Priming gets rice off to a good start in upland Africa and Asia

RIU

Validated RNRRS Output.

A simple, low-cost method for getting rice off to a good start is now available. On-farm seed priming simply means soaking seeds in water overnight, drying them so that they don't stick together, then sowing them as usual. Previously, poor farmers in upland rice-farming areas suffered because much of the seed they sowed failed. Farmers in Cameroon, the Gambia, Ghana, India, Nigeria, Sierra Leone and Thailand now prime rice seed. Primed rice germinates better, grows more quickly and strongly, flowers and matures earlier, and often produces more grain than rice that isn't primed. And, when rice gets a good start it is better able to compete with weeds—a big problem with upland rice, particularly in West Africa.

Project Ref: **PSP25:**
Topic: **1. Improving Farmers Livelihoods: Better Crops, Systems & Pest Management**
Lead Organisation: **CAZS-NR, UK**
Source: **Plant Sciences Programme**

Document Contents:

Description

PSP25

Research into Use
NR International
Park House
Bradbourne Lane
Aylesford
Kent
ME20 6SN
UK

Geographical regions included:

Cameroon, Gambia, Ghana, Nigeria, Sierra Leone,

Target Audiences for this content:

Crop farmers,

A. *Description of the research output(s)*

1. Working title of output or cluster of outputs.
In addition, you are free to suggest a shorter more imaginative working title/acronym of 20 words or less.

Seed priming for upland, direct-seeded rice in West Africa and Asia

2. Name of relevant RNRRS Programme(s) commissioning supporting research and also indicate other funding sources, if applicable.

Plant Sciences Research Programme (PSP)

3. Provide relevant R numbers (and/or programme development/dissemination reference numbers covering supporting research) along with the institutional partners (with individual contact persons (if appropriate)) involved in the project activities. As with the question above, this is primarily to allow for the legacy of the RNRRS to be acknowledged during the RIUP activities.

R6395, R7438

UK
CAZS Natural Resources, Bangor UK (Dr Dave Harris)

West Africa
Rice Research Station, Rokupr, Sierra Leone (Dr S.S. Monde and the late Mr M.S. Jusu)
IRAD Kumba / Barombi Kang, Cameroon (Mr M. M. Ebai and Dr J. A Takow)
CRI, Kumasi, Ghana (Dr R. K. Bam)
NARI, Gambia (Dr F. S. Fatajo)
National Cereals Research Institute, Badeggi, Nigeria (Dr S. O. Bakare)
West Africa Rice Development Association, Côte d'Ivoire (Dr D. Johnson, now at IRRI)

India
Gramin Vikas Trust (West), Jhabua, India (Mr B.S Raguwanshi)
Gramin Vikas Trust (East), Ranchi, India (Mr V.K. Vij)
MPUAT, Banswara, Rajasthan, India (Dr R. Pandiya, succeeding Dr R. S. Tripathi, *retired*)

Thailand
Sanpatong Rice Research Station, Chiang Mai, Thailand (Dr. Waree Chaitep).

*4. Describe the RNRRS output or cluster of outputs being proposed and when was it produced? **(max. 400 words)**. This requires a clear and concise description of the output(s) and the problem the output(s) aimed to address. Please incorporate and highlight (in bold) key words that would/could be used to select your output when held in a database.*

For farmers who grow annual crops from seed, **good stand establishment** is of paramount importance because patchy stands result in low yields and, often, crop failure. Even if sparse crops can be re-sown, it is expensive and can lead poor farmers into crippling debt. Good crop establishment is especially difficult in marginal, rainfed environments where many poor farmers live. **Rice yields** under **rainfed, upland** conditions in West Africa and South Asia are constrained by drought, poor quality seeds and inadequate, untimely agronomy, the effects of which often manifest themselves as sparse stands of stressed seedlings. Such stands seldom recover and can never fulfil their genetic potential.

On-farm seed priming is a simple, low-cost, low-risk technology that hastens germination and seedling emergence and promotes vigorous early growth so that transient resources (soil moisture, nitrogen, etc.) are captured and utilised. Seed priming simply involves soaking rice seeds in water overnight, surface-drying them to facilitate easy handling, then sowing them in the normal fashion.

