

RIU

# Farmers speed up rice improvement in Ghana

## Validated RNRRS Output.

Involving farmers in testing improved varieties of rice has proved very successful. The time it takes for new varieties to be released falls from 15 to 5 years. Booming demand for rice in Africa has fuelled imports. But domestic producers have been going out of business because the traditional African or old varieties they grow perform poorly and are not liked by consumers. In Ghana, a pilot project showed that involving farmers speeds the spread of new varieties. The varieties that farmers chose were being grown up to 100 kilometres away within a year. And because farmers are getting better harvests, larger areas are planted to rice. Involving farmers in testing new varieties has great potential for many crops and is already being used for groundnuts, sorghum, cotton and cassava.

Project Ref: **PSP06:**

Topic: **1. Improving Farmers Livelihoods: Better Crops, Systems & Pest Management**

Lead Organisation: **University of Reading, UK**

Source: **Plant Sciences Programme**

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## Document Contents:

[Description](#), [Validation](#), [Current Situation](#), [Current Promotion](#), [Impacts On Poverty](#), [Environmental Impact](#), [Annex](#),

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## Description

**PSP06**

## Research into Use

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

## Geographical regions included:

[Ghana](#),

## 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.*

Participatory crop improvement; rice in Ghana

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

Plant Sciences Research Programme

**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.**

R6826, R7657

Crops Research Institute, Kumasi, Ghana. Dr K Marfo.

Savanna Agricultural Research Institute, Nyankpala, Ghana. Dr W Dogbe

The School of Agriculture, Policy and Development, University of Reading, UK. Dr P. Craufurd and Dr P Dorward.

**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.*

Problem

Demand for **rice** in West and other parts of **Africa** has grown rapidly and continent-wide imports are valued at US \$1.2 billion or more. In **Ghana** imports are valued at more than US\$125 million. Imports have led to low levels of domestic rice production and loss of 1000's jobs in the rice sector, particularly in northern Ghana. Ghana government is concerned with impact of imports on rural livelihoods and food security (MOFA, 2002;IRRI, 2006).

Domestic rice production is hampered by lack of **improved varieties**, particularly varieties with drought and weed tolerance that satisfy local and urban market preferences. Ghana has never formally released an upland rice variety. Participatory Varietal Selection (**PVS**) is an efficient and effective process to introduce and test new varieties with farmers.

Most rice farmers, equally divided between men and women, are small-scale subsistence farmers (<1ha) using few or no inputs. They grow predominantly traditional African rices (*O. glaberrima*) in the southern uplands or old *O. sativa* varieties in the northern lowlands. For these farmers rice is an important cash and subsistence crop contributing to their livelihood.

Similar conditions and demand exist in **Nigeria, Sierra Leone and Tanzania**.

Outputs

A PVS programme was initiated in Ghana in 1997 through 2003. There are three main outputs:

- A farmer-orientated participatory process (modified PVS) to identify and evaluate new rice varieties was successfully piloted in southern and northern Ghana. This process built capacity within two key national institutions, and fostered links between scientists and farmers and their organisations. Small-scale, male and female farmers have benefited. The PVS process has enabled varieties that have sat on the shelf for up to 15 years to be released, and will shorten the time to release in future by at least 5 years.
- Local, informal systems of seed multiplication and popularisation have been shown to be effective in disseminating new varieties. How to use these **seed systems** in the absence of a formal system has been better understood eg who to give seed to, how much, when and how to maintain quality.
- New varieties have been identified and are being grown by farmers in both regions; **IDSA85** in the south and **IR1279-24-1** in the north. **IR1279-24-1** has been officially released following its inclusion in on-farm 'Mother & Baby' trials while IDSA85 is being promoted in southern Ghana using Gatsby funding. An impact survey in 2005 has shown that adopting IDSA85 has improved livelihood through higher yield combined with larger areas planted to rice.

The PVS process, and associated insights and benefits for improving seed systems and variety release, is generic. Experiences gained in this project on integrating formal and informal **institutions** and actors could be applied elsewhere and on other **cereal, legume** and **root & tuber crops** eg **maize, cassava, sorghum**.

