Pheromone traps help save cowpea

RIU

Validated RNRRS Output.

Simple traps made from small plastic jerry-cans and baited with pheromones give farmers a valuable early warning system against the legume podborer. This insect's caterpillars cause devastating losses in cowpea. But, catching a certain number of adult podborers in traps lets farmers know that caterpillars will soon appear in their fields, and that they should spray their crop in the next few days. The system was designed and tested in tandem with farmers and NGOs in Benin and Ghana, and there is demand for traps and lures from other farmers who have heard about the technique. The system has potential for many more areas where the podborer threatens cowpea.

Project Ref: **CPP27:**
Topic: **1. Improving Farmers Livelihoods: Better Crops, Systems & Pest Management**
Lead Organisation: **Natural Resources Institute (NRI), UK**
Source: **Crop Protection Programme**

Document Contents:

Description

CPP27

A. Description of the research output(s)

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

Geographical regions included:

Benin, Burkina Faso, Ghana, Nigeria,

Target Audiences for this content:

Crop farmers,

1. Pheromone traps – *Maruca vitrata*.

Suggested alternative working title:
Pheromone traps as an aid to controlling *Maruca vitrata*.

2. Relevant RNRRS Programme:

Crop Protection Programme.

3. Relevant projects:

R8411, R8300, R7441.

Institutional partners:

- Lead Institution: Natural Resources Institute (NRI), Chatham, UK (Dr Mark Downham)
- Principal Collaborator: International Institute of Tropical Agriculture (IITA), Cotonou, Benin (Dr Manu Tamò, Dr Ousmane Coulibaly)
- *Institut National des Recherches Agricoles du Bénin (INRAB)*, Cotonou, Benin (Dr Charles Agli, Mr Thomas Houndété)
- *Organisation Béninoise pour la Promotion de l'Agriculture Biologique (OBEPAB)*, Cotonou, Benin (Dr Simplice Vodouhè)
- Crops Research Institute (CRI), Kumasi, Ghana (Dr Haruna Braimah)
- Savanna Agricultural Research Institute (SARI), Tamale, Ghana (Dr A.B. Salifu, Dr Stephen Asante)
- Ghana Organic Agriculture Network (GOAN), Kumasi, Ghana (Mr Sam Adimado)
- *Institut de l'Environnement et Recherches Agricoles (INERA)*, Ouagadougou, Burkina Faso (Dr Clementine Dabiré)

4. Describe the RNRRS output or cluster of outputs and when it was 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.*

Maruca vitrata*,* the **legume podborer**, is a key pest of **cowpea** and other subsistence legume crops. In **West Africa** yield losses in cowpea due to *Maruca* may rise to 80%. A **pheromone** lure and **trap** for *Maruca* were developed and optimised for use by farmers in **Benin** and **Ghana** from 1998 - 2002, together with a recommended mode of use, which was developed with farmers 2002 - 2005. Catches of adult *Maruca* indicate the presence of the pest in cowpea fields and thus the best time for control operations against larval infestations.

Traps are constructed from locally obtained 5-litre white, plastic jerry-cans 26 cm height × 17 × 13 cm, although slight variations in dimensions are not critical. The trap has four windows, one cut out of each side. In operation the trap is filled with water to a depth of approximately 5 cm, which kills trapped moths by drowning. The trap is mounted 120 cm above ground on a stick or pole driven into the ground at an angle so that the trap, suspended

by cord or wire, hangs freely.

The traps are baited with a polyethylene vial lures (23 × 9 mm diameter) containing 0.1 mg of a blend of three pheromone components. The lures are suspended within the trap by means of a paper-clip or small length or string. Pheromone lures for *Maruca* can be obtained from International Pheromone Systems, Ellesmere Port, UK for around US$ 0.75 each for a minimum order of 500. Other suppliers in Europe or elsewhere could also supply the lures.

The total cost of fabricating and operating one trap over a cowpea season is estimated at US$ 4.50, including the cost of two lures and an allowance for the labour of making and maintaining the trap.

