# Effective rodent control techniques

RIU

**Validated RNRRS Output.**

New methods of rodent control have been developed in Bangladesh that could greatly improve the lives of the poor. Rodents eat crops, fruits and vegetables and cause a lot of post-harvest damage as well—by eating or simply contaminating stored food. Most poor producers think that rodents are just a part of everyday life, and don't realise that technologies exist that could help to keep numbers down. Project staff worked closely with local people from farming communities to assess how much damage rodents were doing and how effectively traditional methods managed them. Community rodent control strategies were then put in place in partnership with producers, and suitable technologies developed and tested. The project also produced a range of training materials, including a three-part video, and conducted various training events.

Project Ref: **CPP32:**
Topic: **5. Rural Development Boosters: Improved Marketing, Processing & Storage**
Lead Organisation: **Natural Resources Institute (NRI), UK**
Source: **Crop Protection Programme**

---

**Document Contents:**



---

## Description

***CPP32***

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

**Geographical regions included:**

**Bangladesh,**

**Target Audiences for this content:**

**Crop farmers,**

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

*1. Working title of output or cluster of outputs.*

Ecologically-based rodent management technologies for rice-based ecosystems and small-scale rural farming villages

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

Crop Protection Programme
Poverty Elimination through Rice Research Assistance (DFID-Bangladesh)

*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.*

R8424 (Feb 2005 to Jan 2006)
R8184 (Apr 2002 to Mar 2005)

Lead Institute: **The Natural Resources Institute**, University of Greenwich, Central Avenue, Chatham Maritime, Kent, ME4 4TB, UK
Lead person: **Dr Steven Belmain**
Email: s.r.belmain@gre.ac.uk; Tel: +44 (0)1634 883761

Main partners: **Association for Integrated Development – Comilla**, Raghupur, South of Bakrabad Gas Head Office, Comilla-3500, Bangladesh
Contact person: Ms Rokeya Begum Shafali
Email: aid_comilla@bdonline.com, aidazad@bttb.net.bd

**Bangladesh Agriculture Research Institute**, Vertebrate Pest Division, Joydebpur, Gaizipur-1701, Bangladesh
Contact person: Yousuf Mian
Email: yousufvpd@yahoo.com

**Bangladesh Rice Research Institute**, Entomology Division, Joydebpur, Gazipur-1701, Bangladesh
Contact person: Mofazzel Hossain
Email: mofazzel70@yahoo.com

**CSIRO Sustainable Ecosystems**, GPO Box 284 Canberra, 2601, Australia
Contact person: Ken Aplin
Email: ken.aplin@csiro.au

**International Rice Research Institute**, Crop and Environmental Sciences Division, DAPO Box 7777 Metro Manila, Philippines
Contact person: Grant Singleton
Email: g.singleton@cgiar.org

*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.*

Outputs that could be categorised as **processes** or **methodologies** include understanding 1) the current **impact of rodents** upon rural agricultural communities; and 2) the **impact of existing control strategies** used by small-scale farmers upon rodent population dynamics, the environment and socio-economic capital. Understanding impact is important because the demand for rodent pest management is rarely articulated. For example, the PETRRA programme commissioned needs assessments and subsequent project calls. During this review process, expert evaluation panels in Bangladesh highlighted the widespread problems due to rodents and ranked highly the need for rodent R&D. This is despite the fact that none of the **needs assessments** with farmers identified rodents as a serious problem. The reasons why **participatory appraisals** often fail to identify rodent problems is usually through a combination of defeatism and acquiesce to rodent damage as well as poor awareness about the rodent management tools available, e.g. people can not ask for unknown technology. Identifying the need for rodent pest management is, therefore, a major challenge because it is not usually highlighted through traditional assessment methods. Knowledge collected on impact can lead to the development of **cost-beneficial rodent management** strategies. Studies need to be strongly based on the ecological and sociological factors for a given situation. Methods that can measure the damage caused by rodents to **staple crops**, **fruits** and **vegetables**, as well as **post-harvest loss**/**contamination**, damage to personal possessions (houses, clothes, fishing nets, electrical wires) and **disease transmission** to **livestock** and people are required to holistically measure the economic expenditure that results from **rodent pest problems**.