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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		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

Upland, hydromorphic / lowland rainfed rice. Generic PVS output could be applied to (a) lowland and irrigated rice ecosystems and (b) all other crop commodities but especially cereals, legumes and roots & tubers (eg maize, sorghum and cassava).

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

<b>Smallholder rainfed humid</b>	<b>Irrigated</b>	<b>Wetland rice based</b>	<b>Smallholder rainfed highland</b>	<b>Smallholder rainfed dry/cold</b>	<b>Dualistic</b>	<b>Coastal artisanal fishing</b>
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.

#### Participatory processes

Participatory processes that allow farmers to select and test on-farm new varieties and other technologies can be applied successfully to all other commodities. R8402/8302/7565 'PPT breeding disease resistant cassava' is using participatory methods in cassava in Ghana while R7438 'Seed priming rice in West Africa and Asia' worked with the same PVS farmers used in the Ghana rice programme. WARDA provided initial varieties.

#### Seed systems

Projects such as R8415 'Dissemination of improved beans', Plant Sciences Research Programme Generic 'PVS theme' and 'Community-Based Seed Production theme' have all increased understanding of local seed systems and methods to utilise these systems better. There would be value in sharing experience and ideas.

#### Variety release

The institutional constraints to the adoption of a more participatory approach in crop improvement, and especially in variety release, are similar across commodities and could benefit from clustering outputs.

Relevant research outputs:

R8402/8302/7565 PPT breeding disease resistant cassava

R8415 Dissemination of improved beans

R7438 Seed priming rice in West Africa and Asia

Plant Sciences Research Programme Generic PVS theme

Plant Sciences Research Programme Generic Community Based Seed Production theme

#### 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).*

PVS involves farmers in the process of selecting varieties and then helps to facilitate their spread. The widespread adoption of the varieties by farmers (49% uptake by farmers who did not have contact with the project) is evidence that the varieties are preferred and that the process has been successful.

#### Participatory process

The PVS process was organised by social scientists and plant breeders from CRI and SARI in conjunction with local MOFA extension officers and local organisations (NGOs). In Volta and Western region the local organisations were farmer groups identified within the community; in Northern and Upper East regions the process was facilitated by local NGOs. Local groups were asked to include men and women and to ensure all social and poverty classes were represented in the process. A workshop was held at CRI with plant breeders to introduce PVS and NGOs have been given training in conducting PVS programmes. CRI/SARI and local groups who implemented the PVS programme adapted the process, based on experience and feedback, to suit their needs and circumstances.

Fifty to 100 new varieties were tested with farmers, typically 30 male and 30 female farmers. In the first and second years all varieties to be evaluated were grown at a single accessible location as a rice garden or ‘Mother’ trial so that varieties could be easily compared. In some locations ‘Mother’ trials were repeated at low and high fertility. In subsequent years, once selections had been made by farmers, seed (1-2 kg only) was provided for farmers to grow one or two varieties on their own farm. Individual varieties were replicated on farm by six to >200 farmers.

More than 500 farmers have participated directly in the PVS programme and many more have grown PVS varieties. In the communities in Volta region where PVS was carried out, >90% of farmers are growing a PVS variety. Forty to 60% of farmers who have grown PVS varieties are women.

#### Seed systems

Local seed systems have spread PVS varieties to neighbouring communities, in some cases up to 100 km away. News or awareness of new varieties spreads rapidly, mostly through kin relations. Local private seed producers identified (ie enterprising farmers) provide a sustainable way of seed dissemination but tended to sell only large amounts of seed to other wealthier farmers. Poorer farmers can gain access to new varieties if they are explicitly included in the PVS process or given seed and will share small amounts of seed with other poor farmers through seed exchange and gifts. In addition locally run and organised seed banks, wherein 1-2 kg seed was borrowed from a common community bank - and returned two-fold, was successfully piloted in southern Ghana, but its long term sustainability has not been examined. The system allowed many more farmers to gain access to seed of new varieties in an equitable manner. Studies of seed systems and of how to support them to facilitate rapid and equitable spread were conducted through annual following of seed spread plus ex-post surveys of farmers and traders.