Plants grown from primed seeds generally emerge earlier and in greater numbers, grow more vigorously, flower and mature earlier and often yield better than those from non-primed seeds. More vigorous early growth has been observed to confer a competitive advantage over the extensive weed growth that is a dominant feature of upland rice production, particularly in West Africa. The technology has been developed, tested, refined and promoted using a combination of *in vitro*, on-station and **participatory action research** with farmers in **Cameroon**, the **Gambia**, **Ghana**, **India**, **Nigeria**, **Sierra Leone** and **Thailand** between 1995 and 2005.

5. What is the type of output(s) being described here?
Please tick one or more of the following options.

Product	***Technology***	***Service***	***Process or Methodology***	***Policy***	***Other Please specify***
	x				

6. What is the main commodity (ies) upon which the output(s) focussed?
Could this output be applied to other commodities, if so, please comment.

Rainfed upland rice (direct-seeded, generally in unbunded fields, i.e. with little or no control of water). However, many farmers in West Africa have, on the basis of their experience in testing seed priming for rice, adapted the technology on their own initiative to include maize, melon, okra, sorghum, etc.

Seed priming has also been tested elsewhere in a range of other crops, the results of which are the subjects of other RIUP dossiers - see PSP dossiers:

- Seed priming legumes in South Asia;
- Seed priming in wheat, barley, sorghum, pearl- and finger millet in South Asia and Africa;
- Seed priming in maize in Asia and Africa;
- 'On-farm' seed priming to improve disease resistance in mungbean, chickpea and pearl millet;
- 'On-farm' seed priming to improve plant nutrition in low fertility soils

Seed priming, including all work funded by PSP has been reviewed recently by Harris (2006)

7. What production system(s) does/could the output(s) focus upon?
Please tick one or more of the following options. Leave blank if not applicable

Semi-Arid	***High potential***	***Hillsides***	***Forest-Agriculture***	***Peri-urban***	***Land water***	***Tropical moist forest***	***Cross-cutting***
x		x	x				x

8. What farming system(s) does the output(s) focus upon?
Please tick one or more of the following options (see Annex B for definitions).
Leave blank if not applicable

Smallholder rainfed humid	***Irrigated***	***Wetland rice based***	***Smallholder rainfed highland***	***Smallholder rainfed dry/cold***	***Dualistic***	***Coastal artisanal fishing***
x		x	x			

*9. How could value be added to the output or additional constraints faced by poor people addressed by clustering this output with research outputs from other sources (RNRRS and non RNRRS)? (**max. 300 words**).*
Please specify what other outputs your output(s) could be clustered. At this point you should make reference to the circulated list of RNRRS outputs for which proformas are currently being prepared.

The participatory action research approach used to develop and validate this output (see section 10) is particularly appropriate in situations where farmers are testing new varieties of rice for themselves. The benefits of seed priming are effectively demonstrated with relatively little additional effort.

There is great potential for synergies between seed priming for upland rice and other RNRRS outputs, e.g. other technologies related to the development, promotion and use of direct-seeded rice:

- PSP, Rice varieties for main and *Chaite* seasons in Nepal, R8221;
- PSP, Rice varieties for Ghana, R6826, 7657;
- PSP, Rice varieties for eastern India, R8099;
- PSP, Rice varieties for Bangladesh, R8269;
- PSP, Client-oriented breeding (COB) rice Nepal, R7122, R8071;
- PSP, Rice varieties for upland, medium and lowland ecosystems in eastern and western India, R7434, R8099;
- PSP, Rice-fallow rabi cropping systems, R8098, R8221, ;
- CPP, Extension and promotion of rodent technologies in rice based systems, R8424, R8164
- CPP, Weed management in irrigated rice, R8409, R8233, R7377
- LPP, Cultivation of African *dhaincha* and fodder *khesari* as animal feed in rice fields., R6610;
- PSP, PVS;
- PSP, 'On-farm' seed priming to improve plant nutrition in low fertility soils (rice is known to be susceptible to a number of micronutrient deficiencies, e.g. zinc, and we have demonstrated the effectiveness of using seed priming to deliver zinc to other cereals).

Value could also be added to this ‘on-farm’ seed priming output through linkages to, for example, the Ghana Grains Development Project (GGDP) funded by Canadian International Development Agency (CIDA), the research and promotional activities of National Programmes such as the NCRI Badeggi, CRI Kumasi etc., and regional or international initiatives such as the African Rice Initiative Programme, WARDA and IRRI programmes.

