FINAL REPORT

TITLE OF PROJECT: Participatory promotion of ‘on-farm’ seed priming.

R NUMBER: R7438

RNRKS PROGRAMME: Plant Sciences Research Programme

PROGRAMME MANAGER (INSTITUTION): Centre for Arid Zone Studies

SUB-CONTRACTOR (if relevant): None

RNRKS PROGRAMME PURPOSE: Benefits for poor people generated by application of new knowledge on selection and genetic enhancement of cultivars, and improved agronomic practices, to crop production in semi-arid, high-potential, hillside and forest agriculture-interface production systems.

RNRKS PRODUCTION SYSTEM: Primarily semi-arid production system, but cross-cutting.

COMMODITY BASE: Maize, upland rice, sorghum, chickpea, wheat, pearl millet and others.

BENEFICIARIES: Poor farmers in marginal areas.

TARGET INSTITUTIONS: Bangladesh Agricultural Research Institute; Institute of Agricultural Research for Development, Cameroon; CERAAS, Senegal; CIMMYT; National Agricultural Research Institute, Gambia; Crops Research Institute, Ghana; ICRISAT; GVT Eastern India Rainfed Farming Project; LI-BIRD and NARC, Nepal; National Cereals Research Institute, Nigeria; North West Frontier Province Agricultural University, Pakistan; Ministry of Agriculture, Forestry and Marine Resources, Sierra Leone; West Africa Rice Development Association, Cote d’Ivoire; Sanpatong Rice research Station, Thailand; IRRI; Department of Research and Specialist Services, Zimbabwe.

GEOGRAPHIC FOCUS: Generic technology but focused on Bangladesh, Cameroon, Gambia, Ghana, India, Kenya, Nepal, Nigeria, Pakistan, Sierra Leone, Thailand, Zimbabwe.

<table>
<thead>
<tr>
<th>Planned</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>START DATE:</td>
<td>1st July, 1999</td>
</tr>
<tr>
<td>FINISH DATE:</td>
<td>30th June, 2002</td>
</tr>
</tbody>
</table>

1. **Project Purpose:** Methods to optimise cropping systems by agronomic means developed, tested, piloted and promoted.
Specifically, the project objectives were to facilitate the testing, development and adoption of seed priming by farmers and researchers, using participatory approaches, for as many crops and countries as possible.

2. Outputs:
Project outputs from the logframe are:

1. Benefits of seed priming validated by farmers in at least six countries.
Large numbers of farmers have tested seed priming for themselves. For example (mean yield increases in parentheses), 204 (40%) implemented trials with upland rice in Cameroon, 257 (70%) in Ghana, 274 (33%) in Sierra Leone, 145 (25%) in The Gambia, 40 (113%) in Nigeria and 180 (10%) in Thailand. For chickpea, more than 300 (40%) farmers’ trials have been implemented in Bangladesh (in collaboration with R7540), Nepal and Pakistan. In wheat, 275 farmers in India, Pakistan and Nepal have tested seed priming (5-35%). Maize trials by 72 (29%) farmers in Pakistan and Zimbabwe (in collaboration with R7440) were also very successful.

2. Benefits of seed priming validated by farmers in at least three production systems.
Seed priming was found to be effective in semi-arid (chickpea, mungbean, sorghum, finger millet, maize), high-potential (wheat, maize) and forest agriculture interface (upland rice) production systems.

3. Increased awareness of the value of seed priming with research, extension and development agencies in at least four countries.
The utility of seed priming has been widely recognised. Participatory approaches, funded by PSP, to enable farmers to test seed priming have been used enthusiastically by organisations in Bangladesh, Cameroon, Gambia, Ghana, India, Nepal, Nigeria, Pakistan, Sierra Leone, Thailand and Zimbabwe. More than 150 requests, from scientists and other potential intermediaries and beneficiaries, for information and advice on seed priming have been dealt with (see also 5 below).

4. Increased awareness of the value of a participatory approach with research, extension and development agencies in at least four countries.
Achieved (see output 3 above).

