underway to envisage other aspects of allelopathy by this eucalypt.

035
INTERACTION BETWEEN PLANTS

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In studies on the interaction between wild plants of Sind, mutual interaction was shown by *Acaccia senegal* and *Capparis hamata; Abutilon indicum* and *Mimosa hamata; Cacia holocerecia* and *M. hamata; Withania sommifer* and *A. indicum.* Mutual stimulation was found in *Withania coaglenec,* and *Fagonia cretica; Aristolochea bracteata* and *F. cretica.* In other cases the phenomenm of both stimulation and inhibition was also noticed.

036
SOME PRELIMINARY STUDY ON INTERFERENCE EXHIBITED BY *BOTHRIOCHLOA PERTUSA* (L.) A. CAMUS

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Bothriochloa pertusa (L.) A. Camus besides a wild species, is also a rangegrass. It has been reported to preclude the associated species under favourable physical environment; thereby assuming the status of either first or second dominant in nature.

Preliminary study, carried in pots and field plots, indicated the reduction of growth of associated grasses and species in the condition of root mixing. Subsequent experiments with root exudates, leachates, and extracts showed the inhibition of germination and growth of *Pennisetum americanum, Setaria italica, Brassica campestris, Cenchrus ciliaris* and other species tested in various bioassays. Aqueous extracts, rain leachates, fog drips and litter exhibited phytotoxicity against the various test species. Soil from beneath the grass cover and its rhizosphere proved to be phytotoxic against the germination and radicle growth of the test species. Cytological studies carried on *Pennisetum americanum* and *Allium cepa* exhibited that phytotoxins, besides reducing cell size, its expansion, also arrested cell division. Above ground parts were generally more inhibitory than roots. The phytotoxicity was related to test species, duration of soaking of plant material and physiological process involved.

037
NEW METHOD OF SAMPLING VEGETATION

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A new mean area method for vegetational sampling was developed which proved to be more efficient than point centered quarter method, as it gave more precise mean distance. Cain's coverage stratification diagram was improved to depict greater details of community structure with equal visual ease and comfort. Cain's density size class table was plotted to study the dynamics of savanah and shrub type of vegetation. The size classes were based on the crown cover values rather than height. The future trends of various communities depicted by the modified form of density size class table correlated very well with the successional trends observed in the field.

038
AN INVESTIGATION ON THE EFFECTS OF INDUSTRIAL POLLUTION ON PLANT GROWTH WITH SPECIAL REFERENCE TO PHYTOSOCIOLOGY OF S.I.T.E. AREA, KARACHI.

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A phytosociological survey along the waste disposal runnels of Sind Industrial Trading Estate (S.I.T.E.) Karachi was conducted, communities were identified and the dominant species of different communities were analysed and compared with the specimens collected from non-polluted localities in terms of chlorophyll contents, moisture status, leaf size spectra, stomatal frequency and size.

Paspalidium geminatum was found to thrive dominantly along the runnels having industrial effluents ranging in colour from dark grey to light blue. However, down the stream, with relatively clear water, banks were colonized by *Cynodon dactylon.*

Sampling plots laid ten paces away from runnels encountered the prevalence of *Prosopis glandulosa – Abutilon glaucum – Prosopis juliflora* community near textile industries; *P. juliflora – P. glandulosa – Haloxylon recurvum* community near paints and allied chemical industries; *P. glandulosa – P. juliflora* community near tobacco processing units; *P. juliflora – P. glandulosa – Abutilon glaucum* community in the area adjoining cloth dying, canvas and pharmaceutical production units; *P. glandulosa – P. juliflora – Datura alba* community near food industries; *Cynodon – Cressa* community near metallurgical processing plants and *Cynodon – Suaeda* community near tanneries.

In general both the species of *Prosopis* possessed significantly reduced number of leaflets per pinna with a non-significant increase in the area of leaflets. Differences in the moisture status were also non-significant for both the species of *Prosopis*, however, significantly increased and decreased water contents were found in *Abutilon glaucum* and *Datura alba*, respectively.

Stomatal frequency increased with a decrease in the size of stomata in *P. juliflora* growing near textile industries; reverse was true for *P. glandulosa* rooted in the same soil, and also for dominant plants of all the other communities investigated.

Chlorophyll contents, in general, was more, the highest level being recorded in species dominating near textile industries. An increase in the chlorophyll a/b ratio was also encountered

039
STUDIES ON SOME HALOPHYTES OF PESHAWAR DISTRICT

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During a survey of halophytes inPeshawar District, it was found that *Suaeda fruticosa* and *Desmostachya bipnnata* were the predominant species throughout the saline areas which indicated their tolerance towards such soils. The relationship between plant ressponse and soil characteristics show that *S. fruticosa, D. bipinnata, Juncellus leavigatus* and *Cynodon dactylon* have a very wide range of adaptation, while *Acacia jaquemontii, Capparis aphyla* and *Tamarix articulata* have close range of adaptation. Species like *S. fruticosa* and *D. bipinnata* and *T. articulata* prefer saline and saline sodic conditions while *J. leavigatus, C. dactylon* and *A. jacquemontii* prefer saline sodic condition.

040
PHYTOTOXIC POTENTIALITY OF *ARTEMESIA MARITIMA* L.

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Artemesia maritima L. an aromatic perennial herb, dominates locally forming more or less pure stands. The density and vigour of the associated species is always less than those stands without *A. maritima* dominance. Preliminary field observations revealed poor density, frequency and productivity of *Hordeum murinum, Eragrostis poaoides, Avena fatua, Sophora alupecuroides, Peganum harmala, Heliotropium dasycarpum* and *Bromis* sp. in *A. maritima* dominanted stands under seemingly similar physical environment Seeds of most of the aforementioned plants invariably exhibited either significantly

retarded germination, retarded radicle growth or both when grown in aqueuous extracts of shoots, roots, affected soil, litter, or when grown directly on soil beds. The results indicated allelopathic potential which might be one of the reasons for its dominance making almost pure stands and extermination of the susceptible species. Further study is in progress to explore its allelopathic mechanism.

041
ALGAL SPORES AS FOULING AGENTS AT PARADISE POINT, KARACHI

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Solid objects exposed to marine environment are generally inhabited by a number of fouling organisms including seaweeds. Of the different seaweed spores which settled on surface of wood and asbestos pannels exposed to oceanic water at Paradise Point included 7 species of Chlorophyta, 7 of Phaeophyta and 10 of Rhodophyta. The seasonal settlement occurred in a number of peaks from January to December: a prominent peak in October – November, while smaller peaks in May – June and March. Mostly green algae dominated the other two groups. During monsoon period the only algal species which settled in large number was *Enteromorpha compressa.* In October – November majority of the settled spores consisted of red and brown seaweeds.

042
STRESS OF COPPER AND LEAD ON A MARINE DIATOM *SKELETONEMA COSTATUM*

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Department of Batany, University of Karachi.

Bioassay studies of copper and lead revealed that both metals inhibited the growth of *Skeletonema costatum* at very low concentrations and copper was even lethal. Growth of this species was inhibited at 5 ppb copper and at 50 ppb lead, and all the cells died at 30 ppb copper. Copper was, therefore, more toxic than lead. The cumulative effect of both heavy metals was synergistic. Growth and metal concentrations were inversely related to each other. The size of inoculum had a modifying effect on the result of the experiment. The possible implications of this laboratory study is discussed.

043
PROLONGED EXPOSURE OF PLANTS TO LOW LEVELS OF SULPHUR DIOXIDE AND NITROGEN DIOXIDE POLLUTION

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In the fumigation chambers, test plants were exposed to low levels of sulphur dioxide (0.068 ppm), nitrogen dioxide (0.068 ppm) and levels of sulphur dioxide + nitrogen dioxide (0.068 ppm of each pollutant). *Agrostis tenuis* Sibth. showed no significant change at the beginning of fumigation but after prolonged exposure to all pollutants in summer, a significant increase in growth was recorded particularly with nitrogen dioxide treatment. *Holcus lanatus* L. showed no significant change in growth to any of the pollution even after prolonged exposure in winter.

