Beating rice hispa in Bangladesh

RIU

Validated RNRRS Output.

A computer program to help predict likely outbreaks of the insect pest, rice hispa, is now available. Rice hispa is a serious pest in Bangladesh—up to half the crop can be lost—and in other countries in tropical Asia. The insects are almost everywhere in small numbers and, given the right conditions, plagues erupt dramatically. Now, pest control teams have a simple model—based on humidity levels the previous winter—to forecast outbreaks. This means they can warn farmers. Farmers then use sweep netting and spot applications of insecticide to control the insects, methods proven by small rice growers in Sylhet, northeastern Bangladesh. These methods are now being spread by farmer field schools. This integration of national forecasting with farmer action has great potential for rice-growing areas.

Project Ref: **CPP76:**
Topic: **1. Improving Farmers Livelihoods: Better Crops, Systems & Pest Management**
Lead Organisation: **CABI, UK**
Source: **Crop Protection Programme**

Document Contents:

Description

CPP76

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

Geographical regions included:

Bangladesh, India,

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.

Ecology and management of rice hispa (*Dicladispa armigera*) in Bangladesh

Suggested shorter working title: Management of rice hispa

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

Crop Protection 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.

Project numbers: R No 7891 / ZA 0445

Institutional partners and contact persons:

The project activities were undertaken by a coordinated team effort involving the following scientist and extension staff:

CABI, Europe-UK, Ascot, Berkshire, UK
Dr. S.T. Murphy, Ecologist and Biological Control and Project Leader

Imperial College, London, UK
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Natural Resources Institute, Chatham Maritime, Kent, UK
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Mr Md Hasanul Haque, Director, DAE-DANIDA Strengthening Plant Protection Services Project

International Rice Research Institute, Bangladesh and Philippines
Dr G Jahn, Ecologist

*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.*

The **rice hispa,** is a serious **pest of rice in Bangladesh** and other rice-growing countries in **tropical Asia**, in Bangladesh **yield losses can be 40-50%**. The specific objectives were to: (1) understand the socioeconomic factors associated with the pest, current controls, ecology and the natural mortality factors affecting populations of the insect in endemic and outbreak areas; (2) to use this information to develop recommendations for Extension support and farmers to improve the sustainable control of the pest in Bangladesh. The project objectives were addressed through nine researchable constraints. **Key outputs** from these were:

Monitoring and forecasting tools:

Project surveys showed that hispa is present throughout most of the lowland rice area at very low incidence and this means that all these areas are at risk from locally based outbreaks as well as outbreaks from remote areas. Simple **GIS models** (Global Information System) have been produced to **predict hispa risk** using real time surveillance data.

In addition, studies on **historical hispa population data** have shown good relations between hispa numbers and some abiotic parameters, particularly the previous winter humidity values. A simple **forecasting 'model'** has been produced that can be used to predict risk of outbreaks more generally.

*The role of **biological control technology***:

Field studies showed that insect natural enemies do have an important impact and are density dependent. The need for the **conservation of natural enemies** takes on significance and needs to be built into IPM training; but the episotic nature of the outbreaks makes **augmentation technologies** difficult to implement. Thus current efforts at mass rearing parasitoids for hispa control are questionable. But there are good possibilities for the development of a **mycopesticide** and by linking with more advanced research in **India**. This is only viable alternative to insecticides.

*Strengthening the IPM package for rice hispa in **farmer field schools***:

Socioeconomic study of the current **IPM** efforts by farmers promoted by the Department of Agricultural Extension (DAE) showed that these are generally sound and that the DAE IPM training programme for farmers is providing a good basis for equipping farmers with the right knowledge. In general, **insecticides** are the most popular tool but there is no evidence of abuse in current use; but mycopesticides might provide an alternative (see above).

But some **cultural controls** being promoted are not effective and need to be dropped from the IPM training. A national workshop consolidated the project outputs into an agreed plan that is being integrated into current **IPM implementation** in Bangladesh.

The RNRRS outputs were produced in March 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	*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

The outputs are for rice crops only

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		

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**).*

The outputs of this project should be linked with current work on rice hispa on-going in northeastern India. Rice hispa in this region is also on the increase over recent years and causing concern. Workers at Assam Agricultural University have spearheaded studies on the utilization of local entomopathogens for hispa control. Some of this work has been sponsored by World Bank. Pathogens strains have been identified and production/application techniques developed. These have been validated. Initial links between the RNRRS project in Bangladesh and the India work were successfully made at the end of the RNRRS project but this needs to be developed further.

Bangladesh would benefit from the biocontrol technology developed in India (a need identified during the project) and India would benefit from the ecological and surveillance/forecasting work completed in Bangladesh.