Validation

B. Validation of the research output(s)

*10**. How** were the output(s) validated and **who** validated them?*

*Please provide brief description of method(s) used and consider application, replication, adaptation and/or adoption in the context of any partner organisation and user groups involved. In addressing the “who” component detail which group(s) did the validation e.g. end users, intermediary organisation, government department, aid organisation, private company etc... This section should also be used to detail, if applicable, to which social group, gender, income category the validation was applied and any increases in productivity observed during validation **(max. 500 words)**.*

In India between 1995 and 1998, 351 farmers in Rajasthan, Gujarat and Madhya Pradesh tested seed priming in rice (coordinated by Gramin Vikas Trust) using paired-plot, farmer-participatory trials (Harris et al., 1999). The technology was also tested in Chiang Mai, Lumpang and Lumphun provinces of N.W. Thailand by 104 farmers in 2000 and 2001, with consistent yield increases due to priming up to 25%. Additional trials in 2002 with 11 farmers in Chiang Mai and 10 farmers in Lumphun gave mean increases of 19% and 30%, respectively.

In West Africa, ‘on-farm’ seed priming – soaking seeds in water for 12 hours before surface-drying and sowing them – was tested for upland rice in Cameroon, The Gambia, Ghana, Nigeria and Sierra Leone between 1998 and 2002. A combination of research station- and on-farm, participatory trials was used to assess the yield response to priming and to elicit farmers’ views on the technology. For instance, each year in Ghana, researchers, extension officers and MOFA selected contact farmers working in communities where the technology was to be tested and who were brought together for training. A team of trainers comprising extension officers, contact farmers and researchers then went into each participating community to train participating farmers. The trials were evaluated with the farmers using participatory approaches such as farm walks, field days and focused group discussions. Gambia and Sierra Leone did not implement on-station trials. Nigeria implemented seven on-station trials between 1998 and 2000 in which the mean yield advantage due to seed priming was 22%. Cameroon began their seed priming studies with 2 on-station trials in 1999 in which the mean yield increase due to priming was 37%. Ghana supplemented their on-farm trials in 2000 with an on-station trial in which the effect of priming on yield components of rice was studied. Yield gain was 25%.

In total, 2949 farmers’ trials of seed priming were implemented between 1999 and 2002 in West Africa. In Cameroon seven trials series, involving 421 farmers over three years, gave mean yield increases due to priming of 39%. In Gambia seed priming in three series of trials, involving 145 farmers over three years, raised mean grain yield by 16%. Six hundred and seventy-seven farmers in Ghana between 2000 and 2002 raised yields by an average of 59%, while two years (2001 and 2002) of trials with 440 farmers in Nigeria increased grain yield by a mean of 77% using seed priming. Farmers in Sierra Leone raised the mean yield in 1266 trials by 33% between 1999 and 2002.

Farmers' reactions to 'on-farm' seed priming were very positive. They reported that benefits from priming were the result of a combination of faster germination and emergence and more vigorous growth and development, leading to better crop stands and bigger, more productive plants. This was confirmed by researchers from CRI, Kumasi in the Ghana yield components study and by MPUAT staff in two on-station trials in India (Harris et al., 2002). *In vitro* experiments by CAZS-NR demonstrated a mechanism by which rice seedlings from primed seeds could compete more successfully with weeds (Harris et al., 2002). In India, where a post-rainy season crop is often grown on residual soil moisture or using supplementary irrigation, indirect benefits reported were: earlier sowing of following crops; earlier harvesting of those crops, which allowed earlier seasonal migration from the area in search of work for cash; increased willingness to use fertilisers because of reduced risk of crop failure; use of time saved to grow a third crop (e.g. mungbean) instead of migrating.

Many instances were reported of spontaneous, same-year adoption of priming on the basis of observations of trials and farmers have experimented with priming other crops. In particular, priming maize in Cameroon was very successful. Preliminary assessment of uptake by farmers in Ghana and Nigeria (Bakare et al., 2005) has shown high rates of adoption and some farmer-to-farmer flow of seed priming information.