Interaction between sulphur dioxide and nitrogen dioxide produced a significant effect with regard to leaf parameters of *A. tenuis.* The beneficial effects of nitrogen dioxide were significantly greater in the absence of sulphur dioxide, but when present together the stimulatory effects of nitrogen dioxide were greatly reduced by sulphur dioxide pollution. A similar type of effect was found in *Festuca rubra* L. and *H. lanatus,* but the interaction between sulphur dioxide and nitrogen dixoide was insignificant.

The dead matter was higher in plants fumigated with sulphur dixoide and nitrogen dioxide population in the winter months. Chemical analysis of *F. rubra* exposed to above mentioned pollutants showed greater level of sulphur and nitrogen, respectively.

The genetic adaptation of plants to population was however, not firm, one population of *H. lanatus,* which was collected from a polluted site showed some resistance to sulphur dioxide and nitrogen dioxide pollution. It is concluded that prolonged exposure of plants to low levels of pollution can be beneficial for growth, especially in the favourable growing conditions.

V ECONOMIC BOTANY

044
INTRODUCTION AND DEVELOPMENT OF EXOTIC CROPS FOR INDUSTRIAL OIL

PARVEEN AZIZ
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Veraonia pauciflora (Compositae), an exotic plant, has been cultivated in our experimental fields for about four years. It is an annual plant with bushy habit. The chemical study of its seeds indicate that it contains 35-38% oil of which 75-80% is epoxyoleic acid.

leaflets per pinna with a non-significant increase in the area of leaflets. Differences in the moisture status were also non-significant for both the species of *Prosopis,* however, significantly increased and decreased water contents were found in *Abutilon glaucum* and *Datura alba,* respectively.

Stomatal frequency increased with a decrease in the size of stomata in *P. juliflora* growing near textile industries; reverse was true for *P. glandulosa* rooted in the same soil, and also for dominant plants of all the other communities investigated.

Chlorophyll contents, in general, was more, the highest level being recorded in species dominating near textile industries. An increase in the chlorophyll a/b ratio was also encountered.

Epoxy acids are a good source of vernolic acid which are currently obtained by chemical modification of fats and vegetable oils. The epoxidation process increases the cost of the oil 2 to 3 fold. Epoxy oil are used in plastic formulation, protective coatings and other industrial products.

045
CULTIVATION OF *APIUM GRAVEOLENS* AT LAHORE

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Apium graveolens L. (Celery, Karfas-ajowan) is commonly used as medicine. Its essential oil and oleo-resin is used in flavour industries and in food preparation. It has been successfully cultivated in Lahore. Its yield and percentage of oil is up to the international standard. It has an established export market and is a valuable source of foreign exchange. The return per acre is very high as compared to many other cash crops.

VI EMBRYOLOGY

046
EMBRYO CULTURE OF *ALLIUM CEPA* L.

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The effect of different culture media was studied on the growth of excised embryos of *Allium cepa* L. Of the three media tried Nitsch (1951), White (1953); White's medium as modified by Barker (1953) gave better results.

The effect of temperature and pH on the growth of excised embryos was also investigated. High (40^{o}C) and low (10^{o}C) temperatures completely inhibited the growth of embryos. Optimum temperature range was between 20^{o}C and 25^{o}C. The embryos grew well within a pH range of 6 and 7. Any increase or decrease in pH adversely affected the growth.

047
POLLEN MORPHOLOGY OF *COLDENIA PROCUMBENS* L.

U.S. QURESHI AND K.M. KHAN
Department of Pharmacy, University of Baluchistan, Quetta.

Pollen morphology of *Coldenia procumbens* L. is described in detail. The species have 6-heterocolpate (3-colporate, 3-colpate) grains which differ from the findings of Erdtman (1952) and Johnston (1956).

048
EMBRYOLOGY OF *MURRAYA KEONIGII* LINN. (SPRENG).

RUQAYYA KHAN
Department of Botany, University of Karachi.

Embryological studies of *Murraya keonigii* (Rutaceae) commonly known as curry leaf tree was undertaken. The anthers were tetrasporangiate with persistant epidermis. Pollen grains were 3-colporate with a smooth and thick exine. Ovules were anatropous, bitegmic and crassinucellate. Embryo sac was of *Polygonum* type with epemeral antipodals and fused secondary nucleus. Endosperm development was early and it was of nuclear type. Embryogeny followed Onagrad type with a small two celled suspensor. Well marked adventive nucellar polyembryony was recorded.

049
EMBRYOLOGICAL STUDY OF *MORINGA OLEIFERA* LAM.

RUQAYYA KHAN
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Moringa oleifera (Moringaceae) commonly known as drumstick tree is grown in Karachi for its edible fruits. Embryological studies revealed that the anthers are monothecous and bisporangiate with glandular tapetum. Pollen grains are tricolpate with a smooth exine. Ovule is anatropous, bitegmic and crassinucellate. Embryo sac is of *Polygonum* type with one egg, two synergids and two polar nuclei lying very close to each other. Endosperm development is nuclear which later becomes cellular. Embryogeny is of Asterad type without any suspensor. Seeds are provided with three wings and two coats, the inner stony and outer fleshy. There are two cotyledons of unequal size. Plumule, hypocotyl and radicle with root cap also developed.

VII FORESTRY AND RANGE MANAGEMENT

050
ENHANCING RANGE PRODUCTIVITY THROUGH GRASS SEEDING IN SUBTROPICAL SEMI-ARID RANGELAND NEAR PESHAWAR

SULTAN MAQSOOD KHAN AND RAJA MOHAMMAD ZARIF
Pakistan Forest Institute, Peshawar.

About 2 hectares in Jamrud target area near Peshawar were seeded with *Cenchrus ciliaris* in July, 1980. In September, 1981 due to grass seeding the average forage yield increased from 45 kg to 2324 kg/ha, increasing the carrying capacity of this rangeland

from about 23 to only 0.5 hectares/animal unit/year. This shows that at present level of livestock management the production of livestock and livestock products can be increased about 40 times by simply seeding these areas with *Cenchrus ciliaris.*

051

EFFECT OF WINDBREAKS ON THE GROWTH AND YIELD OF AGRICULTURAL CROPS

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The effect of windbreaks of *Dalbergia sissoo* (shisham) and *Eucalyptus camaldulensis* (eucalyptus) on the growth and yield of wheat and cotton crops were recorded on four different sites in Sukkur Division. Yield of wheat and cotton increased significantly due to effect of windbreaks as compared to open fields. In case of cotton crop the increase in yield was upto 5% while the yield of wheat crop was higher by 7.5% due to the effect of windbreaks. Windbreak of *Eucalyptus camaldulensis* was found more effective as compared to *Dalbergia sissoo.*

052

CAUSE OF DEFORESTATION IN PAKISTAN

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Out of the total land area of 87.81 million ha in Pakistan, the area under control of Forest Department is 10.4 million ha. This figure is inclusive of rangelands which form about 60% of the area. The production forests are 1.2 million ha only. The country is virtually facing a wood famine. The state forests are producing only 0.3 million m^3 of fiewood and 0.4 million m^3 of timber against the estimated requirement of 2.0 million m^3, 16.5 million m^3 of timber and firewood, respectively. The existing poor green cover in the hills and plains is the result of ill treatment given to it in the past. No doubt, the desert formation is a natural phenomenon but man has contributed a lot towards its expansion, the main factors responsible for this situation are shifting cultivation, clearing for agriculture, for pastures, dwellings and intensive grazing by the local as well as migratory flocks of sheep, goats and cattle. An effort is being made by the various agencies to reforest some of these deforested areas using different methods of afforestation.

053

A SURVEY OF FUNGAL DISEASES OF PEARL MILLET (BAJRA) IN RAINFED CONDITIONS

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Six varieties of *Pennisetum typhoides* (pearl millet), viz., y-72, C 47. Hairy Dwarf, D.B-2, composite and local were planted at National Agricultural Reseach Centre (NARC), Islamabad and Barani Agricultural Research Institute (PARI), Chakwal during Kharif, 1981. Among the head diseases, Grain Molds showed heavy infection percentage at NARC, Islamabad, while downy mildew predominanted in the varieties planted at Chakwal. Two foliar diseases, Zonate leaf spot caused by *Gloeocercospora* sp. and leaf blast by *Pyricularia penniseti* were recorded first time in Pakistan.

