New Tools for Pearl Millet Improvement - Applying the Genetic Map

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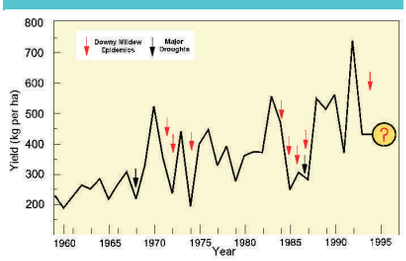
Pearl Millet Production in India

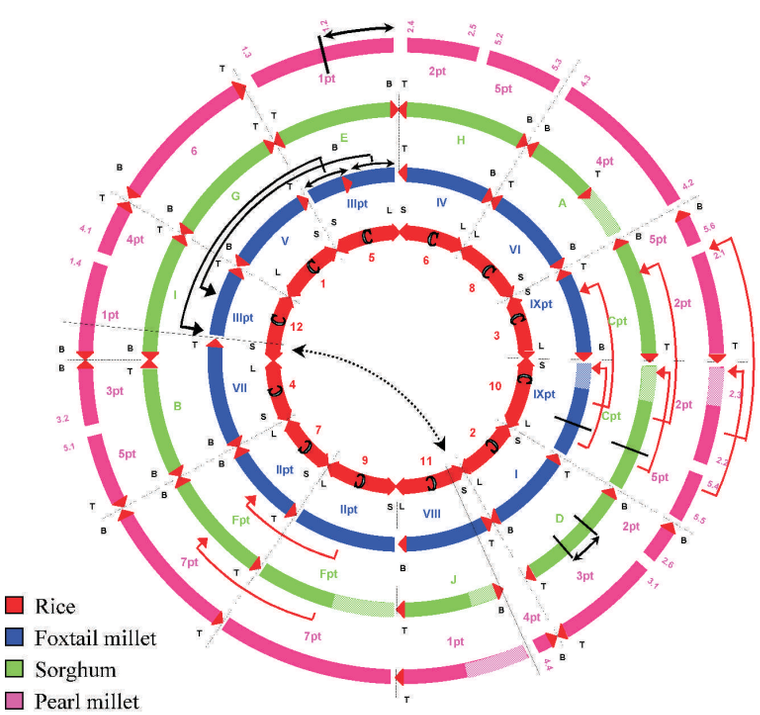


The **DFID *Plant Sciences Research Programme*** began funding collaborative research in 1990 to bring modern molecular plant breeding to bear upon some of the long standing problems of pearl millet such as catastrophic epidemics of downy mildew disease, caused by *Sclerospora graminicola*, and the devastating yield losses caused by drought (see figure left).

Pearl millet is an important food crop of the inhabitants of the world's hottest, driest areas. The people who live there are among the poorest anywhere. They cultivate the crop because where they live it is usually the only staple crop that will grow.

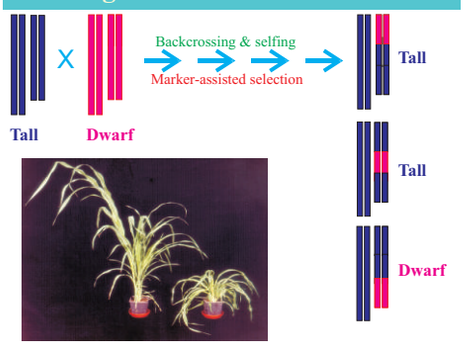
Pearl millet farmers have coped with these harsh conditions for centuries. Today, increasing population density threatens the sustainability of their livelihoods, and ancient agricultural practices and the cultivation of landraces will not continue to provide enough food. Improved varieties more tolerant of stresses are essential.

Comparative Genome Analyses



Pearl millet scientists, producers and consumers can benefit greatly from the tools and knowledge already developed within other cereal crops. Establishment of the genome relationships between pearl millet and other grass species allows transfer and direct exploitation of information from one crop to another. Genes found to control drought tolerance in rice, for example, may predict those genes that play an important role in pearl millet, and *vice versa*.

Creation of Contiguous Segment Substitution Lines

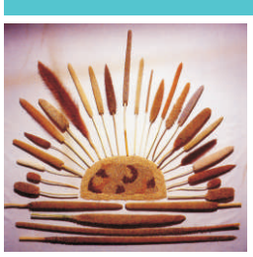


Contiguous segment substitution lines were developed by marker-assisted selection (MAS) and provide a powerful new tool for genetic studies. A simple example of their use is the rapid identification of a gene for dwarf phenotype that is located on linkage group 6.

Defeating Downy Mildew

In 1990, little was known about the inheritance of downy mildew resistance. Gene mapping revealed major-gene, race-specific resistance. This allowed MAS for resistance genes at ICRISAT in collaboration with Haryana Agricultural University, and provided optimal strategies for their deployment in farmers' fields.

Biodiversity Studies



Pearl millet is a highly variable outcrossing species. Using markers, John Innes Centre (JIC) has analysed the genetic structure of the landraces grown by Nigerian farmers.

Defeating Drought

Drought tolerance is difficult to improve by conventional breeding. By using molecular markers the locations of genes that control much of the variation for drought tolerance were identified. Now, instead of expensive, unreliable field screens, MAS can be used.

Future Targets

In Africa, the sandy soils on which pearl millet is grown are phosphate deficient. MAS for improved nutrient uptake from locally available rock phosphate will be possible if the genes responsible for this trait are mapped.

For further information e-mail DFID.PSP@bangor.ac.uk or visit the Plant Sciences Research Programme web site on http://www.dfid-psp.org or visit the MilletGenes database on http://jic-bioinfo.bbsrc.ac.uk/cereals/millet.html