#### New varieties

The PVS process was instrumental in SARI formally releasing a variety, IR1279-24-1 in 2002. This variety was

first tested on-station in 1985 – but never by farmers. On-farm yield data from >100 farmers showed convincingly that this variety was high yielding and of acceptable quality to farmers. On-farm in 2001, for example, this variety yielded on average 1197 kg ha<sup>-1</sup> (n=119) compared with 671 kg ha<sup>-1</sup> (n=167) for the local variety, i.e. nearly 180% more.

Likewise, in Hohoe in Volta region, PVS varieties yielded on average 66% more than local varieties based on data from four years of on-farm comparisons. PVS farmers in Ghana also increased their area under rice between 2002 and 2005 by 36%. IDSA85 is being promoted in southern Ghana through a Gatsby funded initiative.

**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**).

#### Participatory process

A PVS programme was carried out between 1997 and 2003 in four areas of Ghana; Hohoe in Volta region, Sayerano in Western region, Tolon-Nyankpala in Northern region and Bakwu in Upper East region. These areas covered two major rice ecosystems: upland rice in the forest agro-ecological zone (Hohoe, Sayerano) and hydromorphic / lowland rainfed rice in the savanna agro-ecological zone in Ghana. Rice farming in both these zones is an important component of smallholder, rainfed humid systems, dominated by tree farming in the forest zone and other cereals and roots & tubers in the savanna zone. Small-scale (<1ha) farmers, both men and women, were targeted by the PVS programme. The majority of farmers could be described as Moderate and Extremely vulnerable poor.

#### Seed systems

The spread of IDSA85 in Hohoe over three seasons was followed by keeping detailed records of seed distribution and subsequent production, sale or use by individuals. This was followed by surveys of 2289 and 255 households to measure uptake, explore mechanisms and identify successful means of encouraging spread and quality. A significant proportion of the seed produced and sold was from a few seed producing farmers; most other seed was shared or traded in small quantities. In Western region, the spread of a variety called Agya Amoah, first introduced in 1985 from Cote d'Ivoire by Mr Agya Amoah, was documented by survey and interviews of farmers, traders and millers. Seed systems were also investigated across areas in Ghana as part of the independent impact study in 2005.

Farmers, and NGOs involved in the PVS process, have been trained in community based seed multiplication at SARI.

#### New varieties

IR1279-24-1 was formally released by SARI in 2002. This variety is being widely grown throughout the hydromorphic / lowland rainfed rice areas in the north of Ghana. IDSA85 is being promoted in Volta region by CRI as part of a Gatsby funded programme. Further details are given in an independent impact survey was commissioned by Plant Sciences Research Programme in 2005 (See section 21).

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Current Situation**C. Current situation**

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

Participatory process

The PVS process is gradually being institutionalised at SARI where it is being used in the selection and testing of rice varieties, groundnuts, sorghum and cotton. At CRI, the PVS process is being used by the rice programme to promote new varieties and the cassava programme.

Seed systems

Ninety farmers are being trained in CBSM at SARI. Local seed systems continue to function.

New varieties

SARI is promoting new varieties using 'Baby' trials. CRI is promoting varieties in Volta and Western region. Farmers continue to grow and spread PVS varieties through local seed systems.

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**).

Participatory process

The process is being used on several commodities throughout the Northern, Upper East and Upper West regions of Ghana within SARI's mandate. Likewise, CRI is using the process in southern Ghana for rice and cassava.

Seed systems

Farmers in Tolon-Nyankpala in Northern region are producing their own seed and training other farmers in seed multiplication.

New varieties

Farmers in Hohoe in Volta region, Sayerano in Western region, Tolon-Nyankpala in Northern region and Bakwu in Upper East region in Ghana are growing PVS varieties (see section 21).

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

Participatory process

CRI and SARI are the main source of varieties for farmers in Ghana and both are active in PVS. The process is becoming institutionalised in SARI.