054

REDUCTION IN VIABILITY OF SCLEROTIA OF *SCLEROTIUM ORYZAE* BY POLYETHYLENE MULCHING OF SOIL

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Mulching of *Sclerotium oryzae* infested soil moist or dry with polyethylene sheeting during May and June 1981 increased soil temperature from 37 ambient to 48-52 C and resulted in loss in viability of sclerotia. Experiments were performed at 3 field locations viz Karachi, Sakrand and Lahore. Mulching of soil artificially infested with sclerotia did not reduce number but reduced viability by 100% to a depth of 5 cm after a minimum 3-days mulching treatment. Sclerotia from 20 cm depth when brought back to the surface were also eliminated after another 4 days mulching treatment. Mulching treatment showed an increase in yield by 22.8% although no significant difference (p = 5%) in number of culms and Disease Severity Index was noticed. Mulching of soil during winter months of 1981 reduced sclerotial viability by 40-60% in 7 days time.

In artificially heated soil in ovens, a minimum Two-hour temperature of wet soil at 55^{O} and 45^{O}C reduced the viability of sclerotia to zero; whereas at 50^{O} and 45^{O}C respectively, 3 and 12-days Two-hour temperature cycle showed such an effect. Total counts of soil fungi, actinomycetes and bacteria after 24 hrs exposure to high temperature were few however, the proportions of actinomycetes and bacteria inhibitory to *S. oryzae* were greater at 60^{O}C than at 45^{O} and 30^{O}C in wet soil. It is suggested that biological as well as thermal control may be taking place during soil mulching.

055

INFLUENCE OF EXTRACTION RATE AND CONCENTRATION OF STAIN ON THE DETECTION OF LOOSE SMUT INFECTION IN WHEAT SEED SAMPLES

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Cereal Diseases Research Institute, Pakistan Agricultural Research Council, Karachi.

Embryos of wheat were most conveniently extracted in 5% sodium hydroxide; higher concentrations resulted in damage to the scutellum. Mycelium of *Ustilago tritici* could not be detected without the use of a stain and trypan blue @ 0.07 to 0.15 g per litre gave good results beyond which mycelium was not easily detected. A working sample of 100 g may be preferable to a working sample of 120 g.

056

CULTURING AND CULTIVATION OF MUSHROOM IN PAKISTAN

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Different regions of Pakistan were surveyed to have a picture of edible and poisonous mushrooms and to establish a mushroom herbarium. One species each of *Agaricus* and *Pleurotus* have been cultured successfully whereas few other are under study. The spawn of almost all the mushrooms were prepared on different grains and agricultural materials. Spawn of six mushrooms were cultivated on different substrates in different regions of the country. Mushroom cultivation in thatched growing-room proved better. The chinese mushrooms have been cultivated out-door under shade successfully.

057

INCIDENCE OF RICE BLAST IN PAKISTAN

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During a survey rice blast diseases caused by *Pyricularia oryzae* was found extensively prevalent. Quantified observations were made on varieties Basmati-370, Basmati-198 and IRRI-6. Disease appeared right at the early nursery stage and was carried to the fields during transplantation. Maximum incidence of *P. oryzae* in nurseries was 2.62% during first week of July. The incidence of the disease gradually increased on cv. Basmati-198 to 9.8% in September compared to Basmati-370 on which disease decreased to 0.32%. However, IRRI-6 was found more susceptible to rice blast where maximum infection recorded was 17.57% and thus in the Punjab rice blast has become a major problem.

058

WHIP SMUT OF SUGARCANE IN PAKISTAN

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Incidence of whip smut of sugarcane *(Ustilago scitaminea)* was found higher in the ratoon crop than in planted crop. Of the 22 different commercially grown sugarcane varieties tested, 11 of them were found susceptible to the disease with significant reduction in sugar recovery.

059

OCCURRENCE OF FUNGI IN KARACHI MUNICIPAL CORPORATION TRICKLING FILTER PLANT NO. 1 (KMC-TP-1)

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In a monthly survey of water samples and solid wastes collected from trickling filter plant, 29 species of fungi were isolated and identified from plant influents and effluents and from primary and digested sludge formed during processing. These belonged to the genera: *Aspergillus; Alternaria; Cunninghamella; Cladosporium; Curvularia; Drechslera; Fusarium; Graphium; Gliocladium; Mucor, Penicillium; Paecilomyces; Rhizopus; Sepedonium, Stachybotrys, Stysanus; Trichoderma* and *Tetracosporium.*

060

MYCOFLORA OF SIND UNIVERSITY SOIL

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The soil of Sind University campus is calcarious and alkaline. The soil is barren with some vegetation. Temperature ranges from 25°C to 45°C and the rainfall is scanty. Soil samples taken from surface and gradually upto 2′ depth from various sites were plated by soil plate method (Warcup). Altogether 22 species of fungi were isolated. Species of *Aspergillus* were found widely distributed at all sites and depths. *Fusarium* species were isolated in winter season only. Species of *Alternaria* and *Helminthosporium* were present in all sites and at all depths.

Rhizopus nigricans was isolated from all the soil samples upto 4" of soil depth. *Torula lucifuga, Monilia purinosa, Pullularia pullulans* and *Curvularia pallescens* were rarely isolated.

061

SOME SAPROPHYTIC AND PARASITIC FUNGI OF FOREST PLANTATIONS IN UGANDA

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A regular examination of the forest floor, forest tree stumps and standing forest trees in the inter area of Wandagea and Kebanylo and at Kigezi in Uganda revealed the occurrence of saprophytic, mycorrhizal and parasitic fungi. The most frequent and common species of fungi occurring inthe above mentioned areas of Uganda were:

Agaricus haematosarcus, Clytoderma elegans, Clitocybe hydrophora, C. apalus, Agaricus bugadensis, Collibya aurea, Coprinus atramentarious, Lepiota phaeosticta, Strobilomyces strobilaceous, Stereum hirsutum, Lentinus squarrosalus, Suillus granulatus, Polyporus versicolor and *Ganoderma chalcum.*

Fomes applanatus (= *Ganoderma applanatum*) was found causing serious root and butt rot disease of *Acrocarpus fraxinifolius* (Shingle tree) at Wandagea and *Dothiostroma pinii,* the conidial state of *Scirrha pini,* had already caused dangerous needle blight disease of *Pinus radiata* annihilating the whole stand of Capt. 13, R.P. 630 at Mafuga in the district of Kigezi.

062

STUDIES ON THE FUNGI ASSOCIATED WITH THE TERMITE: *ODONTOTERMES OBESUS* (RAMBUR)

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Department of Biological Sciences, Quaid-i-Azam University, Islambad.

Studies were carried out on the fungi associated with the termite *Odontotermes obesus. Fusarium* sp., *Curvularia* sp., *Xylaria* sp., *Sporotrichum* sp. and *Alternaria* sp. were isolated from the termite mound. Only *Sporotrichum* sp. was found to be pathogenic to termites. *Monilia* sp., *Aspergillus fumigatus, A. quadrilineatus* and *Penicillium* sp. were isolated from the cuticle of termites. Observation indicated that infection was through the penetration of fungal mycelia. Vegetative hyphae of the fungus occurred all over the body parts but were abundant on the head and abdomen. The conidiophores of the fungus appeared after the termites were dead. Extracts of the mycelium caused 80% mortality whereas the extracts of associated fungi did not cause mortality. The pH of all the fungal extracts were acidic in nature. On the basis of present study the use of fungal pathogens for biological control of termites has been discussed.

063

A NEW DISEASE OF COCONUT PALMS IN KARACHI

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A disease of coconut palm has been observed in and around the city of Karachi. The affected diseased trees showed discoloration of leaves mainly at tips. The affected tree produced fruits with black patches. Fruits of all size and age were affected and at times premature shedding of fruits occurred. The edible parts of diseased fruits showed rotting which was found proportional to the black patches present on the outer covering of the fruits. In fruits, where several black patches had coalesed, the edible parts were found fully rotted.