5. Experiences with seed priming shared with institutions from non-collaborating countries.
This involved the widespread distribution of more than 3000 copies of a summary, including many photographs of striking differences due to priming, of results from the project and other PSP projects in which seed priming had been tested (Harris, 2001, updated Harris 2006). In addition, a website dedicated to on-farm seed priming was created and is being maintained (www.seedpriming.org). Results from the project were presented at various conferences and papers were published in refereed journals (see below). Dedicated workshops were held in Cote d’Ivoire (2002) and Ghana (2003 and 2004) and in Nepal in 2001. Seed priming was showcased very successfully to NGOs and other interested parties at two ‘Demonstration Fairs’ organised by DFID and the RNRRS Programmes in Zimbabwe in 2005 and in Uganda in 2006.

6. Impact of seed priming quantified for at least four countries.
An external consultant has done this for the Barind area of Bangladesh (Saha, 2002, in collaboration with R7440). A study of the persistence of seed priming with participating farmers, and spontaneous uptake by non-participating farmers, was completed in Zimbabwe in 2002. Preliminary studies of uptake of seed
priming in Ghana were undertaken in 2001. Uptake studies have been implemented in Cameroon, Gambia Nigeria, Ghana and Sierra Leone and are being analysed. Additional studies of technology packages that include seed priming are underway in Bangladesh and India.

7. Greater understanding of the process of farmer-to-farmer spread of seed priming knowledge. The studies in Zimbabwe and Ghana (above) have been very informative in this respect and should be pursued further.

8. Priming-induced disease resistance explained (additional Output, from 2003). Measurements of reduced crop losses in the field due to Mungbean Yellow Mosaic Virus in mungbean and due to collar rot in chickpea have been published in international journals. The first report of priming-induced increases in resistance to disease (downy mildew in pearl millet) was also published. Preliminary measurements have identified a possible biochemical basis for this response and confirmatory work is ongoing.

9. Priming as a vehicle for delivery of micronutrients, rhizobium and crop protection agents developed (additional Output from 2004) (with R8221 and R8269). Use of seed priming to deliver molybdenum to legume seeds has been tested in a range of researcher-managed trials in Bangladesh, Nepal and India (chickpea) and Nepal (mungbean). The practicality and effectiveness of this approach has been successfully tested by farmers in all three countries. Zinc applied during seed priming was found to be highly cost-effective in raising yields of maize, wheat and chickpea in zinc-deficient soils in Pakistan. Preliminary trials in Pakistan showed that priming seeds with dilute solutions of phosphate could increase yields (and substitute for some applied fertiliser) in maize and, to a lesser extent, wheat and chickpea. The potential recommendation domain for P-priming technology is enormous as P-deficient soils are widespread in the developing world. The project showed that adding Rhizobium to priming water was at least as effective as conventional application in promoting nodulation and fixation of atmospheric nitrogen by legumes.

3. Contribution of Outputs to Project Goal. The outputs of this project contribute satisfactorily to project goals in the semi-arid and high potential production systems and exceed those for the forest-agriculture interface.

4. Publications:


Harris, D., Tripathi, R.S. and Joshi, A. (2002). ‘On-farm’ seed priming to improve crop establishment and yield in dry direct-seeded rice. Pp. 231-240 in: Pandey, S., Mortimer, M.,


5. Internal Reports:

6. **Other Dissemination of Results:**

Dissemination fairs:
- Zimbabwe
- Uganda

Newspaper articles and radio interviews on seed priming syndicated world-wide by Wren Media.


Helping plants cope with harsh conditions. Pages 6-7 in: ‘Advances Wales’ no. 28.

Tailoring technology to marginal environments – a prime example. Page 13 in: ‘Bringing hope to marginal environments’, ICRISAT’s submission for the 2000 CGIAR King Baudouin Award. ICRISAT


7. **Follow-up indicated / planned:**

‘On-farm’ seed priming has been tested widely in a range of crops and countries. Priming with water alone is an effective, low-cost, low-risk, farmer-friendly technology that confers a range of benefits and is an ideal component of future upscaling initiatives. For example, priming is an integral part of the promotion of rainfed *rabi* cropping after rice in Bangladesh (R8269) and in eastern India (R8221), both activities that are poised to expand, given funding and support. In addition, priming with micronutrient solutions (Zn, Mo) and with Phosphorus offers enormous potential to improve yield and income in nutrient deficient areas and may have impact on human health through fortification of, e.g., the mineral content of grain. These uses of seed priming need to be tested more widely and, if found useful, disseminated and promoted. Finally, the contribution of seed priming to crop protection (as a component of IPM) should be investigated in more detail.

8. **Name and signature of author of this report.**

Dr David Harris.