

agroecological zone is an outcome of this approach. Hence defining an agroecological zone is the first priority. This was amply emphasized by Frere *et al.* and Miglietta *et al.* Knowledge of the potential productivity of the zone sets the yield limits for the breeders. Breeding for an idio-type in which crop phenology matches the target environment and is associated with drought-resistant traits becomes the aim of plant breeders. Information on the heritability and stability of the physiological characters important for stress tolerance is very meagre and more must be generated. Collaborative effort is required from plant physiologists and breeders in developing quick and reliable screening methods for key physiological and biochemical traits that breeders can use in screening large segregating populations.

In conclusion this symposium has highlighted the

fact that plant breeders will need active support of meteorologists, physiologists, biochemists and soil scientists to achieve the goal of improving and stabilizing productivity in stress-prone environments. By highlighting the deficiencies in knowledge in various disciplines this book will serve as a catalyst for research in the area of breeding for resistance to environmental stresses. With its well-written chapters and up-to-date references the book will be an excellent addition to all libraries catering to researchers and post-graduate education.

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SUMMARY OF ANNUAL REPORT (1987) OF THE INTERNATIONAL RICE RESEARCH INSTITUTE, MANILA, THE PHILIPPINES

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The research activities of the Institute are presented under the following heads: Genetic evaluation and utilization (GEU) programme (pp. 1-218); Management of rice pests (pp. 219-286); Water management (pp. 287-302); Soil and crop management (pp. 303-414); Climatic environment and rice (pp. 415-419); Consequence of new technology (pp. 420-429); Crop systems programme (pp. 430-505); Machinery development and testing (pp. 506-515); Training programme (516-536); and International collaboration (pp. 537-614). There are also chapters on research support services, publications, seminars, finances and weather summary.

Work on abscisic acid (ABA) and drought resistance in 60 upland rice genotypes and nine species of *Oryza* grown in controlled environmental cabinets is presented. ABA was assayed by radioimmunoassay. A five-fold difference in drought-induced ABA accumulation among the 60 genotypes and a two-fold difference among the nine species was found. Perhaps there is a possibility of increasing or decreasing ABA levels of rice cultivars through breeding and selection. Under field conditions stomatal conductance and growth appeared to be

more sensitive to water deficit than did leaf ABA levels.

Zinc content *per se* may not be important in varietal screening. It would appear that the nutrient balance particularly, Fe/Zn imbalance, can induce zinc deficiency. This emphasizes the importance of nutrient balance in the study on nutrient deficiencies or toxicities and underscores the usefulness of nutrient ratios as an adjunct to visual scoring in varietal screening tests for micronutrient deficiency.

A detached-leaf technique was used to assess sheath blight infection on different species of *Oryza*. Leaves were detached and inoculated with discs of potato dextrose agar containing the mycelium of a three-day-old culture of *Rhizoctonia solani*. The leaves were then placed under moist conditions and incubated at 27°C.

Through genetic analysis IRRI has identified a buff-pigment mutant that acts epistatically to virulence in the blast fungus. The buff gene controls melanin synthesis, which is essential for successful penetration of host cells. Buff mutants cannot infect rice even though they have the right combination of virulence genes.

Due to problems in obtaining a reliable supply of ³²P radioactive nucleotides IRRI explored the use of a non-radioactive labelling technique with biotinylated

nucleotides. This technique exploits the high affinity between biotin and avidin or streptavidin. Biotinylated DNA molecules could be coupled with biotinylated enzymes using avidin or streptavidin as bridge. The DNA-streptavidin/avidin-enzyme complex will in turn give a colour reaction when incubated with substrate.

The feeding behaviour of brown planthopper (BPH) biotypes, examined by studying electronically recorded wave forms corresponding to planthopper probing, salivation and ingestion, differed significantly on the leaf sheaths of susceptible and resistant rice plants. The insects fed longer on the susceptible varieties than on the resistant varieties. The quantity of food ingested and assimilated was also significantly higher on susceptible than on resistant varieties. In some of the experiments there was an indication that at higher levels of nitrogen fertilizer (180 kg/ha) leafhopper damage increased significantly.

Rice germ-plasm is routinely screened now by identifying polymorphic isozyme patterns. In addition to 14 isozyme loci already mapped to specific chromosomes, new genes are being mapped through trisomic analysis.

Grain and sheath discoloration, according to scientists at the Centro Internacional de Agricultura Tropical, Cali, Colombia, is due to *Pseudomonas fuscovaginae*.

Green leafhopper (GLH) survival on plants treated with carbofuran alone or with neem mixed with carbofuran was negligible. Rice tungro virus (RTV) infection was significantly lower in plants treated with neem seed kernel (NSK)+carbofuran mixture than plants treated with carbofuran alone.

Neem seed bitters (NSB) seemed to have cytogenetic effects on spermatocytes of GLH and BPH. Neem bitters, in aqueous suspensions of 100–2500 ppm, were tested for their effect on reproductive fitness of the first generation male progeny of GLH and BPH. Meiosis, but not interphase, was significantly affected. There was significant reduction in the meiotic index in the progeny derived from NSB-treated parents.

In herbicide screening single herbicides and combinations are being tested under different cultural conditions. Pendimethalin, singly or in combination, effectively controlled some grasses. Fluazifop-butyl controlled the grasses but not the broad-leaved weeds. The follow-up application of either bentazol or 2,4-D on Fluazifop-butyl treated

plots decreased broad-leaf weed stand in advanced trials in farmers' fields of upland rice.

IRRI has developed a computer predictive model for detecting flooding depth and duration for different field elevations, areas and periods of submergence of crops of given heights in the field for floods of varying severity. A user nomograph was developed to estimate the effect of flooding of various recurrences, intervals, maximum water depth, durations and periods of crop submergence in some chosen field locations.

Amendment of urea with the urease inhibitor phenyl phosphorodiamidate reduced but did not eliminate nitrogen losses in field application. Use of polymer-coated urea (PCU) could drastically reduce the quantity of urea required for desired grain yield. PCU-40, with only 3.3% coating by weight of urea, was most effective in the tests.

Work is in progress on nitrogen fixation by rice seedlings inoculated with free-living and symbiotic nitrogen-fixing bacteria under gnotobiotic conditions. Significant grain yield increases of 23 and 42% were obtained in treatments with *Enterobacter* (IR5-6) and *Pseudomonas diazotrophicus* (H-8) in greenhouse tests.

The agricultural economics department has presented data on differential adoption of modern varieties and labour market adjustment and their demographic effects.

In the international collaborative programme with the Indian Council of Agricultural Research (ICAR), which was established in 1974, joint research is undertaken in the collection and exchange of germ-plasm, exchange and evaluation of breeding material, study of disease and insect biotypes, and crop production. In 1987, in the project on deep-water rice (DWR), mapping of areas for DWR in eastern India was undertaken and detailed studies on the population dynamics of pests and studies on rice-fish ecology were also attempted.

The Annual Report contains a lot of information on rice culture and is a valuable publication for all those who are interested in rice production in its various aspects.

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