This disease of coconut palms occurring in Karachi and the nature of causative organism will be discussed.

064

GRAVITY SUBSTITUTING LIGHT FOR THE SPORULATION OF *HELMINTHOSPORIUM TERES*

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Helminthosporium teres Sacc. does not sporulate in dark as it needs light for sporulation. Experiments were conducted to investigate if other factors like temperature, gravity, magnetic field etc, could act as a source of stimulation for sporulation. It was observed that gravity is a strong agent for the induction of sporulation.

065

MECHANISM OF RESISTANCE OF *ASOCOCHYTA* BLIGHT IN CHICKPEA

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Inoculation of 10 chickpea lines (Aug. 480, 2008, C 727, C 235, S 1, Aug 424, S 2, CM 72, CM 68, 6153) at 14 different ages with *Ascochyta rabiei* under artificial epiphytotic conditions revealed that chickpea plant is susceptible at all the stages of growth. Aug 424 being extremely susceptible exhibited severe blight symptoms only 4 days after inoculation. C 727 and C 235 were also found susceptible and the degree of susceptibility decreased in other varieties in the following order: S 1, 2008, 6153, Aug 480, S 2, CM 68

and CM 72. The chickpea lines CM 72 and CM 68 were found comparatively less susceptible. The ten lines studied do not fit well in the standards of blight rating scale reported by Morral and McKenzie (1974) and Khan *et al.* (1975). Efforts have been made to establish an easy and practicable system of rating chickpea against *Ascochyta* blight.

066

DISEASE RESISTANCE IN COTTON

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Of the several diseases of cotton in Pakistan, bacterial blight (*Xanthomonas malvacearum* (Smith) Dowson, root rot (*Rhizoctonia* spp.) and boll rots caused by a number of primary and secondary pathogens have been recognized as major diseases. Genetic resistance to these three major diseases appears to be possible within the genetic sources available in this country. Genetic factors known as 'B' genes conform resistance to bacterial blight; certain morphological characters like okra leaf, frego bract and nectariless afford an escape to the bolls from the attack of pathogens. Shallow and spreading root system of cotton plant enables the plant to escape from the attack of root rot pathogen inhabiting deep in the soil. Some new trends to develop Multi-Adversity-Resistant cotton have been discussed.

067

REDUCTION IN POPULATION OF SCLEROTIA OF *MACROPHOMINA PHASEOLINA* BY SOLAR HEATING OF SOIL THROUGH POLYETHYLENE MULCHING

ABDUL HAKEEM SHEIKH AND ABDUL GHAFFAR

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Mulching of soil, wet or dry with transparent polyethylene sheets during May-June 1981 was highly effective in reducing population densities of sclerotia of *Macrophomina phaseolina* in 1 week, and after 4 weeks it was possible to eliminate the sclerotia irrespective of amendment with lucerne or wheat. The reduction in number of sclerotia was related to increased soil temperature from 36°C ambient to 48-52°C after polyethylene mulching. Sclerotia at 20 cm depth, however, did not show greater reduction. At another location, where during hot summer months soil temperature after mulching reached a maximum of 52° in wet and 65°C in dry soil, the viability of sclerotia in the surface soil was reduced to zero after 1 week. More than 50% reduction in the viability of sclerotia was noticed in depth under wet soil whereas under dry soil conditions the scleroia were not affected.

From a natural infestation of 5-7 sclerotia g^{-1} soil which gave 20% infection on *Vigna*, the population of sclerotia after 1 week mulching treatment reduced to zero with 0% colonization on test plant. Soil pasteurization can thus be applied to the field to eliminate *Macrophomina* infection.

068

INTERACTION OF *ASPERGILLUS FLAVIPES* WITH SOIL FUNGI

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Aspergillus flavipes isolated from soil was found to inhibit soil fungi viz., *Aspergillus flavus, A. fumigatus, A. niger, A. terreus, Curvulasia pallescens, C. lunata, Drechslera rostratum, D. papendorfii, D. halodes, Fusarium solani, Macrophomina phaseolina, Myrothecium striatispermum* and *Sclerotium oryzae* in agar culture producing a zone of inhibition. *Rhizopus nigricans, Botryodiplodia theobromae, Cunninghemella echinata* were not inhibited. In soil, however, cultures of *A. flavipes*, alone or in combination with wheat bran used as organic substrate did not reduce sclerotial numbers of *M. phaseolina* and its infection on chick pea.

069

DISTRIBUTION OF SOME SOIL FUNGI IN THE ARABIAN DESERT

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In an investigation the mycoflora of an Arabian desert soil was isolated and studied. Fungi belonged to the species of *Asperillus Fusarium, Penicillium, Papularia, Drechslera, Phoma, Humicola Actinomucor, Rhizopus, Curvularia, Teteracoccosporium, Circinella, Cryptomella, Cunninghamella, Hormodendron, Paecilomyces* and *Mucor.*

This investigation was made to provide information on the mycoflora of desert soil in an attempt to determine the suitability of the soil for reclamation programme.

070

OCCURRENCE OF PARASITIC FUNGI ON SOME HOST PLANTS OF UGANDA

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Collection of diseased plants from in and around the city of Kampala (Uganda) and

study of the diseased parts revealed presence of parastic fungi. The names of those parasitic fungi which have been identified on the respective host plants are given.

Sphacelotheca sorghi on *Sorghum vulgare; Phyllachora pennisiti* on *Pennestium typhoides; Selerospora graminicola* on *Zea mays; Uredo cypericola* and *Meliola circinans* on *Cyperus* sp.; *Hemilaia vestatrix, Diplodia* sp. and *Glomerella* sp. on *Coffea arabica, Macrophomina phaseolina, Corcospora personata* and *Fusarium oxysporum* on *Arachis hypogea; Glomerella cingulata* and *Gleosporium musarum* on *Musa* sp. and *Termitomyces* sp. from Termite mounds.

IX NEMATOLOGY

071

STUDIES ON SOME CRICONEMATIDAE (NEMATODA) FROM PAKISTAN ASSOCIATED WITH FRUIT PLANTS

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During a study of ring and sheathoid nematodes of Pakistan, an undescribed species of the genus *Hemicriconemoides* (Hemicriconemoidinae Andrassy, 1979) was collected and is described and illustrated herein. *Hemicriconemoides ghaffari* n.sp. is closely related to *H. strictathecatus* Esser, 1960 and *H. mangiferae* Siddiqi, 1981, but is distinguished from these and all the species of this genus by the presence of massive and rounded basal knobs sloping downwards. This new species was collected from soil around the roots of citrus plants from Muzaffargarh (Punjab).

Criconemella onoensis (Luc, 1959) Luc & Raski, 1981, *Criconemella curvata* (Raski, 1951) Luc & Raski, 1981, *Criconemella xenoplax* (Raski, 1952) Luc & Raski (1981) and *Hemicriconemoides strictathecatus* Esser, 1960, were found around the roots of some fruit plantations. These four species are recorded for the first time in Pakistan.

