Safe biological pesticides for India and South Asia

RIU

Validated RNRRS Output.

Small-scale farmers in India can now use environmentally benign pest management methods. New biological pesticides mean that smallholders can control crop pests but still meet international food safety standards. This is particularly important for vegetables and fruit for export. Pollution from chemical pesticides is a major concern in India. Some of the old pesticides still in use are extremely toxic. Many workers, especially in cotton-growing areas, are poisoned. Government policy encourages locally produced, low-cost biological pesticides. Already, nearly 500 private and state laboratories have taken a 2.5% share of the Indian pesticide market. This share is growing rapidly as more and more are registered.

Project Ref: **CPP55:**
Topic: **1. Improving Farmers Livelihoods: Better Crops, Systems & Pest Management**
Lead Organisation: **Natural Resources Institute (NRI), UK**
Source: **Crop Protection Programme**

Document Contents:

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Geographical regions included:

Bangladesh, India, Nepal,

Target Audiences for this content:

Crop farmers,

Description

CPP55

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.

Scaling up availability of safe biological pesticides for poor farmers in India and South Asia.

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

Crop Protection Programme
Forestry 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.

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R5540 Use of viruses to control Helicoverpa
R7004 The improvement of insect virus application for control of Helicoverpa armigera in India
R7299 An evaluation of the promotion and uptake of microbial pesticides by resource poor farmers
R6295 Development of NPV biological pesticide for control of Teak defoliator Hyblea puera in India

Tamil Nadu Agricultural University Professor R J Rabindra
ICRISAT Dr G V Ranga Rao
Institute of Forest Genetics and Tree Breeding Coimbatore Dr Raja Rishi
Kerela State Forest Research Institute Dr V Kumar
Forest Research Alice Holt Dr H Evans

*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 Crop Protection Programme of DFID from 1995-2001 supported a raft of projects to develop and promote **environmentally benign pest management** methods for small farmers in **India.** Access to these novel and safe **biological control products** was an explicit national policy goal in support of agricultural growth and poverty reduction. New biological pesticides (biopesticides) are needed to ensure smallholders could produce crops with reduced chemical residues to meet non tariff international trade barriers (**Maximum Residue Levels**, MRLs) to the exportation of vegetables and fruit in particular.

A policy of improved access to locally produced, and therefore affordable, biopesticides is a component of a national IPM policy to reduce the **pesticide pollution** from agriculture that is an increasing problem in India. Poisoning of rural workers by pesticides is a major health concern in India where the use of older more toxic chemical pesticides is a problem widespread especially in cotton growing areas. The new biopesticides were seen as part of the Integrated Resistance Management (IRM) strategy for key agricultural pests such as **Helicoverpa armigera** that through pesticide overuse on cotton had become highly resistant to pesticides causing poor farmers in particular heavy financial losses and livelihood uncertainty.

A major output was to build a centre of excellence on biopesticide development production, formulation and quality under Professor Rabindra at Tamil Nadu Agricultural University with the first laboratory in India for characterising, formulating and developing production methods for insect viruses and specifically **nucleopolyhedroviruses** (**NPV**s) as biological control agents.

A series of training, capacity building and consultancy initiatives were carried out 1997- 2001 advising new biopesticides producers including, state organisations, private companies, NGOs and international advanced research institutes (ICRISAT) on the new technologies and production techniques for biological pesticides. Included in the outputs were manuals for the model production and quality control of nucleopolyhedrovirus products (Grzywacz et al 1999). These helped to launch production of biopesticides in India as commercial products and. NPV production alone is >100 tons per year. In 1996-98 with funding from a Forestry programme project capacity building in biopesticides research and production was also given to two forestry institutes in India to develop NPV biopesticides for major forestry pests.

The project was also active advising on registration policy and international quality standards for the new products. Two publications setting international standards for NPV and Fungal biopesticide products were produced (Jenkins and Grzywacz 2000, Jenkins and Grzywacz 2003)

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 output is focussed on all crops suitable for the biological pesticides developed these include, vegetables, cotton, legumes, fruit and forestry

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.

A clustering of the biological pesticides outputs and South Asia collaborators from CPP projects led by NRI and CABI would produce a comprehensive innovations platform aimed at improving access to biological control products in India and South Asia. The NRI led output of improving the quality and availability of low cost biological pesticides has focussed on NPV based pesticides but it has worked closely with and complementary to the work on CABI on improving the quality of fungal pesticides in Asia. The CABI work has in part been funded by the CPP developing regulation quality control and production for fungal agents for both classical biocontrol and pesticidal application.(R6695 and R8228) but also by UNEP under its project “Delivery of biological technologies to IPM farmers in India and Vietnam”. These initiatives also involved Professor Rabindra in his new capacity as Director of the project Directorate of Biological control, the ICAR institute for biological control. This work could also link with biopesticide development of rice Hispa (R7891) focussed on Bangladesh and integrated crop management for Chickpea in Nepal (R7855) thus building this cluster into a South Asia biological pesticides platform.

A very valuable objective for the cluster would be the scaling up of a low cost powder formulation similar to that developed recently in Africa for armyworm NPV (R8408 and R7954). This technology would be very appropriate for producing low cost long shelf life products in for poor farmers in Asia.

A promising focus for a cluster on new biological pesticides would be in the new National Agricultural Innovations programme NAIP (250 million US$) for India there is a specific objective of developing new mass production of biopesticides. The ICAR institute mandated to research Biopesticides the Project Directorate for Biological control has requested NRI with CABI to be part of two new research consortia. This would provide knowledge products and expertise developed under CPP funding in support of an innovations consortium led by PDBC and including private sector to promote the production of improved biopesticide.