Trap **monitoring** should be done by six or more farmers within a village who place traps in their respective fields about three weeks after sowing. Individually, they check for trap captures at least three times per week and co-operative to share information about this regularly with each other and if appropriate, with their neighbours. When the threshold of an average cumulative catch of two moths per trap is reached, spraying within three days is advised, but farmers decide the best control agent to apply and exactly when to apply it, taking account of the overall pest situation. Lures should be replaced after four weeks.

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

Cowpea is the target commodity. In principle, the traps could be used in pigeon-pea, bean or other legume crops where *Maruca* is a pest. However, some limited testing in these crops outside W. Africa has not produced promising results (see response to Q17).

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				

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						

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).

There would be value in clustering this output with the pheromone trap related elements of the “Cocoa ICPM W. Africa” projects (R8448, R8313). Although the two sets of technology targeted different pests in different agricultural systems, the respective technologies developed (pheromone traps) were the same, the constraints and problems were similar and the outputs were developed in the same geographical region/country.

There are common issues for *Maruca* and cocoa mirid traps in relation to finding viable means of manufacture and supply of the traps and lures, and of introducing a novel technology to small-holder farmers. See Q17 and Q18.

Validation

B. Validation of the research output(s)

*10. **How** were the output(s) validated and **who** validated them?*
*11. **Where and when** have the output(s) been validated?*

A distinction is made between validation of the *Maruca* pheromone traps themselves – their effectiveness in attracting moths – and their validation as monitoring tools for cowpea farmers, that is the reliability with which trap catches can be used to signal future larval infestations.

Several parameters were found to affect the numbers of moths attracted by the traps. These included the composition of the pheromone blend (i.e. complement of attractant compounds), degree of blend purity, lure age and type, trap design, trap height etc. Experimentation to optimise these was carried out 1998 – 2000 in on-station, researcher-managed trials using standard replicated methodologies, initially at the IITA research station near Cotonou, Republic of Benin. The results of these were published in peer-reviewed scientific journals, as well as project reports.

Validation of the optimised traps then took place at locations representing all the principal agro-ecological zones in W. Africa. Replicated, on-station trials were carried out at the SARI, Tamale, Ghana and the IITA experimental farm near Kano, northern Nigeria in 2000 – 2002 and additionally in 2004 at the INERA station near Bobo-Dioulasso, Burkina Faso. In addition, in 2000 optimised traps were set out in around 60 farmers' cowpea fields in season-long researcher-managed observations in five principal areas throughout Benin: the Ouémé valley, near Bohicon and in the Mono region in the south, near Savè (central Benin) and in Borgou region in the north. In 2001 and 2002 catches were monitored in bush areas and cowpea fields at several sites on North – South transects in Benin and Nigeria. In each case these observations were conducted in partnership with subsistence cowpea farmers – who were contacted through their participation in the region-wide *Projet de Niébé pour l'Afrique* [1] (PRONAF), whose broad aim is the development and dissemination of cowpea related agricultural technologies. The work was led by scientists and extension workers in the respective national institutions, participating in PRONAF, with input from NRI and IITA staff. These observations confirmed that in Benin, central Ghana and parts of Burkina Faso, trap catches were sufficient to allow seasonal trends in *Maruca* populations to be followed. However, in northern Nigeria and northern Ghana the traps did not attract useful levels of catches. These results are documented in project final reports.

These regional studies had shown that traps could signal the immigration of the pest into cowpea fields, and in the Benin-wide on-farm observations of 2000 details of larval infestations were also recorded so that the relationship between trap catches and infestations could be investigated. Linear regression analyses showed that no reliable *quantitative relation* existed; however, quite consistently, trap catches were recorded several days in advance of the first larvae. Based on this *temporal relation* a threshold approach was developed 2002 – 2005 whereby the first few moths trapped signalled the best time to initiate control sprays against *Maruca* (as described in the last paragraph of the response to Q4). This went hand-in-hand with the testing of a variety of botanical pesticides as this was a priority activity of PRONAF.