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*11. **Where and when** have the output(s) been validated?*

*Please indicate the places(s) and country(ies), any particular social group targeted and also indicate in which production system and farming system, using the options provided in questions 7 and 8 respectively, above **(max 300 words)**.*

In **West Africa**, resource-poor male and female rice farmers in rural communities whose livelihoods depend on the production and processing of rice were targeted (hillside and forest-agriculture production systems and smallholder rainfed humid farming system – see Table 1).

Table 1. Sites of on-farm, participatory trials of seed priming in upland rice in West Africa 1999-2002.

Country	Year	Site
Cameroon	2000	Besongabang, Ediki.
	2001	Besongabang, Ediki, Barombi Kang.
	2002	Mbalangi, Ikiliwindi, Konye, Kossala, Mambada, (all Kumba), Okoyong, Ossing, Kembong, Akak, Akwaya (all Mamfe).

Gambia	1999	Bankam, Berending (North Bank Division), Kafuta, Faraba Sutu, Tumani Tenda (Western Division)
	2000	Tambana, Dsilame, Karanta (N.B. Division), Kabokorr, Killing (W. Division
	2001	Toubakolong, Aljamdu, Sitanunku (N.B. Division), Gifanga, Kaimo Bintang, Sitta (W. Division), Bambako, Manduar (Lower River Division).
Ghana	2000	Besease, Boamaduase, Duapompo. Dromankuma
	2001	Likpe Babua, -Mate, -Bala, -Todome, -Abrani, -Agbozome, -Koforidua, -Kukurantumi, Fodome Amele, New Koforidua
	2002	Hohoe, Jasikan and Kadjebi Districts.
Nigeria	2001	Shendam, Mangu (Plateau State)
	2002	Nasarawa-, Benue-, Kwara-, Taraba-, Plateau-, Kogi- and Niger States.
Sierra Leone	1999	Lokomasamma (5 villages)
	2000	Lokomasamma (6 villages), Newton (4 villages)
	2001	Lokomasamma (7 villages), Newton (12 villages), Moyamba (1 village).
	2002	Kambia, Port Loko, Tonkolili (North), Bo, Pujehun, Bonthe, Moyamba (South), Kenema, Kailahun (East).

In India, the technology was validated by resource-poor farmers in tribal (*Bhils, Rathwas, Bhilalis and Minas*) villages concentrated in the lower rainfall, marginal areas of Panchmahals (Gujarat), Jhabua (Madhya Pradesh) and Banswara (Rajasthan) districts. The villagers have poor access to infrastructure and services and livelihoods are based on rainfed agriculture. Droughts and years with exceptionally high rainfall are common in the area and farmers report a crop failure three years in 10 and a serious shortfall four to five years in 10.

In Thailand, hill-tribe farmers from the border region between Thailand and Myanmar tested the technology in an area where, because of the shortened fallow period due to population increase, the traditional practice of rotational shifting cultivation with slash and burn has resulted in a sharp decline in productivity and in the degradation of forests, soils and the environment.

Current Situation

C. Current situation

12. ***How and by whom*** *are the outputs currently being used? Please give a brief description* ***(max. 250 words)****.*

The output is being used by resource-poor smallholder upland rice growers in the forest in the communities in which validation of the output took place.

The CRI has produced research reports/papers on on-farm seed priming which have been circulated among scientists, Universities, MOFA and other groups involved in extension in Ghana. Staff of MOFA, agricultural students and other groups involved in extension are also being trained. Other cereal and grain crops are being primed at CRI and some farmers in the Volta and Ashanti Regions have also applied the technology to other crops such as cowpea, okro, maize and watermelon. In Nigeria, seed priming technology is now incorporated into the research activities for technology transfer in the farming systems programme of the National Cereals Research Institute and extension staff and Subject Matter Specialists are trained during any organised programme on upland rice production.