Other RNRRS project outputs that are likely to facilitate 'role out' of the rice hispa outputs are:

R 8417/R 8341 – IPM promotion through improved training manuals
R 8301 – Data management
R 8447 – Managing rice pests in Bangladesh by improving extension service information management for policy and planning

The last of these (R 8447) would be particularly relevant as it provides the foundation of a national scheme to support pest surveillance and forecasting. These aspects are very important for pests that erupt dramatically such as the rice hispa.

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.

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)**.*

The following covers the work conducted on the validation of the three outputs described above (A4) These outputs are complementary and 'sum' to provide a strong strategy and plan for the management of rice hispa. The first two outputs are technologies to be implemented by government and are about tools to support farmers in the implementation of IPM. The third is about environmentally benign IPM for rice farmers.

Monitoring and forecasting tools. The GIS modelling to predict rice hispa outbreaks was developed by the Agricultural Statistics Division of the Bangladesh Rice Research Institute (BRRI) with inputs from the external project partners. BRRI. used seasonal geographical survey data on rice hispa from the northeast of Bangladesh to build GIS models that can used to predict areas in that region that are at risk from rice hispa outbreaks. The predictions from the models were compared with what was reported about the general outbreaks for the northeast. There was found to be a good correspondence. The models and the results were presented to the Department of Agricultural Extension (DAE) during a national workshop held during the course of the project (in 2004).

A more general simple forecasting model for hispa outbreaks was also produced based on the value of the previous winter minimum relative humidity values. This models was then used to predict outbreaks for a series of recent years. The predicted outbreaks were then compared with observed data held in DAE archives and a very close correspondence was found. This work was conducted by external partners and BRRI's Agricultural Statistics Division.

Role of biological control technology. Mycopesticide technology for use against rice hispa has been developed in India by Assam Agricultural University (AAU) under another project. The mycopesticide is based on a local strain of the fungal pathogen, *Beauvaria bassiana* collected from rice hispa; this strain is highly pathogenic. This product provides an excellent alternative to insecticides for farmers in Bangladesh. Production methods and field application methods by farmers have been validated in India (this work is published in Indian journals). Under the CPP project, BRRI, DAE made exchange visits with AAU and also agreed to exchange information and technologies as a follow-up to the CPP project. Such a plan would allow Bangladesh to introduce and develop mycopesticide technology using the Indian model. Practically, it is likely that the mycopesticide would be produced and stored by DAE and then supplied to farmers when rice hispa outbreaks are predicted. The implementation of this technology would need another project.

Strengthening the IPM package for rice hispa in farmer field schools. The package of IPM ('integrated pest management') tools includes cultural and insecticidal controls. These are being promoted through an on-going programme of farmer field schools run by DAE but the tools have never been validated in terms of ease of application and costs and benefits. Proper experimental trials with controls were conducted in farmer fields in northeastern India to validate the control tools. These were conducted by DAE and BRRI staff and the external project partners. The study showed very positive returns for farmers for some of the tools (sweep netting and spot applications of insecticide). These validated tools are being promoted through DAE farmer field schools throughout Bangladesh along with promotion of the conservation of natural enemies.

*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)**.*

These are as follows;

Monitoring and forecasting tools. The GIS work was conducted at BRRI, Gazipur, using data and reports from the northeast of Bangladesh. This was in 2003.

Role of biological control technology. The mycopesticide technology was developed and validated in northeastern India under another project during the late 1990s/early 2000s.

Strengthening the IPM package for rice hispa in farmer field schools. The tools for this were validated in northeastern Bangladesh (Sylhet Division) in smallholder rice (land-water production – wetland rice based systems). This was during the rice seasons of 2004.

Current Situation

C. Current situation

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

Monitoring and forecasting tools. The 'know-how' for these tools are held by BRRI who are working on their refinement. DAE (the user) are currently developing their capacity to use computer based tools.

Role of biological control technology. The mycopesticide technology is held by India (AAU – see above) but plans are agreed for India and Bangladesh to begin collaborative work on rice hispa including the development of mycopesticides for rice hispa control in Bangladesh.

Strengthening the IPM package for rice hispa in farmer field schools. The tools for hispa control are being promoted with rice farmers (male and female) through farmer field schools. The field schools are run by DAE Extension staff through the DAE-DANIDA Strengthening Plant Protection Services project (SPPS).

*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).***

This question is only relevant to the third output at the moment - strengthening the IPM package for rice hispa in farmer field schools. General IPM tools are being used by many farmers throughout the lowland rice growing areas of Bangladesh. Validated tools for hispa management have been advised to DAE for incorporation in to the field school training. DAE have indicated that the new tools in the northeast in Sylhet Division.

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

As with question 13, this only relevant to the third output. DAE have been running farmer field schools covering a range of topics for several years. These have developed under the DAE –DANIDA Strengthening Plant Protection Services (SPPS) project and other projects (e.g FAO). Some of the schools under the DAE-DANIDA project have included aspects of hispa management but, as mentioned above, the tools included had not been validated and some tools (cultural controls) have not been found to be efficient. So new messages have been advised for rice hispa management for the field schools. There are no measures of how widely these messages are being incorporated or to what extent farmers are benefiting from the messages. This needs follow-up.