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 products outputs were validated in Southern India by the Agricultural University of Tamil Nadu and nationally by ICAR, its biocontrol institution PDBC Bangalore and its national IPM centre as well as at commodity research institutes (see 11 below). ICRISAT has also validated H.armigera NPV 1995-98 and taken up NPV technology for legume use in India, Nepal and Bangladesh. The DFID PSP projects have also validated HaNPV use in its projects to promote chickpea as a rice fallow crop in Nepal and India (R8221). The CBC the registration body for biopesticides has validated and adopted standards set by CPP in country project partners as a basis for NPV products.

Outputs were also evaluated by National agricultural Research Council in Nepal on legumes under R7855 and Bangladesh Agricultural Research Institute on, legumes and vegetables.

Companies in India have in effect also validated outputs by adopting and scaling up the production of NPV biopesticides to a fully commercial basis for H.armigera and S.litura NPV products.

*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 products outputs were validated in India by the Agricultural University of Tamil Nadu and nationally by ICAR through its National Centre for IPM (NCIPM) as part of the National Agricultural Technology Programme that ran a major project on validating IPM technologies 1998-2005 on cotton, vegetables and legumes

ICRISAT has also validated H.armigera NPV in India during 1995-98 as part of its grain legumes programme and taken up NPV technology for legume use in India, Nepal and Bangladesh. The DFID PSP projects validated HaNPV use in its projects to promote chickpea as a rice fallow crop in Nepal 2001-2005 (R8221).

Subsequently outputs were evaluated by National Agricultural Research Council in Nepal on legumes under R7855 and are being evaluated by the Bangladesh Agricultural Research Institute on legumes and vegetables using their own funding.

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 outputs are being used by Indian NARS, extension services and by commercial and state sector producers of new biological pesticides. Sharma (2005) quotes the figure of >400 laboratories and production facilities in India currently producing biopesticides (see 14 below)...

The outputs here have been followed up in India under Dept Biotechnology funding. In recent years 2001-2005 knowledge products concerning NPV biopesticides has also been disseminated to Nepal for use of Nepal Agricultural Research Council and several rural NGOs and in Bangladesh (Bangladesh Agricultural Research Council) under R8427 and R8366.ICRISAT has also taken up NPV technology for legume use in India under World Bank funding.

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 main focus of use is India nationally but Indian companies also export to Bangladesh and some companies are seeking registration for the HaNPV product in Australia. In recent years knowledge products concerning NPV biopesticides has also been disseminated to Nepal for use of NARC and NGOs and Bangladesh BARC under R8427 and R8366. .

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

Since the mid 1995-97 when <20 companies were active biopesticides production in India has grown and has now a 2.5% share of the pesticides market with currently 130 commercial and 300 state sector producers now active (Sharma 2005). NPV biopesticide production at the start of the CPP funded projects was only at a research stage in all companies contacted in 1994 but is now estimated to exceed 100 tons of products per annum. This growth was especially rapid after 2000 when the biopesticides share of the market rose to 2.5%. Currently more than 40 NPV products are undergoing registration through the national system most (35) are Helicoverpa armigera NPV and (7) Spodoptera litura NPV products, both the focus of earlier CPP funded work (R5540 & R7004).

While much of the production is in small state supported units with limited growth potential 8-10 major commercial companies including Pest Control India are active and provide the most dynamic sector of the market.

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).***

The central government through its ICAR network are the key national player in promoting biopesticides policy and this has also been strongly supported by Department of Biotechnology (DBT) funding for biopesticides research and production. ICAR currently support 31 production facilities at its research centres, while DBT fund another 22. A major platform for support was the National Agricultural Technology Programme that ran a major project on validating IPM technologies 1998-2005 which was well placed to take up outputs of DFID- CPP funded outputs 1995-2001.

Central Insecticides Control board has also greatly facilitated the introduction of biopesticides by adopting simplified registration system. This is in many respects an enlightened model approach that allowed pilot commercial production to start in parallel with registration. This especially facilitated the entry of SMEs and new biotechnology companies that were among the keenest to draw on knowledge products and expertise developed by the CPP partners.

A specific programme of technology transfer through training, mentoring and follow up consultancies run by the CPP projects network of Tamil Nadu Agricultural University (TNAU), NRI and ICRISAT with the co-operation of ICAR was particularly effective in drawing the commercial sector into adopting outputs. TNAU with CPP and DBT lead by setting a centres of excellence and pilot scale biopesticide unit to stimulate further uptake by private sector producers.

Individual state governments such as Tamil Nadu and Andhra Pradesh have also been active in supporting biopesticide based IPM and in developing local capacity to produce biopesticides. A target of 50% of state plant protection budgets are allocated to promoting and procuring eco-friendly biological inputs and currently state governments support 200 laboratories for biopesticide production.

Private companies are a most significant player in biopesticide promotion. The commercial sector is quantitatively more important than the more numerous public sector producers and has a wider promotional footprint (Singhal & Sharma 2003).

ICRISAT has also been a promoter of NPV technology particularly to poor farmers through its network of associated NGOs.

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 adoption of safe and biodegradable biopesticides in place of chemical pesticides is seen by the governments and NARS as a significant tool in reducing pesticide poisoning and the environmental damage caused by pesticide residues in soil and water. The full extent of pesticide poisoning in India is difficult to determine but India is reckoned to account for a substantial part of the 20,000 deaths and one million cases estimated to occur annually. Pesticide poisoning is particularly an issue for marginal poor farmers who lack access to safer more expensive pesticides or landless labourers employed to carryout more dangerous tasks such as spraying and where safety procedures and equipment are almost universally deficient.

The use of BCA to reduce pesticide levels in food and commodities to meet MRL standards also benefits consumers and food handlers of such produce which while currently produced mainly for export is finding an increasing market locally.

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

None

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)***

No they are climate change neutral