072

ASSOCIATION OF *MERLINIUS BREVIDENS* (ALLEN, 1955) SIDDIQI, 1970 WITH IMPORTANT CROPS OF PAKISTAN

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Merlinius brevidens (Allen, 1955) Siddiqi, 1970 has been recorded from 21 localities of Pakistan in frequency ranging from 200 to 500/100 gm of soil associated with *Avena sativa, Citrus sinensis, Citrus medica, Ficus carica, Hordeum vulgare, Oryza sativa, Prunus persica, Prunus domestica, Sorghum vulgare, Triticum aestivum* and *Zea mays.*

073

STUDIES OF PLANT PARASITIC NEMATODES ASSOCIATED WITH PEAR *(PYRUS COMMUNIS)* IN PAKISTAN

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Out of 350 soil samples collected around the root of *Pyrus communis* from 22 different localities of Baluchistan and N.W.F.P. regions, the parasitic nematodes found in high frequency were *Criconemella xenoplax, C. caclata, Helicotylenchus digonicus, H. dihystera, H. multicinctus, Heterodera zeae, H. mothi, Merlinius brevidens, M. nanus, Paratylenchus hamatus, P. holdemani, Pratylenchus penetrans, P. thornei, P. vulnus, Quinisulcius capitatus, Q. acutus, Rotylenchus buxophilus, Tylenchorhynchus mashhoodi, T. martini, Xiphinema americanum* and *X. diversicaudatum.*

074

VARIATION IN PLANT PARASITIC NEMATODE POPULATION AT VARIOUS DEPTHS AND MOTSTURE CONTENT ON OKRA PLANTED SOIL

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Effect of depth and moisture content of okra planted soil on the nematode population at the Cereal Diseases Research Institute Karachi was studied for a six month period. The population of *Meloidogyne* sp., *Aphelenchus* sp., *Helicotylenchus* sp., and *Pratylenchus* sp. was confined to the root zone area (0-30) cms and no population was recorded beyond 60 cms depth. Increase in the population occurred during the month of December and January when the moisture content was low, however, high moisture content did not stop hatching of the larvae but only lowered the motility of the nematodes.

075

EFFECT OF INTERACTION BETWEEN *MELOIDOGYNE INCOGNITA* AND *RHIZOBIUM JAPONICUM* ON THE GROWTH OF COWPEA PLANT

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M.A. MAQBOOL,

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Field experiments were conducted to study the effect of interaction between a root-knot nematode and root nodule bacterium on the growth of cowpea plants (*Vigna un-*

guiculata). Cowpea were inoculated with *Rhizobium japonicum* and *Meloidogyne incognita* singly or in combination. Plants inoculated with the rhizobium developed large pink nodules effective in nitrogen fixation as shown by healthy growth and lustrous green colour of the plants. Plants inoculated with nematodes showed stunted growth. Plants inoculated with the rhizobium and nematode showed severe symptoms of nitrogen deficiency and retarded growth. Microbivorous nematodes were found in large numbers in the nodular tissues where they were apparently feeding on the nodular tissues and reproducing themselves.

076

AN AUTECOLOGICAL STUDY OF ANHYDROBIOSIS IN SOME PHYTONEMATODES

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Three members of Criconematidae *(Hemicriconemoides pseudobrachyurum, Hemicycliophora conida, Macroposthonia ornata), Aphelenchoides ritzemabosi,* and *Psilenchus hilarulus* were desiccated to study their capacity to survive anhydrobiotically. Results indicate that the relatively loose attachment of the sheath with the main animal and the ablity of the sheath to shrink quickly allow *Hemicycliophora* to survive longer than *Hemicriconemoides;* the survival of *Macroposthonia* was intermediate. *Aphelenchoides* and *Psilenchus* survived immersion in paraffin oil for 12 and 17 days, respectively. Both of these nematodes possessed multiple contraction ability i.e., coiling coupled with transverse and longitudinal folding of the cuticle. *P. hilarulus* is a new addition to the list of anhydrobiotic nematodes. Advantages of desiccating nematodes in paraffin oil are discussed.

077

PRIMARY PLANT HEALTH CARE – NEMATODE-FREE CORMS OF BANANA

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Since only a few nematodes are capable of causing more injury to a seedling than numerous to a grown-up plant, technology has been developed whereby plants can be protected at seedling stage i.e., their critical period of growth. Nematode-free nursery of banana has been raised at the PCSIR Laboratories campus from where growers may purchase nematode-free corms of banana for transplantation. The corms which are free of pathogenic nematodes are coated with a substance which keeps the nematodes away upon

transplantation for about 6 weeks. This coating also slows down the rate of dehydration of the corms which results in increased storability. Raising nematode-free nurseries checks dissemination of nematodes to newer sites and is therefore considered a very effective preventive measure of nematode control

X PLANT BACTERIOLOGY

078

FIELD ASSAYS FOR THE NITROGENASE ACTIVITY OF ACTINOMYCETE NODULATED NON-LEGUMES OF PAKISTAN

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Field tests for the nitrogenase activity by acetylene reduction assay, of the nodules of six actinorrhizal species (*Alnus nitida, Datisca cannabina, Elaeagnus angustifolia, Hippophae rhamnoides, Casuarina glauca* and *Coriaria nepalensis*) were conducted. The nitrogenase activity varied considerably among the assayed species. *Datisca cannabina* exhibited highest activity for acetylene reduction (15.0 = moles/g.fr.wt. nodule/hr.) while the lowest rates (0.6-2.1 u moles/g.fr.wt. nodule/hr.) were observed for *Casuarina glauca.* Detailed studies with *Datisca cannabina* nodules revealed a high and consistent nitrogenase activity (10.8 4.2 u moles/g.fr.wt. nodule/hr.) for young nodules while the activity was lower in the old perennial nodules (6.1 ± 2.7 u moles/g.fr.wt. nodule/hr.).

079

A STUDY ON THE NODULATION OF SOME WILD AND CULTIVATED LEGUMES OF NORTHERN PAKISTAN

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Of a total of 43 leguminous species examined for root nodulation in different areas of N.W.F.P. and in the districts of Islamabad and Rawalpindi of the Punjab, 35 species were found to bear root nodules while the others were non nodulated. Data on the habit and habitat of species and the shape, size, color of the nodules were recorded. Nodule formation in *Argyrolobium roseum* (Camb.) Jaub. and Spach. and *Lathyrus emodi* (Wall. ex Fritsch) Ali are the first records of nodulation (Mrs. Allen, Personal communication, 1980).

Nitrogenase activity by gas chromatography (acetylene reduction) was carried out for a number of wild and cultivated legumes for the assessment of their nitrogen fixing potential which will be discussed.

080

SOME STUDIES ON THE RESPIRATORY METABOLISM OF THE ENDOPHYTE FROM THE ROOT NODULES OF *DATISCA CANNABINA* AND *ALNUS NITIDA*

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Alnus nitida and *Datisca cannabina* bear actinomycete nodulated nitrogen fixing root nodules. Vesicle clusters of the endophyte (*Frankia* sp.) from the nodules of these plants were prepared by homogenization and filteration through 100μm and 20 μm filters under anaerobic conditions. The material retained on the 20 μm filter was mostly vesicle clusters of the endophyte which was repeatedly washed with and suspended in 50 mM Tris-HCl buffer containing 0.3M sucrose, 4% PVP, 5mM $MgCl_2$ and 5mM EDTA. The *Datisca* preparation of vesicle clusters has an intense yellow colour while that of *Alnus* is of brown colour.

Preparations both from *Alnus* and *Datisca* exhibited considerable dehydrogenase activity as indicated by the reduction of tetrazolium salts in presence of the vesicle clusters, NADH and PMS forming coloured formazan crystals.

Studies on the uptake of oxygen showed that the vesicle clusters alone were unable to consume oxygen. In the presence of 50mM NADH the *Alnus* vesicles showed oxygen uptake at a rate of 18 nmole O_2 g^{-1} nodule min^{-1} while the rate of oxygen uptake in the presence of NADH by *Datisca* vesicles was 23 nmole O_2 g^{-1} nodule min^{-1}.

ADP stimulated oxygen uptake by *Datisca* vesicle clusters but did not show any effect on oxygen uptake by *Alnus* vesicle clusters, indicating that the membranes in the *Datisca* endophyte preparation remained highly intact to show respiration control while the membranes of the *Alnus* vesicle clusters were damaged during preparation.

081

BIOLOGICAL NITROGEN FIXATION IN THE RHIZOSPHERE OF GRASSES

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A number of cultivated and wild grasses have been screened for the nitrogenase activity associated with their roots by acetylene reduction assay. Considerable activity was detected in the rhizosphere region of *Zea mays, Cynodon dactylon, Sorghum bicolor* roots and in certain grasses. In maize the nitrogenase activity varied with the specimens collected from different locations. Very little activity was detected in plants to which

nitrogenous fertilizers had been added (NARC farm) while plants from unfertilized fields exhibited high nitrogenase activity. The enzyme activity varied with the age of the plant, the highest activity being at the time of flowering. The isolation of nitrogen fixing bacteria was attempted from the rhizosphere region of the grasses. An isolate was obtained from the rhizosphere region of maize on inoculation in nitrogen defficient medium. On further subculturing of the isolate in the same medium, its growth continued upto ten transfers. The characterization of the isolate is in progress.