*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 Bangladesh a major thrust at national level has been the promotion and implementation of integrated pest

management techniques. This also captured in national policy that explicitly aims to reduce pesticide use and support the development of environmentally benign tools. The main body responsible for the 'role out' of this policy is the DAE, supported in the case of rice, by BRRI. There is an understanding that IPM by farmers will also be supported through state level actions by DAE; e.g early warning through pest surveillance, supply of some materials such as sweep nets and sprayers. The DAE –DANIDA SPPS project referred to earlier has built on this framework in Bangladesh.

Overall, this framework has provided a pathway for new initiatives on pest management to feed into and build on. The rice hispa project has used this framework to link to farmers and to government.

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).***

As with question 13, promotion is mostly concentrated where the DAE have been able to run farmer field schools for rice hispa management – in Sylhet and Barisal districts. New messages covering cultural controls (sweep netting), conservation of natural enemies and insecticide applications (when necessary) have been built into the field schools in Sylhet. But there are no measures of how widely these messages are being incorporated or to what extent farmers are benefiting from the messages. This needs follow-up.

*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)**.*

A number of barriers need to be addressed in relation to the outputs discussed earlier. Taking the outputs in order, these are:

Monitoring and forecasting tools. The barrier here is the lack of computer skills within DAE. There is an intention by government to computerise the civil service and this will have benefits for the implementation of specific initiatives under government departments such as pest surveillance and forecasting under DAE. However, the main need is for a 'critical mass' of skill to be available in DAE, not a complete 'computerisation' of the whole department

Role of biological control technology. The opportunity for the development of mycopesticide was identified at the end of the CPP project and steps were taken to provide an opportunity for workers in Bangladesh and India to share experiences and develop plans (see above). These have been accomplished. What is now required is a framework to allow an exchange of information and technology. This needs to be initiated from the Bangladesh side but the capacity to do this is not available. If this were to be addressed then this technology could be available to farmers in a very short time as the all the basic research has been done.

Strengthening the IPM package for rice hispa in farmer field schools. For this there is a need for an assessment of the extent to which information from the CPP research project is being actively included in the farmer field schools run by DAE and the extent to which this information is being adopted by farmers. In other words the adoption pathways need to be assessed and any 'barriers' to uptake by farmers addressed through participatory methods. Such an exercise could be integrated into the current national farmer field school programme.

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).***

See question 17 for the context of the comments. Changes needed are:

Monitoring and forecasting tools. The government policy for computerisation of the civil service to be implemented within DAE.

Role of biological control technology. The process needs to be steered by an expert in mycopesticide development who could 'steer' the parties through the various steps necessary for the introduction of mycopesticide technology. The institutions in Bangladesh who will be involved also need to confirm commitment to the activity but this is not likely to be a barrier.

Strengthening the IPM package for rice hispa in farmer field schools. No major changes are necessary. Here the need is for a linking of a socio-economic capacity to help with the development of the farmer field schools. This capacity exists in Bangladesh and thus there is a need for the development of linkages between the various capacities.

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).***

In general, a major issue for most project outputs is the mechanism of 'scaling up' and for an output to be sustainable. Identifying adoption pathways at the farmer to farmer level is not straightforward. From the perspective of this CPP project, efforts were made during the project to utilize existing national programmes where linkages with farmers and gender groups have already been made over a wide region. For this project the linkages are national. Thus, the trust has been to use build on and improve existing national systems that are government policy.

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.

No direct studies have been for this specific CPP project. However, assessments have been made of the farmer field schools and the training of trainers (ToT) set up under the Bangladesh DAE-DANIDA SPPS project (referred to above); in some areas these schools have included hispa management. Overall the schools have been successful and a large number of farmers (male and female) have been trained. This has resulted in improved crop yields for farmers and reduced the use of pesticides.

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 study quoted under question 20 is only very general. Information is not available to answer this question.

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.

The project outputs will provide better national awareness of the risk of rice hispa outbreaks in particular areas which in turn will create time for measured responses by Extension workers and farmers; i.e time for the implementation of cultural controls and rationale pesticide use – tools being promoted through farmer field schools. Thus overall, the new tools delivered by the CPP project will support the general thrust of the national IPM policy to reduce pesticide use and promote effective environmentally benign controls for pest management.

The development of a mycopesticide for rice hispa management will also contribute to the above objective as this will provide a direct replacement for insecticides currently used by farmers.

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

None that can be identified. The agent that would be used for the mycopesticide is native to the region (a fungal agent collected from rice hispa in India – this is host specific strain of *Beauvaria*). During the development of this technology for Bangladesh the agent would undergo non-target testing to double check that no negative impacts will occur.

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)***

The outputs will contribute the averting natural disasters. Rice hispa is an outbreak pest that can affect very large regions and cause massive damage to rice crops.