Seed systems

Local seed systems continue to be the main source of seed for farmers. In Tolon-Nyankpala, Northern region, farmers have about 40 ha under seed multiplication of PVS rice varieties. Knowledge of seed systems is being used to supply seed in ways that maximise spread and maintain quality and as part of promotion (section 16).

New varieties

These have spread rapidly in and around communities involved directly in the PVS process, moving up to 100 km in a year. 49% of farmers who have not had direct contact with the project were growing PVS varieties by 2005 (see section 21). Uptake and spread is continuing.

*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).*

Participatory process

A strong partnership with collaborating stakeholders (MOFA and NGO's). These institutions have developed working relations with farmers most of whom belong to farmer groups. Farmers, individually and in groups were highly motivated recognising the value of new varieties. Research institute directors were supportive of participatory approaches. The regional promotion of NERICAs (New Rice for Africa) and donor support for participatory approaches also helps

Seed systems

Local seed systems function and can successfully spread seed of new varieties but will operate more effectively with targeted interventions to support them.

New varieties

Variety release procedures are in place in Ghana, and on-farm data can contribute towards release. Concurrent evaluation of farmer selected varieties by research at multi-location sites helped to reduce the variety testing time and provided data needed for variety release.

Current Promotion**D. Current promotion/uptake pathways**

*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).*

Participatory process

In the Bawku East and the Garu Tinpani districts, seeds of varieties selected by farmers in Nyorigu and Tambalug community PVS (2001 et seq.) are being evaluated by 280 farmers in 10 new communities using the 'Mother and Baby' participatory system.

Seed systems

Ninety farmers are being trained this year by SARI in community-based seed multiplication to add up to the 15 already trained last year. A total of 40 ha seed farm has been cultivated by the trainee seed growers. Varieties already released are being popularised using 'Baby' trials, i.e. by informal methods. Targeted seed supply continues to maximise spread of new varieties (see below).

New varieties

IDSA 85 and NERICA 1 & 2 are currently being promoted in the Tolon-Kumbungu district in Northern region. Under the project, which is being funded with a loan from the African Development Bank, 1000 farm households were targeted this year and 500 supplied with seed of the varieties being promoted. In Volta region, IDSA85 is being promoted through a Gatsby-funded programme. Informal seed spread of PVS varieties continues in all regions (see impact report, op. cit.).

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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).*

Participatory process

Institutional change is needed in Ghana to get participatory processes adopted and integrated more widely. Within research institutions, especially plant breeding programmes, greater recognition is needed that the ultimate clients of research are farmers, and that farmers have valuable knowledge and experience. The integration of extension with research could also be strengthened by closer ties between CSIR and MOFA, and more focus on adaptive research. Farmers also need to be more closely involved in on-farm research processes as partners and not contractors.

Seed systems

Local seed systems are effective, but work slowly in the absence of large inputs of seed, and in the initial stages favour wealthier farmers who can afford to purchase seed in larger quantities. Identification and working with farmers who already produce seed is not common (and neither is the use of community-based seed multiplication (CBSM) programmes for any commodity). Farmers seed storage practices are also poor, leading to poor seed establishment and variety mixtures.

New varieties

Very few varieties have been nominated for release in rice. Seed release committee decisions are still dominated by on-station yield rather than by on-farm yield and farmer acceptance data. The seed release process also requires a financial input from the institution proposing varieties, and institutions do not necessarily budget for this. Formal seed systems to multiply and supply seed of new varieties also need rejuvenating.

Poor quality post-harvest processing limits farmers' ability to obtain premium quality price.

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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).*Participatory process

Institutions need to encourage and reward scientists for working in or closely with those involved in extension and development, i.e. in getting research into use. Institutions need to recognise that the whole system from varietal development through to seed production needs to be integrated and farmer-orientated.

Seed systems

Institutional acceptance and promotion of private seed multiplication and supply by farmers already engaged in or interested in growing seed would aid spread, including 'truthfully labelled' seed. Support and quality assurance standards and training for local seed production are needed as is greater use of local seed systems and knowledge pathways to promote new varieties (i.e. informal research and development).