082
NEW RECORDS OF LEGUME NODULATION FROM PAKISTAN

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Surveys of nodulation in leguminous plants carried out indicate that most of them are nodulated. Additions to the list of nodulated legumes have been made in recent years and fifteen species have been recorded as new nodulating species. The species recorded are *Acacia nilotica* ssp. *cupressiformis, A. nilotica* ssp. *hemispherica, Alysicarpus heterophyllus, Caesalpinia pulcherrima, Cassia purpurea, C. roxburghii, Crotalaria burhia, C. medicagnea* var. *luxurians, C. medicagnea* var. *medicagnea, Tamarindus indica, Tephrosia subtriflora, T. uniflora* ssp. *petrosa, Trigonella monantha* ssp. *incisa, Sesbania concolar* and *S. sesban.* Failure to find nodules on a given plant at any time does not prove that the plant is always non-nodulated. Many plants were examined over the years for establishing the criterion of nodulation. Species failing to yield nodules were grown and regrown from inoculated seeds and were examined for nodulation. *Cassia fistula, C. holosericea* and *C. siamea* repeatedly failed to form nodules yet flourised well and were accepted as lacking nodulating ability. Although certain members of the Mimosaceae and Papilionaceae appear not to nodulate, the available information indicates that it is especially members of the Caesalpiniaceae which lack this ability.

083
ROOT NODULES IN *TRIBULUS TERRESTRIS* LINN

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Nodules were observed on the roots of *Tribulus terrestris* (Zygophyllaceae). Internal structure of the nodules resembled *Alnus* type nodules on the one hand and *Parasponia* on the other. The endophyte was identified as *Rhizobium* which is an exception in non-legumes alongwith *Parasponia* reported from Australia. The colony characteristics, biochemical tests and infective behaviour of the isolate from *Tribulus* nodules resembled in

many respects with slow growing rhizobia and is nearest to *R. japonicum.* The isolate from *Tribulus* nodules was used in cross-inoculation experiments with 9 legumes belonging to different cross-inoculation groups. It produced effective nodules in *Vigna radiata.*

V. unguiculata var *minor, V. unguiculata* var. *major, Cyamopsis tetragonoloba* and *Sesbania sesban.* Cross-inoculated legumes showed luxuriant growth, increased dry weight and high nitrogen content as compared to legumes inoculated with their respective effective strains. Qualitative studies on free amino acids from nodules of *T. terrestris* showed 22 amino acids. Glutamic acid, glutamine, aspartic acid and asparagine were 4 major amino acids. The pattern of distribution of free amino acids in these nodules resembled with *Myrica gale* nodules on one hand and leguminous nodules on the other.

084

ISOLATION OF OIL UTILIZING BACTERIA FROM SOIL AND MINERALIZATION OF PARAFFIN OIL BY FOUR BACTERIA

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Oil polluted soil samples, collected from various petrol pumps and around furnace oil storing underground tank were analysed for their total microbial population and the frequency of oil utilizing bacteria. The oil utilizing microorganisms ranged from 28.1% to 74.4% of the total population. Isolation of oil utilizing bacteria was carried out and four of the isolates were used for mineralization of paraffin oil in flasks with mineral medium under shaking condition. In three of the strains lag period for carbon dioxide evolution ranged from 8-12 days after which a rapid increase was found. With one of the isolates a very slow release of CO_2 could be noted even after 20 days of incubation.

XI PLANT PHYSIOLOGY AND BIOCHEMISTRY

085

INFLUENCE OF DIFFERENT CONCENTRATIONS OF NaCl PRESENT IN THE CULTURE MEDIUM UPON MORPHOLOGICAL AND PHYSIOLOGICAL ASPECTS OF *FAGOPYRUM ESULENTUM* MOENCH

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Buckwheat (*Fagopyrum esculentum* Moench) plants were grown in Hoagland and Arnon's solution along with the NaCl 2,5,10,25 and 50 meq/l. Buckwheat showed the same type of growth in presence of 2 meq/l NaCl, as in control. In higher concentrations of NaCl the plants were smaller with increasing salt concentrations. Osmotic pressure of the plants increased with increase of salt concentration in the culture medium except at

5 meq/l NaCl, where it decreased as compared to control. The decrease was also found in the absorption of Cl ions. In general the absorption of Cl and Na^+ increased with increase of NaCl in the culture medium, whereas absorption of Ca^{++} and K^+ decreased. Absorption of Mg^{++} was variable. The osmotic pressure of the roots was more than that of the aerial parts.

Metabolic activities of the plant showed that respiration was irregular and there was disintegeration of chlorophyll at high concentrations of NaCl. The peroxidase activity and total proteins increased in plants growing in presence of 2 meq/l as compared to control but afterwards decreased with the increasing concentrations of NaCl.

Rate of transpiration also increased with the increase of NaCl in the culture medium. Treatment of plants with Choline Chloride and Chlorocholine Chloride @ 1 mM, two growth regulators, gave better yield as compared to nontreated plants.

086

EFFECT OF DIFFERENT CARBONACEOUS MATERIALS ON IMMOBILIZATION-REMINERALIZATION OF INORGANIC N.

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Immobilization-remineralization process of inorganic N was studied in soil for 6 weeks. Nitrification of inorganic N was complete within 6 days of incubation and NH_4-N content remained at a very low level during subsequent incubation. Glucose C resulted in a complete immobilization of 200 ppm of N followed by a rapid remineralization. It took 4 weeks for a complete immobilization in cellulose amendment followed by a much slower remineralization. In wheat straw amendment inorganic N was not immobilized completely and upto 50% of the added N remained in inorganic form even after 45 days.

Two sources of inorganic N added as ammonium nitrate and ammonium sulphate behaved similarly with regard to immobilization and remineralization of N.

087

STUDIES ON THE PHYSIOLOGICAL MATURITY IN *BRASSICA JUNCEA*

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A new variety of Raya called "Poorbi Raya" *(Brassica juncea)* was released for general cultivation in Punjab in 1972. This is sown in Zaid Kharif (August-September) and

matures in late December. Since the variety matures in cool season its proper stage of harvesting is always baffling. If harvested late, the crop shatters profusely and very often secondary flowering gets initiated consequently lowering the quality and the seed yield.

To determine the appropriate stage of harvesting, an experiments with variable dates of sowing and one date of harvesting of Poorbi Raya was conducted at the Ayub Agricultural Research Institute, Faisalabad, during 1981-82. Seed yields were higher when the crop was harvested 90 days after its sowing and plants sundried in the field. This result was found to hold good for almost all the variable sowing dates. There were insignificant differences in oil content and germination capacity of the seeds between the crop harvested after 90 days and the crop harvested when fully mature. This was apparently due to the fact that photosynthsis and translocation of photosynthate continued due to favourable water balance in the plant cells. It is therefore, recommended that for better yields, Poorbi Raya may be harvested 90 days after sowing.

088.

PRODUCTION OF ETHANOL FROM STARCH

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Maize starch was hydrolysed with commercial preparations of α-amylase and glucoamylase to glucose. This glucose was used as substrate for fermentation studies using *S. carlsbergensis* and *Zymomonas mobilis* to provide comparative kinetic data for production of ethanol from starch in batch culture. The yeast utilized glucose to produce ethanol, biomass and other products much faster than the bacterium. Kinetic data revealed the supermacy of the yeast in this particular fermentation process.

089

THERMOCOUPLE PSYCHROMETRY IN PLANT WATER RELATIONSHIP IN ARID ZONE: THEORY AND APPLICATION

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Thermocouple psychrometry was developed to investigate the water-potential. Technique for the construction of thermocouple, psychrometer chamber and a readout unit is described. Of the three forest species viz., *Eucalyptus camaldulensis, Ceratonia siliqua,* and *Zizyphus mauriatiana* grown under dry afforestation trials at Pakistan Forest

Institute, Peshawar the soil-waterpotential was found to be higher than the leaf-water-potential of the test species indicating healthy growth of these species without any irrigation.