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*13. **Where** are the outputs currently being used? As with Question 11 please indicate place(s) and countries where the outputs are being used **(max. 250 words).***

In **West Africa**, on-farm seed priming is currently being used in all the communities where validation was carried out and some communities where there has been uptake of the technology by non-project upland rice farmers. In **Ghana**, the communities currently using on-farm seed priming are: Ejisu-Besease near Kumasi, Duampopo, Adadientem, Dromankuma, Kubease, Likpe Bakua, Likpe Mate, Likpe Bala, Likpe Todome, Likpe Abrani, Likpe Agbozome, Likpe Koforidua, Likpe Kukurantumi, Fodome Amele, Santrokofi Bume, Wli Todzi, New Koforidua, Wli Dzogbega, Fodome Dzogbega, Likpe Alavanyo, New Baika, Old Baika, Awoma, Teteman, Bodada, Fodome Hloma, Wli Agoviefe, Wli Ahor, Wli Afegame, Ve Koloenu, Ve Gbodome, Donalso, Nyamease, Amangoase, Ampabame and Konogo. In Nigeria, communities in Kano, Katsina, Gwagwalada and Nasarawa are priming rice seeds.

A survey (Takow et al., 2004) in **Cameroon** in 2003 found that nearly 1400 farmers were priming rice seeds in the Manyu, Meme and Fako regions of the monomodal humid forest zone. A study in 2003 of a sample of 60 farmers in 7 villages in **The Gambia** showed that uptake of rice seed priming varied from 0-8% in villages that had not hosted farmers' trials to 37-63% in villages where farmers had tested priming previously for themselves (Fatajo, 2004).

A survey in 2003 of 83 farmers in Abia, Kano, FCT, Katsina, Nasarawa and Plateau states in **Nigeria** (linked to farmers' trials) reported good uptake of the technology but there is currently no information on the total number of farmers priming rice seeds in Nigeria, Sierra Leone, The Gambia or in N.W. Thailand. Future promotional activities in those countries should be based on uptake and impact studies (Bakare and Ukwungwu, 2004).

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*14. What is the scale of current use? Indicating how quickly use was established and whether usage is still spreading **(max 250 words).***

In **Ghana**, an uptake study carried out in 2003 in 10 communities which had participated in on-farm seed priming validation trials in 2001 and 2002 showed that 73% (49 out of 67) of the respondents who were interviewed primed their own seed in 2003. Of the 73% who primed their own seed in 2003, 81.6% had personally participated in either 2001 or 2002 in an on-farm, farmer-managed paired-plot trial. An impact assessment carried out in 2004 in 19 communities which took part in on-farm seed priming validation trials between 2000 and 2003 showed that most (76.3% or 164 out of 215) of the respondents primed their seed in 2004. About 74% (122 out of 164) of the respondents who primed their own seed in 2004 had participated in a seed priming validation trial with 80% (131 out of 164) of the respondents priming all their seed. Usage is still spreading with the major sources of information on the technology to farmers being farmer-to-farmer (36.8%), extension (31%) and research (13%).

Apart from surveys targeted towards previous trials participants (see above and Question 13) there are no good estimates of the number of farmers adopting rice seed priming in any of the target countries. Additional resources are needed to obtain good estimates of uptake and persistence of the technology.

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15. In your experience what programmes, platforms, policy, institutional structures exist that have assisted with the promotion and/or adoption of the output(s) proposed here and in terms of capacity strengthening what do you see as the key facts of success? ***(max 350 words).***

In West Africa, all the NARES originally involved with validation of rice seed priming are keen to promote the technology on a larger scale. For instance, the Crops Research Institute (**Ghana**) has a multidisciplinary team approach to research with 80 research scientists who have the mandate to carry out research on all food crops in Ghana. The CRI coordinates Research Extension Linkage Committees in the Ashanti, Brong-Ahafo and Volta Regions with MOFA, farmers, processors, traders, and millers as stakeholders. CRI has institutionalised participatory methods in its adaptive research and validation trials and also works in collaboration with universities and other research institutes, MOFA and non-governmental organisations involved in agricultural extension, particularly for rice, for which importation is to be reduced by 30% annually by increasing domestic rice production.

The National Cereals Research Institute (**Nigeria**) has the national mandate for genetic improvement as well as improved production husbandry for rice. Scientists in the institute collaborate with Agricultural Development Projects and their Extension Agents who work very closely with farmers and NGOs in a participatory manner. Similarly close linkages between researchers, Departments of Agriculture and NGOs exist in **Cameroon**, **The Gambia** and **Sierra Leone**.

There is no information on the extent of adoption of rice seed priming in **India** and **Thailand** since project funding ceased in 2003, although there are reports that the technology has been tested in some of the projects promoted by the King of Thailand.