**Technology** and **service** outputs occurred through developing **community** rodent control strategies through farmer participatory research. Successful rodent management is based on the knowledge, attitudes and practices of people dealing with rodent problems and the ecological context. **Integrated pest management** usually employs a number of tools and technologies to sustainably manage pests. In the case of rodents, this involves evaluating “new” technology that is not widely available or known about, such as new trap designs or trap barrier systems which optimally exploit rodent biology and cropping systems. It also involves environmental management to reduce the carrying capacity of the environment to sustain large numbers of animals. Rodent species significantly vary in their behaviours and damage, and their local ecology needs to be studied in the context of appropriate technology.

**Policy** outputs to disseminate recommendations and increase the uptake of cost-beneficial

management appropriate for small-scale farming communities were delivered through workshops, training events to farmers and extension institutions, and the development of training materials, including booklets, manuals and a three-part video.

*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 | 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 main commodity focussed upon was rice where yields are reduced by rodents by 5-10% pre-harvest and 5% post-harvest. However, rodents attack all crops, and damage to many fruit and vegetable crops was noted. Rodent damage to fruit and vegetable crops affects yield by damaging flowers and young fruits (10%) as well as marketability of large percentages of crops through partial damage (>25%) that reduces quality. This is particularly important for farmers who are trying to diversify into higher value crops to improve their income by selling fruit and vegetable crops. Most small-scale agricultural systems are mosaics of different habitat types, and this can support a great variety of rodent species which have variable impacts on the different crops grown. IPM for rodents can, therefore, be adapted to nearly all cropping systems, and, indeed, work best when they are holistically addressing the multiple impacts that rodents have on people's livelihoods.

*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 | 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 | 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 theme of integrated pest management in crop production (including insects, weeds, diseases) would be a natural clustering for which the project research outputs could be integrated. It is expected that similar extension approaches for different pest problems for crops such as rice could be sustainably managed through a common platform. However, most other crop pests are not as mobile or polyphagous as rodents. Therefore, management strategies which narrowly focus on a single crop may fail to mitigate rodent population dynamics in the same way as other relatively geographically restricted pest problems. (e.g. R8409, 8233, 8412, 6519, 7778, 8447)

Outputs would also be relevant for clustering around post-harvest protection and marketing by reducing rodent access to stored food at household levels through preventing contamination and damage to stored grain and food produced for sale, including the sale of fruits and vegetables and post-harvest processing and handling where rodent contamination may enter small- and large-scale processing systems. (e.g. R8263, 7543, 6331, 6658, 6502, 6684, 8265, 7486, 6684, 7442, 8433, 8272, 7530,)

In relation to post-harvest issues, rodents are well-known reservoirs for many microbiological contaminants such as salmonella and can contaminate food and water sources used by people and animals as well as vectoring zoonotic diseases that affect livestock production and human health. In this regard rodents could be clustered with platforms on 1) livestock health and production, 2) water utilisation/sanitation management, 3) or maternal and child health programmes. (e.g. R8306, 8495, 6608, 8151, 7596, 7597 8152, 7359)

Farmer training platforms focussed on subsistence level or food insecure small-holders can easily benefit from knowledge on how to manage rodent pests and making use of available technology. Generic issues on population dynamics, preventive management, damage thresholds and monitoring are applicable to the management of any crop pest. Platforms that target the service providers and policy makers that deliver knowledge to farmers at a community level (NGOs, national extension) would be highly appropriate. (e.g. R8299, 8219, 8296, 8041, 8219, 8417, 8341, 8429, 8447, 8438)

---

## 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 project was validated at several levels.

i. Farmers where the original ecological research was carried out were involved in the collection of ecological and social data, thereby validating the outputs. Under the guidance of the project partners, a team of villagers coordinated rodent trapping actions, and monitoring/ evaluation of the rodent management interventions. This was achieved through the use of farmer diaries and meetings which recorded farmer observations of rodent damage over time, what rodent management actions they were doing, and the results achieved through their actions. The analysis of farmer-reported data showed that the trialled strategies for ecologically-based rodent management were recognised as cost-beneficial by the farmers themselves. Further farmer validation could be observed by continued use and adoption of recommendations demonstrated during the project.