090

PLANT BEHAVIOUR UNDER WATER STRESS

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Maize plants grown under water-deficit conditions exhibited stunted growth reduced leaf and intrnode size. Shape and tendril size were also affected. Epidermal cells were of smaller size with heavy cuticle deposition. Xylem differentiation was pronounced, while the formation of interfasicular cambium inhibited. Trachea: tracheid ratio cortex and pith size was reduced and fistular pith formation induced. Ring of vascular bundles shifted towards stem periphery.

Four varieties of maize differing in drought resistance and geographical origin were analyzed for their proline and abscisic acid accumulation during a prolonged water stress period. Proline levels increased continuously during the stress period in all the four varieties, but to different amounts. Maximal levels in the drought susceptible varietics were nearly twice that of drought resistant varieties. A negative correlation was also found between maximal abscisic acid contents and degree of drought resistance during prolonged stress of younger plants. ABA levels did not increase steadily, but reached a maximum long before the end of the stress phase and then declined.

091

NITRATE REDUCTASE ACTIVITY IN *SOLANUM TUBEROSUM* L. AS INFLUENCED BY SALINITY INDUCED CHANGES IN CHEMICAL CONSTITUENTS

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Potato cvs., Kufri, Red bed, Ajax and Atom alue were grown in soil containg 0.5 % and 1 % salinity. After six weeks of growth, all the cultivars showed significant changes in Na^+, K^+, proline, total sugars, chlorophyll and TGA content of leaves. As a result nitrate reductase activity was inhibited very significantly ($P < .001$) in cvs., Atom alue and Red bed at both levels of salinity. However in cvs. Kufri and Ajax at 0.5 % salinity the nitrate reductase activity increased. In the present study ntirate reductase activity is correlated with TGA, proline, Na^+ and K^+ changes in potato leaves.

092

BIOCHEMICAL CHANGES IN *SORGHUM VULGARE* INFECTED BY *SPHACELOTHECA SORGHI*

SOALIHA AHMED, BUSHRA IQTEDAR, NAGHMAN ASLAM AND SAYEEDA BATOOL ZEHRA
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Preliminary studies have been caried out on *Sorghum vulgare* Pers. var. BR116 infected by the grain smut fungus, *Sphacelotheca sorghi.* Striking differences were observed in diseased and healthy plants in the contents of protein, carbohydrates, amino acids, rates of respiration and photosynthesis. The amount of protein was found to be lower in diseased samples as compared to healthy samples. The types of amino acids identified in diseased plants were different from those of healthy plants. The content of reducing sugars was found to be higher in diseased plants than in healthy plants. Diseased plants, 68 days old, showed a decreased rate of respiration and photosynthesis as compared to healthy plants.

093

LEAF AREA AND PROTEIN CONTENTS OF SOYBEAN AND SUDAN GRASS AS AFFECTED BY SPACING AND SEEDING RATE

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A study of various combinations (single cropping, alternate row cropping and mixed cropping) of sudan grass and soybean with varying row spacings and seeding rates was conducted at the Agricultural Institute Tashkent during the years 1976, 1977 and 1978. Row spacing in all the treatments was maintained as 15,30,45 and 60 cm with a seeding rate as 25+40, 12+20, 12+40 and 25+20 kg/ha of Sudan grass and soybean, respectively. In alternate row cropping (15 cm) sudan grass produced 230500 and 199600 M^2/ha leaf area in 1977 and 1978, respectively whereas this area was 209300 M^2/ha in 1977 and 179200 M^2/ha in 1978 when row spacing was kept as 30 cm. Leaf area of soybean (15 cm) was 6100 M^2/ha in 1977 and 7600 M^2/ha in 1978 while with 30 cm spacing, it was 6000 M^2/ha and 7400 M^2/ha in 1977 and 1978 respectively. Leaf area,however, decreased with decreasing seeding rates.

Sinigificant variation of protein occurred among the various components. i.e. pure sudan grass contained 50.8 to 57.7 gms while pure soybean 117.6 gms per Kg of fodder. This amount was 71.7 to 87.6 gms in case of alternate row cropping with 15 cm row spacing.

094

EFFECT OF GAMMA RAYS ON GROWTH INHIBITORS IN WHEAT AND SOYBEAN SEEDS

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Dry seeds of wheat cv. C591 and soybean were exposed to gamma rays, @ 1 Kr, 10Kr, and 100Kr. Experiments were carried out to compare the presence of endogenous growth inhibitors (ABA like compounds) in irradiated and non – irradiated seeds. Significant increase in growth inhibitors level was observed in the seeds exposed to high irradiation doses. At the same doses the level of endogenous growth inhibitors was higher in soybean seeds as compared to wheat seeds.

095

AMINO ACID ANALYSIS OF LEAF PROTEIN CONCENTRATES PREPARED FROM THREE SPECIES OF *CASIA*

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Nutritive value of leaf protein concentrates prepared from *Casia angustifolia, Casia holoceratia* and *Casia italica* was examined on the basis of their amino acid contents. Amino acid composition was determined by using two-dimentional paper chromatographic technique. A total of fifteen amino acids were separated from leaf protein concentrates of all the three species of *Casia.* Amino acid composition showed that all the essential amino acids except phenylalanine were present in significant amounts.

096

ESTIMATION OF HOLOCELLULOSE, ALHA CELLULOSE AND LIGIN OF SOME *EUCALYPTUS* SPECIES

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In three species of *Eucalyptus* viz., *E. tereticornis, E. macrotheca* and *E. mannifera* holocellulose, α cellulose and lignin were estimated from the wood taken from main trunks as well as from the branches. The amount of holocellulose in the wood from main trunks varied between 67.80% to 70.30% whereas the holocellulose of the wood from the branches varied between 67.22% to 74.89%. The range of α cellulose contents in the wood from main trunk was between 40.09% to 42.56% whereas the amount of α cellu-

lose in the wood from branches varied between 39.40% to 42.86%. The lignin content in the wood from main trunks varied between 27.91% to 35.28% whereas the lignin content in the wood from the branches varied between 18.405 to 32.77%. The amount of α cellulose in all the three species including the main trunks and branches did not show much variation and ranged between 39.40% and 42.86%. Moreover there was not much variation in the α cellulose contents in the wood from the main trunks and branches.

097

UTILIZATION OF KALLAR GRASS FOR ENERGY PRODUCTION

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Attempts were made to produce cellulases in submerged cultures of Kallar grass using bacteria and fungus, *Aspergillus terreus.* Only the latter produced the required enzymes but insufficient (2 units of enzyme per 400 ml of culture fluid) to produce enough reducing sugars from Kallar grass for fermentation studies. Acid hydrolysis, however, produced sufficient sugars which were utilized by *S. carlsbergensis* for cell growth and ethanol production. The cell yield increased to 6g per litre and the amount of sugars left in the vessel after fermentation was merely 0.7%.

Recent interest in conversion of biomass to methane has prompted research for isolation of methanogenic bacteria which could efficiently convert lignocellulosic fractions of such substrates to methane. For isolation of such organisms well mixed water, sediments and decomposing biomass of local sewerage, and submerged culture of Kallar grass were used. Four isolates obtained were characterized in solid and liquid culture for utilization of end products. Only one culture demonstrated its prowess for utilization of cellulose, starch and hydrolytic products of hemicellulosic fraction of biomass.

XII PLANT PROTECTION

098

THE COMPARATIVE EFFICACY OF SOME NEW INSECTICIDES AGAINST RICE STEM BORER LARVAE

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The efficacy of granular pesticides Celathion (5G), Dacamox (5G), Evisect (5G),

Lorsban (5G), Miral (5G) and Basudin (10G) granules tested against rice stem borer larvae on rice crop Basmati 370. Each insecticide was applied in standing water, in two doses of 1.5 and 2.0 kg (a.i.) per hectare at 30 and 55 days after transplanting. The efficacy was determined on the basis of the yield of rice paddy, larval mortality, dead heart counts and white head counts. The data on plant height, tiller number and leaf area index were also recorded in order to study the indirect influence of insecticides on the physiology of rice plant. Results indicate that plots treated with pesticides showed improved plant height and tiller number. The pesticide application reduced rice stem borer infestation and, thus gave negative correlation of white head and dead heart with yield. On the basis of the results obtained, it is concluded that application of insecticides exercises not only a pesticidal effect but also improves the physiological conditions of the plant.