There is great synergy between efforts to test and promote new rice varieties with farmers, such as the recent Africa Rice Initiative and WARDA activities, and many of the validation exercises described above have been combined seed priming/variety testing efforts (Harris, 2000; WARDA, 2002).

Current Promotion

D. Current promotion/uptake pathways

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*16. **Where** is promotion currently taking place? Please indicate for each country specified detail what promotion is taking place, by whom and indicate the scale of current promotion **(max 200 words).***

The CRI Ghana is involved in training extension staff and their contact farmers and other stakeholders annually on the technology and others at RELC planning meetings. Similarly, any training programme on rice organised by NCRI Nigeria, e.g. Monthly Technology Review Meetings of the Agricultural Development Projects includes training on seed priming but activities are limited by lack of financial resources.

There is no other ongoing promotion of this technology specifically for upland rice. However, there are a number of ongoing **generic activities** to promote seed priming. A website www.seedpriming.org is maintained and CAZS-NR receives many requests for additional information on seed priming. Several thousand copies of two colour brochures (DFID/PSP 2001; 2006) have been distributed to interested parties as well as many copies of specific research publications arising from the work and customised protocols for testing seed priming. Seed priming has also been widely promoted during conference presentations around the world and at dedicated Technology Fairs (in Zimbabwe in December 2005 and in Uganda in February 2006).

*17. What are the current barriers preventing or slowing the adoption of the output(s)? Cover here institutional issues, those relating to policy, marketing, infrastructure, social exclusion etc. **(max 200 words)**.*

Farmers who validated the technology for themselves during participatory action research (PAR) are enthusiastic to adopt it but lack of resources to support more PAR activities on a wider scale is a problem for countries where extension activities are not given a high priority. However, given the recent high priority on rice import substitution for many countries in West Africa, there may be an increased willingness to put more emphasis on cost-effective ways to produce more rice.

Institutional structures for promotion and extension of agricultural information exist in all target countries that have validated rice seed priming but our experience has been that potential institutional collaborators are generally unwilling to promote seed priming on evidence gathered elsewhere. In addition, seed priming is often viewed as being too ‘simple’ to extend on its own. Successful adoption has been achieved when priming is promoted as part of a ‘package’ and the ‘integrated’ approaches (IPM, ICM, ICNM, etc., often implemented through Farmer Field Schools or something similar) offer a good platform for such an approach.

*18. What changes are needed to remove/reduce these barriers to adoption? This section could be used to identify perceived capacity related issues **(max 200 words).***

A carefully targeted programme is required to raise awareness of the benefits of a good start for upland rice crops and how this can be achieved cheaply and effectively by priming rice seeds. Such a programme will need to include training for GO and NGO staff who work with farmers and provision of material support to enable them to facilitate PAR with as many farmers as possible.

*19. What lessons have you learnt about the best ways to get the outputs used by the largest number of poor people? **(max 300 words).***

One of the best ways to get seed priming technology to a large number of farmers is to link the technology to a PVS programme. Experience has shown that farmers are very keen to try new varieties. By giving improved rice cultivars to farmers and asking them to prime some of the seeds they can see the direct and indirect effects for themselves, thus leading to adoption. Experience in Cameroon, Ghana and Nigeria suggests that farmers have often then applied the technology to crops other than rice, Use of participatory methods, such as farm walks and field days, is very useful in the validation of the technology as they allow farmers to observe it in a range of familiar situations and can facilitate the effective use of farmers' feedback in fine-tuning it. Participatory approaches also break down barriers between scientists, extension agents and farmers.

Seed priming is an enabling technology – helping to ensure good stands of vigorous plants – and, as such, is an important component of an integrated approach to crop production. Holistic approaches to agricultural development, such as those pursued in rural development programmes or through Farmer Field Schools would be an ideal vehicle for promoting seed priming because its effects open up additional opportunities to apply other technological innovations, such as low-risk use of fertilizer.

Impacts On Poverty

E. Impacts on poverty to date

20. Where have impact studies on poverty in relation to this output or cluster of outputs taken place? This should include any formal poverty impact studies (and it is appreciated that these will not be commonplace) and any less formal studies including any poverty mapping-type or monitoring work which allow for some analysis on impact on poverty to be made. Details of any cost-benefit analyses may also be detailed at this point. Please list studies here.