New varieties

Many countries, including Ghana, use a UK based variety release process. This top-down formal process does not function well. A greater acceptance of on-farm and farmer preference data in the variety release process is needed and this can be achieved by integrating seed release, PVS and seed multiplication systems. Greater exposure of seed release institutions to PVS and giving farmers or NGOs a role in decisions would help.

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*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).*

Participatory process

PVS can be effective in reaching poorer farmers and women, and can be modified to suit different purposes, i.e. seed release and variety promotion. PVS, in the form of 'Baby' trials can be used to scale-up and promote varieties. Once a PVS process has been successfully used in a community, it is easy to continue to use this process to introduce new varieties and hence sustain the process.

Seed systems

Uptake of varieties, assuming they are of acceptable quality to farmers, is limited by the availability of seed. Large-scale seed multiplication is essential to the success of this process – whether by formal or informal system.

New varieties

New varieties will spread rapidly if they are good, and local knowledge systems spread news of a new variety very effectively. New varieties sell at a premium and this encourages seed producing farmers to grow new varieties.

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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.*

An independent study of the process (output 1) and adoption of the varieties (output 3) was conducted by BMOS Agro-consultants Ltd, University of Ghana [1] at the end of 2005. The study covered three areas of Ghana with different climatic, farming and social conditions: Hohoe District in Volta Region; Bwaku-East District in Upper East Region; and Tolon-Kumbugu District in Northern Region. Five hundred and thirty nine farmers were interviewed.

[1] BMOS Agro-Consultants (2006) The impact of the rice Participatory Varietal Selection programme in Ghana: Hohoe, Tolon-Nyankpala and Bwaku-East. pp 138. BMOS Agro-Consultants, University of Ghana, Legon, Accra, Ghana.

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*

Positive impacts on livelihoods, time period and who benefited

The study focused on uptake, yield and financial benefits. All figures in this section are from the BMOS Agro-consultants study unless stated otherwise. By 2005, one year after the project had ended, **49%** of farmers interviewed who had *not* had direct contact with the project already grew PVS rice varieties (35% in Hohoe, 35% in Bwaku-East, 74% Tolon-Kumbugu.) This is supported by Marfo et al (2003) who reported 37% adoption by farmers in Hohoe. BMOS Agro-consultants also compared farmers who had been involved in PVS (and adopted the varieties; 226 'PVS farmers' interviewed) with farmers who had not been involved ('non PVS farmers'). Yields per hectare for PVS farmers in 2005 were 11% higher than for non PVS farmers. However 2005 may not be typical. Yield increases of PVS varieties vs local varieties from farmer managed replicated comparisons in 1997, 1998, 2001 and 2002 in Hohoe were 10%, 83%, 90% and 82% (mean 66%) (Project FTR, 2003). The greatest difference was in 2001 when rainfall was low indicating the ability of the improved varieties to reduce vulnerability. In the Savannah zone in 2002 yields from PVS varieties in farmers' fields were 75% greater than for local varieties (Project FTR, 2003). The study by BMOS Agro-consultants indicated that income was approximately US \$35.5 higher per hectare from rice for PVS farmers due to the new varieties, based on the 11% yield increase. (Using the mean increase in yield of 66% gives an increase of US\$117.60 per ha). The area of rice grown by PVS farmers on their farms increased by **36%** (mean) between 2002 and 2005 (increased yields made it preferable to other crops). There was no increase by non PVS farmers. Combining the yield (11%) and area increases associated with the PVS varieties gives an average increase in income from a crop of rice of US\$182.16 per

farmer (not including lost income from crop replaced).

Other livelihood impacts were not investigated but are expected to include (many were observed during the project): increased knowledge of varieties and relative benefits, improved health and education (Human); increased use of traditional seed exchange and gifting, greater connectedness between households sharing seed, more food and finance available for informal safety nets (Social); greater ability of poor to hire land for rice production (Natural); improved ability to pay for communication, transport, shelter (Physical).

