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NATURAL RESOURCES RESEARCH DEPARTMENT

Plant Sciences Programme

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Semi-arid Production System.
Purpose 2. Production of target crops on impoverished soils in semi-arid conditions increased by physiologically appropriate agronomic practices.

R6395. *Seed priming to improve crop establishment in Zimbabwe and India. The establishment of research linkages.*

Good crop stand establishment is a pre-requisite for the efficient use of resources such as water and light and plant stand is a major determinant of yield. This is particularly true in the semi-arid tropics where there is a delicate balance between supply of, and demand for, water. High and rapid germination and emergence determine good stand establishment, and the related vigorous early growth of seedlings often produced higher yields. Observations in many semi-arid areas suggest that stand establishment, particularly of cereals such as sorghum (the fifth most important cereal in the world) and millet (a crop of immense importance to the world's poor people), is often extremely poor. Patchy stands and the need to replant commonly occur for many reasons, both physical and socio-economic. However, even when good quality seed is sown properly into soil at the optimum moisture content, stands may still fail to establish properly if hot, dry weather follows sowing. In such cases the surface layers of the soil dry quickly, and soil temperature rises rapidly. Under certain circumstances, surface crusts and hard layers form impenetrable barriers to shoot emergence and root penetration.

Only seeds which germinate rapidly and emerge before soil surface conditions deteriorate too far will be able to emerge and form viable adventitious root systems with access to moisture deeper in the soil. Intra-specific variation in germination and emergence rates exists in many crops but previous work has suggested that priming seeds i.e. soaking them in water before sowing can speed up emergence and improve early growth of sorghum. This project seeks to extend the promising work on sorghum to other varieties and crops in an attempt to address serious and widespread establishment problems reported from Zimbabwe and India.

On-farm and on-station field trials are not yet complete but laboratory studies in the UK have confirmed the potential of seed-priming (Figure 4). Soaking seed for 8 hours in water reduced germination time by 38% and 33% in millet and sorghum, respectively, while emergence of sorghum from soil was advanced by 12 hours (16%). In areas where evaporation rates may reach 10-12 mm per day, a saving of 12 hours could make all the difference between establishment success and failure.

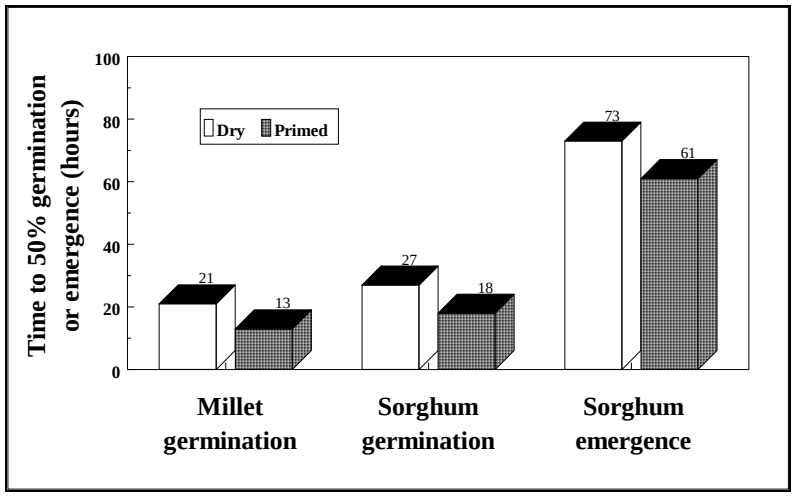

Figure 4. Sorghum and pearl millet response to seed priming

There appears to be some variation amongst genotypes in the detailed response to priming and this has important implications in minimising the risk of using the technique. Table a. shows the range of this variation amongst some maize genotypes tested so far. This sort of information is essential for the development of robust, farmer-friendly seed priming techniques.

Table a. Safe limits for seed-priming in maize.

Cultivar	Country	*Estimated* safe limit for priming (hours)
R 201 (hybrid)	Zimbabwe	16
Desi 2 (local Dudly *dent*)	India	24
Desi 1 (local Sameri *flint*)	India	36
Shweta	India	36

Seed priming is not unknown to farmers in semi-arid Zimbabwe, who sometimes soak maize seeds if planting has been delayed and the soil has dried out likewise farmers in the KRIBP area of Gujarat, Madhya Pradesh and Rajasthan will soak their chickpea seeds in similar circumstances. Neither group has considered seed-soaking and planting under optimal conditions or extending the technique to other crops (e.g. maize in India, sorghum and millet in Zimbabwe). Early results, at least from controlled environment experiments, suggest that benefits are likely from both approaches.

Initial collaboration has been with KRIBP, a bilaterally-funded NGO with strong extension links in India and with the Department of Research and Specialist Services, the research arm of the Ministry of Agriculture in Zimbabwe. On the strength of early results, an invitation was received from ICRISAT to screen millet and sorghum germplasm for its reaction to seed priming. The material provided is to be tested under hot, dry, conditions in Rajasthan as part of work relating to seedling thermotolerance in pearl millet (**R5487**).