There have been no impact assessments of seed priming in upland rice that have quantified effects on livelihoods components. However, given that the technology costs almost nothing to implement and yield benefits are large, it can be implied that income will be increased if seed priming is adopted.

Benefit: cost (B: C) ratio for rice production in farmers' fields in the Gambia using seed priming was 3.44 whereas it was only 2.23 when seed was not primed. The difference was due to increased yields and reduced costs because less weeding was required in primed crops (Fatajo, 2004).

Bakare and Ukwungwu (2004) reported that most farmers questioned in 2003 in five states in Nigeria considered there to be no additional cost of production related to seed priming, although a few farmers mentioned that priming seeds took some time. However, yield increases in this study ranged from 33% to 84% and, although no costs were presented, it is likely that seed priming was very cost effective.

B: C ratio in a study in Ghana was 12.3 reflecting the profitability of on-farm seed priming technology. The marginal rate of return (MRR) to additional investment required due to seed priming was 1,230% (Bam et al., 2004).

21. Based on the evidence in the studies listed above, for each country detail how the poor have benefited from the application and/or adoption of the output(s) ***(max. 500 words):***

- *What positive impacts on livelihoods have been recorded and over what time period have these impacts been observed? These impacts should be recorded against the capital assets (human, social, natural, physical and, financial) of the livelihoods framework;*
- *For whom i.e. which type of person (gender, poverty group (see glossary for definitions) has there been a positive impact;*
- *Indicate the number of people who have realised a positive impact on their livelihood;*
- *Using whatever appropriate indicator was used detail what was the average percentage increase recorded*

The beneficiaries of the technology in West Africa are poor men and women whose livelihoods depend on the production of upland rice. They have benefited because their rice yields have consistently increased without a corresponding increase in cost of production (see Q10 and Q20). For instance, over four years in Ghana mean yields from on-farm, farmer managed paired-plot trials ranged from 0.86 t ha^{-1} in non-primed plots to 1.27 t ha^{-1} in primed plots. Percentage increase in yield due to priming averaged over locations was 53% in 2000, 89% in 2001, 16% in 2002 and 48% in 2003.

The year 2001 was characterised by a severe drought towards the end of the season and, in Ghana and Nigeria, priming was often the difference between harvesting at least some yield and complete crop failure. As an example, in Ghana the mean yield in non-primed plots was only 0.53 t ha^{-1} whereas primed crops yielded 1.0 t ha^{-1}. In 20 of the 132 trials only the primed crop gave any yield at all.

Environmental Impact

H. Environmental impact

24. What are the direct and indirect environmental benefits related to the output(s) and their outcome(s)? ***(max 300 words)***

This could include direct benefits from the application of the technology or policy action with local governments or multinational agencies to create environmentally sound policies or programmes. Any supporting and appropriate evidence can be provided in the form of an annex.

Priming can result in higher yields of crops thereby reducing pressure on land and, in West Africa where it is common practice, allowing fallowing cycles to be maintained at sustainable levels.

25. Are there any adverse environmental impacts related to the output(s) and their outcome(s)? ***(max 100 words)***

No adverse environmental effects of rice seed priming are envisaged.

26. Do the outputs increase the capacity of poor people to cope with the effects of climate change, reduce the risks of natural disasters and increase their resilience? ***(max 200 words)***

Yes. In any given environment, primed crops emerge faster and more uniformly, and grow faster than non-primed crops. The risk of crop failure is reduced (Harris, 2003). In countries such as India where a successful crop following rice needs to be sown as early as possible, earlier maturity and harvest of primed rice will facilitate this. Priming increases the level of control farmers have over their environment and increases farmers' range of options. More choice increases resilience.

Annex

References

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Bakare, S.O., Ukwungwu, M.N., Fademi, A.O., Harris, D. and Ochigbo, A.A. (2005). Adoption study of seed priming technology in upland rice. Global Approaches to Extension Practice (GAEP) 1 (1): 1 – 6.

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DFID/PSP (2001). 'On-Farm' Seed Priming. A key technology to improve the livelihoods of resource-poor farmers in marginal environments. DFID/PSP information booklet, English language version. Centre for Arid Zone Studies, University of Wales, Bangor, UK.

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