A series of on-station researcher-led and managed trials 2002 – 2003, mostly at IITA-Cotonou, compared conventional and botanical pesticides in combination with different forms of the trap threshold (two or five moths per trap triggering applications after three or six days) and applications based on crop stage. The trials also made provision for control of other pests besides *Maruca* – flower thrips in particular. On farm trialling took place 2002 – 2005. Initially the activities were quite prescriptive, researcher-led trials but gradually the approach developed and

trap use was incorporated into farmer field schools (FFS) and normal agronomic practices. As this took place, responsibility for operating the traps and deciding control actions based on catches was passed progressively to groups of farmers within a village. Institutional partners who co-ordinated FFS activities were SARI in Ashanti Region, Ghana; the GOAN and CRI, both in Brong-Ahafo, Ghana; INRAB (under the auspices of PRONAF) in Mono and Zou departments, Benin; OBEPAB in Borgou, Benin. In all, some 700 – 800 subsistence farmers, of which around 40% were women, in 36 villages were involved.

Technical conclusions were that in combination with botanical pesticides a trap threshold approach can produce yields equivalent to normal farm practice, with reduced input costs and use of toxic pesticides. In addition, surveys of participant farmers showed that a majority of believed traps can signal arrival of *Maruca*. Despite this, in the final year (2005) uptake was poor. Ten villages with previous experience of the traps were provided with pheromone lures and with refresher training in trap manufacture and use, but otherwise farmers were left free to decide whether or not to utilise the traps. No formal FFS meetings took place. It appears that under these conditions only a minority of cowpea farmers used the traps: only six of 24 farmers in two villages overseen by CRI used them, none in OBEPAB villages and interest was reportedly 'poor' in villages overseen by the INRAB/ PRONAF team.

[1] In English = Cowpea project for Africa. PRONAF is co-ordinated by IITA-Cotonou and funded by IFAD. Its broad aim is the development and dissemination of cowpea related agricultural technologies to subsistence farmers in the W. African region. Its principal mode of operation is the season-long Farmer Field School (FFS), meeting weekly in each village.

Current Situation

C. Current situation

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

No use is currently being made of the traps in central Ghana and Benin where previous project activities were focussed, although IITA report that there has been unfulfilled demand for traps and lures from some cowpea farmers being assisted by PRONAF. In 2006, PRONAF itself, in absence of collaboration from the former DFID-CPP project is focussing on assisting farmers with the production of seeds of improved varieties.

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).***

See response to Q12, above.

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

See response to Q12, above.

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 institutional links between NRI (as lead institution) and IITA (as principal collaborators) on the one hand, and CRI, GOAN, OBEPAB and INRAB (principal implementing institution for PRONAF in Benin) on the other hand were essential in enabling both technical and farmer uptake evaluations of *Maruca* pheromone trap use.

PRONAF regionally had adapted the Asian model of season-long, weekly farmer field schools (FFS) to test, adapt and promote a range of cowpea-related technologies for subsistence farmer use. The CPP projects R8411, R8300 and R7441 made vital use of the village contacts as well as the processes and approaches developed by PRONAF to evaluate the traps. Farmers were given training in the manufacture, operation and science behind the use of the traps and, following the PRONAF participatory approach were involved in all aspects of the trap testing. CRI, GOAN and OBEPAB similarly adapted the PRONAF model of FFS, according to the needs of farmer groups in their regions and their own institutional experience, to achieve the same objective. Without these institutional links, or the participatory approach developed by the partner organisations, it would not have been possible to evaluate the traps over such a wide agro-ecological range or to have exposed the technology to so many farmers.

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.

Use of the traps for predicting infestations of *Maruca* should enable a reduction in the use of conventional pesticides either through a reduction in the number of sprays required (since they will only be used when strictly necessary) or a wholesale switch to alternatives such as botanical pesticides. Indirectly therefore, environmental benefits will accrue in terms of reduced toxic effects on non-target species. There was some evidence for reductions in conventional pesticide sprays when traps were used in 2004, as compared to normal farmer practice: in many villages one fewer conventional spray was made and/or farmers chose to substitute conventional with botanical pesticides.

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

No adverse outcomes are foreseen other than the potential for broken or used traps and lures to litter the environment if not cleared away after use.

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 *Maruca* trap technology offers no direct protection or mitigation of climate change or natural disaster other than their potential to improve food security.