ii. Outputs were scientifically validated by the project researchers, showing that rodent population dynamics could be significantly changed through the interventions. Rodent populations were observed to be lower through replicated trials using trapping and tracking tiles to measure rodent activity levels in different habitats over time. Replicated trials were also used to measure rodent damage levels to crops and stored food. These trials showed that there were strong correlations between reduced rodent populations and less crop damage and loss/ contamination of stored food. These scientific comparisons were made before and after rodent management interventions were adopted in a community and, more importantly, by comparison between villages that had adopted ecologically-based management recommendations and villages nearby that had carried on with their traditional approach to rodent management.

iii. Partners (BRRI, BARI, NGOs) and Associates (Dept. Ag. Ext., IRRI) of the project validated the outputs through training programmes for extension staff and farmers. This involved producing materials (training video and written booklets) for use in short courses that were partially delivered in a formal setting as well as through field visits to demonstration sites to show practical interventions.

iv. Further validation occurred through international conferences and peer-reviewed publications.

It is important to note that, in Bangladesh, rodents pests are traditionally managed by women around the village, while men manage field rodents. However, women depend on men for the purchase of poisons; a constraint when poison is traditionally considered the main option available. These gender issues were affected by showing that investment in traps and environmental management is more effective, while making women less dependent on regular poison purchases.

Observed impacts of ecologically-based strategies showed that rodent populations could be reduced by 75% (in comparison with villages using traditional management strategies). Independent monitoring with tracking tiles confirmed rodent activity was reduced by more than 50%, while reductions in post-harvest loss were more than 60% with even greater reductions in contamination levels of stored food. Field damage by rodents to fruit, vegetables and rice was halved. Although the initial investment made for traps was similar in comparison to that usually spent on poisons, the returns on intensive trapping were much greater in labour saved in carrying out interventions and repairing rodent damage. Hence, the ecological strategies saved time and money, and this was widely recognised by end users and intermediaries.

*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)**.*

The project took place in the southeastern districts of Comilla and Feni, Bangladesh. Entire village communities were targeted where the main activity was rice production. Most households were small-scale subsistence level farmers producing 2-3 crops per year, usually one irrigated rice crop, one rain-fed rice crop and one vegetable crop, with rodent pest problems experienced in all crops. All social groups were targeted because there were a significant number of landless villagers (30%) involved in agricultural production and other groups which also suffered from rodents. Education and wealth indicators in the target villages were comparable to national averages for rural agricultural villages in Bangladesh.

---

## 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 target villages involved in the research project continue to employ very similar strategies to those trialled and have successfully kept their rodent pest problems in check. Villages nearby that had been acting as “control” villages where monitoring of their traditional practice had occurred have also largely adopted the strategies through subsequent training that was provided to them near the end of the project. In addition to the main research villages, a further 500 villagers from 11 villages received training, materials and demonstration of the rodent management actions shown to be effective during the project.

The Bangladesh Department for Agriculture Extension was significantly involved in the later stages of the project. They have found the training video produced by the project to be particularly effective and are using this as part of their national video extension unit which travels around the

country. However, there have been no major policy changes or programmes at the DAE to date. Local NGOs in the Comilla region which received training during the project have been promoting rodent management for livelihood improvement, but these efforts have been relatively small-scale and have not been independently assessed for impact.

*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).***

The outputs are being used in approximately 15 villages in the Comilla region. However, the degree of success is likely to be variable, and it would take time to measure how well the outputs are being used in these villages. We do know that at least four of these villages are using the outputs effectively. As the training video was broadcast over national TV and is being used by the DAE for its own video extension programmes, there may be villages throughout Bangladesh which are using some of the project outputs.

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

The scale of use remains limited to a handful of villages, but it is continuing to spread through word-of-mouth by farmers, farmer field days and local NGO programmes. Rodent pest problems are ubiquitous so it is relatively easy to encourage farmers to try new methods and tools. However, uptake is dependent on farmers seeing real benefits from their actions, and this is only noticed over cropping seasons meaning it can take a full year for new rodent management strategies to become established.