All farmers irrespective of poverty level have benefited. Poorer farmers had access to improved varieties through seed gift and exchange systems. There are no additional input costs associated with new varieties. The majority of farmers are Moderate Poor and Extreme Poor, with some Extreme Dependent Poor and Children of extreme poor. Characteristics of farmers growing rice were: approximately 30% of farmers have less than 0.5ha of land for farming and only 8.5% more than 1 ha; 49% of rice farmers in Hohoe and Bwaku-East and are women; 13% of farmers were unable to pay hospital bills (31% in Hohoe). Rice was the main income earning activity for most farmers.

Average percentage increase recorded (any indicator)

49% of rice farmers have adopted varieties in a very short time and uptake is continuing.

(499 words)

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.*

Participatory process & seed systems

None.

New varieties

In the short to medium term, the adoption of new varieties will have positive environmental impacts on genetic diversity; in southern Ghana rice cultivation is dominated by one or two traditional varieties and the introduction of new varieties will diversify the gene pool.

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

Participatory process & seed systems

None.

New varieties

There are no adverse environmental impacts related to outputs and their outcomes. Rice is a traditional crop in southern and northern Ghana and replacing old varieties with new varieties that are generally shorter duration and better adapted has a neutral impact. In southern Ghana areas under rice have increased slightly but areas are nonetheless still small (<1ha). It is not known whether increased area is new land or rice replacing another annual crop. There is no evidence that farmers growing new rice varieties have increased pesticide use (and in any case most couldn't afford to do so).

*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)*

Participatory process & seed systems

Yes. The institutional adoption of participatory processes, particularly if included in a formal variety release system, will allow new varieties to be more rapidly introduced and tested with farmers. PVS systems typically shorten the cycle of introducing new varieties by up to 50%, as well as providing a more robust testing system that ensures any new variety is well adapted and of acceptable quality. e.

New varieties

New rice varieties are generally of shorter duration, as well as being more drought, weed and disease tolerant than existing varieties. These traits will all contribute to greater resilience of the system.

Annex**Annex A References**

ADF (2004) Republic of Sierra Leone Agricultural sector rehabilitation project appraisal report. ADF.

Aggrey-Fynn (1999) The rice sector in Ghana: A case study. Accra: FAO Office

BMOS Agro-Consultants (2006) The impact of the rice Participatory Varietal Selection programme in Ghana: Hohoe, Tolon-Nyankpala and Bwaku-East. pp 138. BMOS Agro-Consultants, University of Ghana, Legon, Accra, Ghana.

Dalton, T and Guei R (2003) Productivity Gains from Rice Genetic Enhancement in West Africa: Countries and Ecologies. World Development. Vol. 31(2): 359-374

Defoer T, Wopereis M, Jones M, Lançon F, Erenstein O and Guei R (2004) Rice-based production systems for food security and poverty alleviation in sub-Saharan Africa. Proceedings of the FAO Rice Conference Rice is Life, *International Rice Commission Newsletter*, Special Edition Vol. 53

FAO. FAOSTAT database (available at [www.fao.org](http://www.fao.org)).

IRRI (2006) Transforming Sub Saharan Africa's rice production through rice research. IRRI.

Kanyeka Z, Msomba S, Kihupi A and Penza M. (1994) Rice ecosystems in Tanzania: characterisation and classification. *Res. Train. Newsl.* 9 (-2), 13-15.

Marfo K (2003) A study of uptake of PVS varieties and of seed spread mechanisms in Hohoe, Ghana. CRI, Ghana.

Ministry of Food and Agriculture (2003) Special Task Force Report on strategies for improving the rice industry in Ghana and business plan. Accra: MOFA

Meertens H, Ndege L and Lupeja P (1999) The cultivation of rainfed, lowland rice in Sukumaland, Tanzania. *Agriculture, Ecosystems and Environment* 76: 31-45.

Spencer D, Dorward A, Abalu G, Philip D and Ogungbile D. (2006) Evaluation and adoption of NERICA and other improved upland varieties following varietal promotion activities in Nigeria. A study for the Gatsby and Rockefeller Foundations. Gatsby Foundation, London.

USAID (2006) USAID Sierra Leone operational plan. USAID.

WARDA (2005) Rice trends in sub Saharan Africa. WARDA.