New Tools for Pearl Millet Improvement - Defeating Drought

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The Problem

For many millions of resource-poor farmers in agriculturally marginal areas of the world, pearl millet provides basic sustenance. It is a crop that is able to produce nourishment from the poorest soils in the driest regions in the hottest climates, where no other cereal can grow. However, not even millet can grow when there is no water at all. The low and very unpredictable rainfall of the areas in which it is grown (see figure right) results in extremely unstable yields. Improving the adaptation of pearl millet to drought is therefore a major objective in breeding programs. Success in this objective would improve food security for many of the world's poorest people.

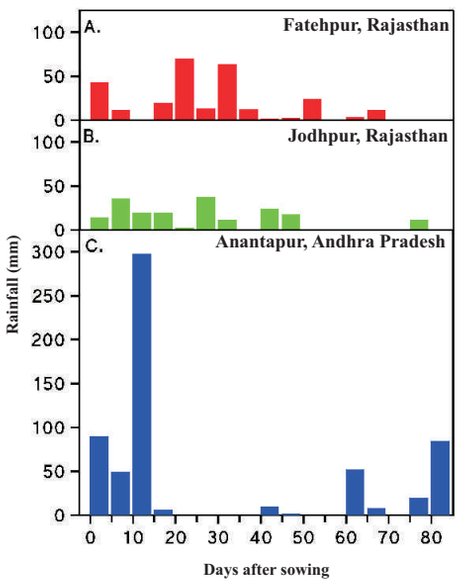
Until now, progress in producing new drought tolerant varieties of millet has been very slow. Plant response to drought is not only complex but also natural drought stress environments are highly variable in the timing, duration, and severity of drought stress, making the targeting of direct selection difficult. Over the past 10 years the ***DFID Plant Sciences Research Programme*** has funded collaborative research to solve these problems.

Drought susceptible (left hand side in above image) and drought tolerant (right hand side) pearl millet under assessment in the field.

Can we achieve this in water limited environments?

The Solution

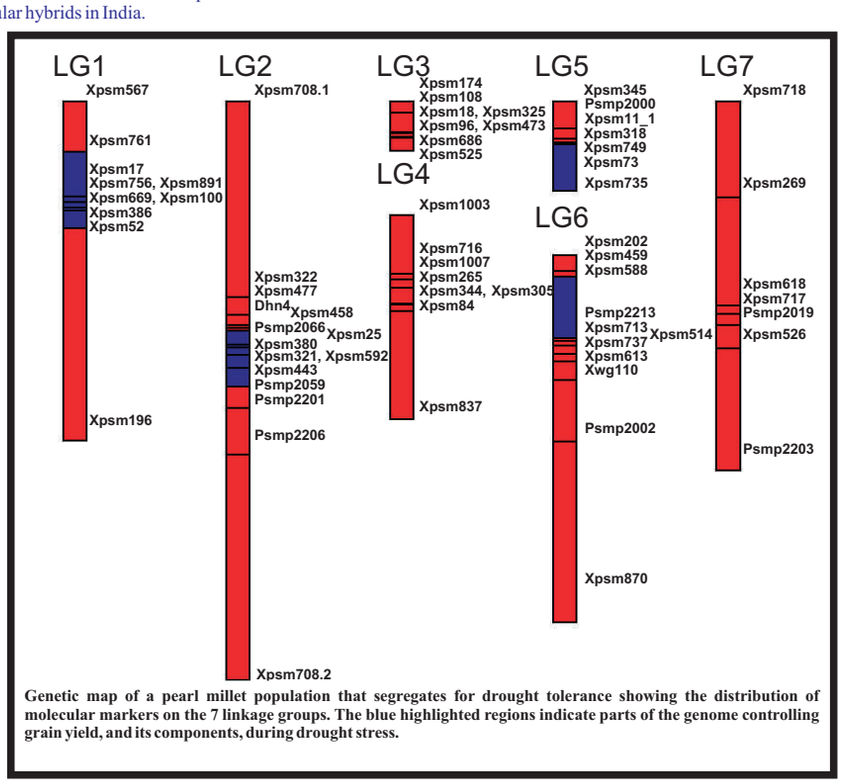
- Assess genetic variation for drought tolerance, particularly in landraces and other potential donors.
- Identify molecular markers linked to specific components of drought tolerance and use these directly in a breeding programme. We will then, for the first time, be able to breed directly for improved drought tolerance rather than simply evaluate material in expensive and unreliable field screens after it has been bred.
- Four regions of the pearl millet genome have been found so far to control components of grain yield under post-flowering drought stress. Now these are being transferred into a drought-susceptible but otherwise agronomically elite and highly desirable line that is used to produce popular hybrids in India.



The unpredictability of rainfall during one growing season in three pearl millet growing areas of India.

The Future

- ! Test new lines developed by marker- assisted selection in farmers' fields.
- ! Transfer drought tolerance traits into other agronomically elite material.



Genetic map of a pearl millet population that segregates for drought tolerance showing the distribution of molecular markers on the 7 linkage groups. The blue highlighted regions indicate parts of the genome controlling grain yield, and its components, during drought stress.

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