*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).***

Ecologically-based rodent management is knowledge-intensive, and successful adoption requires farmer education about basic rodent biology and behaviour and the way management strategies work. So programmes such as IPM farmer groups currently promoted by the DAE, farmer field schools and training programmes operated by NGOs and government will all be effective in conveying appropriate rodent management knowledge. These existing structures can all be used to improve the uptake of ecologically-based rodent management. However, the DAE widely recognises its training can not effectively reach a large number of small-scale farmers, and local NGOs do not always have sufficient capacity and access to funds to run enough training programmes. Training of trainer programmes are one way to increase capacity, but these need to be effectively managed to ensure messages are not degraded. An important feature of ecological rodent management is that many actions are best performed at the community level. In this regard, a degree of organisation and trust are usually required which is often best served by NGOs who generally work with communities on a broad range of issues.

Although commercial enterprises involved in rodent pest management are limited to urban rodent

control in large cities, preliminary discussions indicate there could be commercial interest in supplying management tools (e.g. traps) if attached to promotional training schemes. However, NGOs also regularly provide the role of input supply in South Asia so this is not seen as a major constraint.

Strategies to educate farmers and raise awareness could be supplemented through simple messages to promote long-term community-wide intensive trapping programmes using effective traps. The DAE in Bangladesh currently runs an annual rodent bounty campaign to encourage people to collect rodent tails. Although the current bounty campaign is misguided, the operational platform could be adapted to promote intensive trapping and other techniques instead. As will be the case with all knowledge-intensive agricultural interventions, advertising can get basic messages across that are then backstopped by extension agency programmes.

---

## 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.*

Existing common rodent management practices in developing countries involve the use of acute poisons. These are fast-acting highly toxic compounds with no antidotes. Non-target toxicity (including humans) is very high, and many of the acute substances are illegally used. More importantly, neophobic behaviours of rodents result in poor percentage mortalities (<50%) and behavioural resistance among survivors through induced bait shyness. Acute poisons also reinforce adverse human behaviour to assess success through the collection of dead rodents. Indeed, most traditional rodent management (hunting, electrocution, trapping) relies on the misguided value of carcass collection. In some countries, toxic chemical cocktails are mixed with used vehicle oil and poured onto flood-irrigated crops. Rats are killed through preening their fur but so too are arthropods, crustaceans, and, indeed, most living things in this microcosm.

The adoption of EBRM reduces the use of acute poisons and other dangerous practices, thereby reducing non-target poisoning. This is achieved by ensuring that success is measured through measuring changes to the impact of rodents on people's livelihoods and rodent population dynamics (as opposed to the number of dead animals observed). It is unlikely that government policies would change much in regards to acute poisons, where the problem is more of enforcing existing policies and ensuring that cost-effective alternatives are made available instead of acute poisons. In this regard, policies over the cost, quality and availability of anti-coagulant poisons and good quality traps must be ensured. The adoption of EBRM should result in lower

dissemination and prevalence of environmental contaminants and subsequent diseases.

There are more species of rodent than all other mammal groups combined, many of which are serving important ecological roles in the wild. The adoption of EBRM should help to appropriately identify pest (cosmopolitan commensal) and non-pest (sylvatic, indigenous) species, ensuring that management targets the pest species.

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

Traders which rely on the sale of banned poisons on the black-market could see their income reduced. All poisons, including anti-coagulants, have the potential to cause non-target poisoning when misused. Although anti-coagulants are much safer and less persistent, there is a risk of adverse environmental impact if their use increases without improved information on their use. However, EBRM does not strongly emphasize the use of poisons in fragmented ecosystems, particularly as intensive trapping is more cost-beneficial for small-scale farming systems.

*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)***

Rodent populations are well-known to outbreak following natural disasters such as flooding. Disasters can result in sudden large increases in food and shelter while knocking out predators which take longer to recover. Commensal rodents are particularly adaptable to changing ecologies, but are significantly influenced by climate, particularly rainfall and temperature where warmer and wetter conditions will favour higher rodent populations. Climate change may, therefore, create some areas with more severe rodent problems, while other areas find fewer problems. Changing cropping systems may be driven by climate or technology (e.g. irrigation removing fallow periods). Climate change has been reported to lead to the geographic expansion and prevalence of rodent-borne diseases (e.g Lyme disease in northern USA and southern Canada). This is an emerging area and little is known about the potential Impact of global climate change on rodent-disease-human interactions in developing countries. End users which are confident in managing rodent populations using EBRM will have the capacity to adapt their strategies to manage rodent populations and their impacts as their cropping systems change.

---