099

INTERCEPTION OF FUNGI AND BACTERIA ON IMPORTED SEED

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At Plant Quarantine Station in Karachi, during 1980, the cauliflower and cabbage seeds imported from Holland were found infested with *Alternaria brassicicola, Alternaria tenuis, Botrytis cinerea, Phoma lingam* and *Rhisoctonia solani.* Cabbage and cauliflower seeds from Denmark were mixed with sclerotia of *Sclerotinia sclerotiorum* and *Xanthomonas campestris.* Tomato seeds imported from England and France carried infestation of *Cladosporium fulvum, Verticillium alboatrum* and *Stemphylium botryosum.*

XIII PLANT TAXONOMY

100

EVOLUTION OF EXINE STRUCTURE, SURFACE PATTERN AND PORE STRUCTURE IN FAMILY PROTEACEAE.

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It is postulated that the semiticate exine structure is the primitive form of the family Proteaceae from which the pertectate form has evolved in one direction and an intectate form in the other.

In semitectate forms, foveolate is considered to be the primitive and in these forms reticulo-foveolate exine surface patterns are more primitive than ruglo-foveloate, scaboro-rugulo-foveolate and scabro-faveolate forms whereas foveo-ornate and scabro-gemmo-ornate surface patterns are considered to be the advanced. Pertectate forms with scabrate,

subpsilate and verrucose surface patterns, and the intectate form with baculate surface pattern are considered to be advanced types in the family Proteaceae. However, pores without costae and postvestibulum have been considered more primitive than pores with costae and without postvestibulum, and pores with costae and postvestibulum have been considered to be the advanced type of pore in the family Proteaceae.

101

ON THE LOCALIZED POLLINIUM GERMINATION IN *CALOTROPIS PROCERA* (WILLD.) R.BR. (ASCLEPIADACEAE)

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In Asclepiadaceae, the germination of pollinium is restricted to certain part of pollinium which is referred to as germination locus. According to the orientation of pollinia in the flower the germination locus for *Calotropis procera* pollinium is exocentrolateral. In an attempt to find out the reason for this localized germination, *in vitro* as well as *in vivo* studies were carried out. *In vitro* experiments were done on intact as well as longitudinally and transversely dissected pollinia. The dissected pollinia germinated along the cut margins vigorously and did not show any particular polarity. Therefore it is obvious that only the pollinium wall is responsible for the localization of germination. The *in vivo* studies have revealed that this behaviour of germination is definitely related with the flower structure and pollination mechanism of *C. procera* and it leads to minimized or no loss of pollen tubes.

102

AN ANALYSIS OF THE ALTITUDINAL REPARTITION OF LILIACEAE IN POTOHAR REGION

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Potohar region comprises of district Rawalpindi, Jhelum, Attock, Abbottabad, Mansehra, Kohistan, and Azad Kashmir. Of the 283 localities of the region visited, the study area ranged from an altitude of 300meters in the Attock district to 3,400 meters at Mount Makra in the Kaghan valley. The family Liliaceae comprising 22 genera and 43 species in the Potohar region, is generally confined to the hilly areas but some taxa are widely distributed.

Only a few species like *Allium griffithianum* Boiss; *Asphodelus tenuifolius* Cavan; *Tulipa stellate* Hook, F. etc, have stenorophytic distribution while about 90% species of Liliaceae in the Potohar region are euriophytic.

103
NEW SPECIES OF *GERANIUM* FROM KASHMIR

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Two new species of *Geranium* from Kashmir are described and illustrated: *G. stewartianum* Y. Nasir and *G. nasirii* Y. Nasir. Three new infraspecific taxa are described under *G. stewartianum;* they are subsp. *khillanmargensis* and 2 varieties, *viz., chorwanianus* and *schmidii,* included under the Type subsp.

XIV PLANT VIROLOGY

104
TESTING OF COWPEA SEEDS FOR SEED-BORNE VIRUSES

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Multiplication seeds of cowpea (*Vigna sinensis* Endl.) cvs. white and red were checked for the presence of seed-borne viruses, under controlled conditions. Distinct symptoms such as crinkling, mottling, slight enations, necrotic lesions and yellowing of tips appeared on the seedlings. Where necrotic lesions were present on the primary leaves of both the cultivars, the infection eventually become systemic and the trifoliate leaves showed typical mottling. Of the 400 cowpea seeds var. white tested, 20% were found infected. Work on the thermal inactivation, dilution end point retention of infectivity and host range including differential hosts of viruses present in both the cultivars of cowpea is under study.

XV SOIL FERTILITY

105
WHEAT MUTANTS ORIENTED FOR LOW INPUT OF FERITILIZERS

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Two wheat mutants (M-5 of Indus, M-35 of Nayab) were evaluated with Pak-70 at

5 different fertility levels of N and P (180:90, 157:78 135:67, 112:56 and 90:45 Kg/ha) in a factorial experiment with RCB design. Data on yield and yield components were collected and statistically analysed. The analysis of variance revealed highly significant difference between cultivars for earhead characters and 1000-grain weight. Mutant-5 was characterized by its high yield. Mean squares attributable to differences in fertility levels were non significant for yield and its components. Most of the interactions between cultivars and fertilizers were also non signiccant. However, shifts in positive direction in the mean values of these characters was noted at F_2(157N: 78p). The non significant fertility difference for yield and its components suggest that the economic yield is possible at low to medium fertility levels.

106

TIME OF NITROGEN APPLICATION INFLUENCING SUGAR CANE QUALITY

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Nitrogenous fertilizer @ 112 Kg N/ha was applied to plant and then ratooned sugarcane at monthly interval from March 15th to July 15th for two growing seasons. Cane samples were collected at monthly interval from November to March for determining brix, purity percent, fiber percent and commercial cane sugar percent (CCS).

Early application of nitrogen gave high percentage of sucrose, purity, fiber and brix values than late application. Sucrose content and brix values increased gradually with maturity and then declined slightly. Purity percentage had no pattern while fiber percentage increased steadily with maturity.

107

EFFECT OF HUMIC ACID ON SEEDLING GROWTH OF WHEAT (*TRITICUM AESTIVUM* L.) UNDER DIFFERENT CONDITIONS.

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Humic acid extracted from soil was tested for its effect on the growth ot wheat seedlings under different cultural conditions. Addition of humic acid to the liquid culture medium enhanced several times the root growth and development of secondary roots. The effect was more pronounced in nutrient medium without nitrogen compared to distilled water alone.

Shoot growth and nitrogen uptake was enhanced due to humic acid and the later had favourable effect on seedling growth in the presence of salts. Soaking of seeds in humic acid before sowing had similar effects.

108

TRANSFORMATION OF *DIPLACHNE FUSCA* AND *SESBANIA ACULEATA* UNDER DIFFERENT CONDITIONS OF SALINITY, TEMPERATURE AND MOISTURE

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Decomposition of *D. fusca* and *S. aculeata* was carried out in a normal, saline and saline-sodic soil for 8 weeks at 25, 30 and 35°C and 60 and 180% WHC moisture. *S. aculeata* decomposed more quickly under all the conditions compared to *D. fusca*, but the later contributed more to the stable organic matter fraction. Decomposition of organic matter was retarded in salt-affected soils and at higher moisture in all the three soils, but was more at higher temperature. Decomposition of *D. fusca* was relatively more affected by different incubation conditions.

D. fusca amendment resulted in a net immobilization of N whereas *S. aculeata* in a net mineralization. Losses of *Sesbania* N increased at higher salinity, temperature and moisture. C and N mineralization of organic matter was closely related under different conditions.