Communities reap the benefits from new, improved cassava varieties

Validated RNRRS Output.

Locally adapted cassava varieties with resistance to cassava brown streak disease (CBSD) are promoting improved food security and livelihoods in Malawi, Mozambique, Tanzania and Uganda. Specially designed seed systems are being used to produce disease-free planting material for wide distribution. An information campaign, using radio, leaflets and posters, is helping to get the word out. The CBSD-resistant varieties are used by smallholders in semi-arid and coastal fishing communities that supply fresh cassava to urban areas. They are also used for processing to make cassava flour. Previously, CBSD damage resulted in poor yields and root quality. Over five years the improved materials have reached more than 1 million people in eastern and southern Africa, and their use is still spreading.

Project Ref: **CPP22:**
Topic: **1. Improving Farmers Livelihoods: Better Crops, Systems & Pest Management**
Lead Organisation: **Natural Resources Institute (NRI), UK**
Source: **Crop Protection Programme**

Document Contents:

Description

CPP22

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.

R8404: Promotion of control measures for cassava brown streak disease

Preferred working title: Control of cassava virus diseases

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Geographical regions included:

Kenya, Malawi, Mozambique, Tanzania, Uganda,

Target Audiences for this content:

Crop farmers,

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

Crop Protection Programme [CPP]

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.

R6765: Management of cassava virus diseases in southern Tanzania
Leader: Rory Hillocks, NRI, UK

R7563: Control of cassava virus diseases in eastern and southern Africa
Leader: Rory Hillocks, NRI, UK

R8227: Promotion of control measures for cassava brown streak disease
Leader: Rory Hillocks, NRI. UK

R8404: Promotion of control measures for cassava brown streak disease
Leader: Rory Hillocks, NRI. UK

*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 problem addressed is the threat to food security and livelihoods in **Tanzania**, **Mozambique**, **Malawi** and **Uganda** due to poor **cassava** yields and poor root quality for processing caused by **whitefly-transmitted** virus disease; **cassava brown streak disease** [CBSD].

Previous CPP-funded projects on CBSD had established the distribution of the disease in eastern and southern Africa, had shown that whitefly could transmit the virus and that some local varieties showed a form of tolerance to the disease.. The output cluster developed **control measures for CBSD** based primarily on the use of locally adapted **resistant varieties**. Promotion of these varieties depended on systems for multiplication and distribution of **disease-free planting materia**l, accompanied by an **information campaign** that used **FM radio, leaflets and posters**. Primary multiplication was done on farms run by the NARS [ARI Naliendele] and secondary multiplication used CBOs, particularly schools and **farmers groups**.

Towards the end of the project an outbreak of CBSD was confirmed in Uganda by **molecular diagnostics**. This was the first record of a major occurrence of CBSD at altitudes above 1000 m and seemed to be due to the release of **mosaic** disease-resistant varieties that were highly susceptible to CBSD.

Process output:

Methodologies for **selection of CBSD resistance**

Technology output:

Cassava varieties with resistance to CBSD

Product output:

Communication media: Information posters and extension leaflets on CBSD in Kiswahili for Tanzania. The posters were also reproduced in English for Malawi and in Portuguese for Mozambique.

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

CASSAVA

7. What production system(s) does 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*		

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 with what other outputs your output(s) could be clustered.*

Cassava is the predominant staple in the coastal regions of eastern and southern Africa and the lowland lakeshores of Lake Victoria and Lake Malawi. In some areas such as central Malawi cassava growing has increased at the expense of maize in response to climate variability. Food security and the ability to use cassava for cash income through value-added products, is constrained by two whitefly-transmitted virus disease: CBSD and the cassava mosaic diseases [CMDs]. CMDs occur almost everywhere that cassava is grown. CBSD occurs in the coastal and low-altitude areas of eastern and southern Africa and a new outbreak has occurred in Uganda. There are unconfirmed reports of the disease in Congo, Zambia and Angola. There have been a series of projects on the biology and control of these diseases, mainly funded by CPP but also by the Plant Science Programme [PSP].

As the two virus disease are both transmitted by the same whitefly and often occur together, it would make sense to cluster these outputs together as technologies for the management of cassava virus diseases. Sustainable cassava production and promotion of cassava for income generation requires that smallholders have access to planting material of varieties carrying resistance to both virus disease and/or to whitefly.

Other outputs:

R7565, R8302, R8405: Developed a process output on methodologies for participatory plant breeding to ensure that virus-resistant varieties also meet other important farmer selection criteria.

CPP and PSRP/R7565: Participatory breeding of superior mosaic disease resistant cassava
Leader: Dr RW Gibson, NRI, UK

R8302: Participatory breeding of superior mosaic disease resistant cassava: Validation, promotion and dissemination
Leader: Dr RW Gibson, NRI, UK

R8405: Participatory breeding of superior mosaic disease resistant cassava: enhancing uptake

CPP/R8303: Extending the control of cassava mosaic disease
Leader: Dr RW Gibson, NRI, UK

Identified varieties with some resistance to whitefly which would decrease transmission of both CMDs and CBSD.

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).

Validation of the CBSD-resistant varieties has been done in two ways, both within the CPP projects by NARS partners. Firstly by on-station, including women as farmers and as household cooks [end-users], compared the varieties with their local varieties in terms of agronomic performance and culinary quality. On-station testing was conducted at two NARS institutes in Tanzania. Secondly, through participatory on-farm trials, supervised by NARS partners which have validated the varieties for disease resistance, yield and consumer qualities. On-station trials were replicated trials, while in the on-farm validation, the emphasis was more on a participatory approach in which farmers compared the CBSD-resistant varieties with their local varieties. The participant groups were those using cassava for food security as well as those with access to small-scale processing pants for the production of cassava flour.

The best CBSD-resistant varieties gave yields a high or higher than the local varieties under low disease pressure and produced as much as 50% more root fit for consumption under high disease pressure. Even low scores for severity of root symptoms significantly decreased the quality of the root and flour produced from it, so that roots with any sign of root necrosis, were unacceptable for processing.

Earlier CPP projects provided technical support to World Vision and Save the Children. Save the Children implemented a large-scale food security programme to multiply and distribute CBSD-tolerant varieties identified by the CPP project to farmers. The variety 'Nikwaha' for instance continued to show tolerance to CBSD throughout the programme.

*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)**.*

Between 2000 and 2005, CBSD-resistant varieties were validated in the Eastern and Southern Zones of Tanzania in coastal artisanal/fishing and rainfed smallholder communities.

The large programmes funded by US AID to distribute CBSD-tolerant varieties were implemented in Mozambique between 2000 and 2005, under food security [Save the Children] and disaster relief [SARNET] programmes, providing validation of the projects approach of using locally adapted tolerant varieties as a disease management strategy that could be immediately implemented.

Research and adoption of resistant varieties as a control measure has taken place much more widely [see below].

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 CBSD resistant varieties are being used by smallholders in semi–arid and coastal fishing communities. They are being used to increase food security and in villages that supply fresh cassava to urban areas, they are being used for processing to make cassava flour. Access to planting material has been made possible by direct supply funded by the CPP project from multiplication sites based at NARS facilities. Much larger amounts of planting material have been distributed to villages through collaboration with NGOs and other projects. US AID for instance, as part of funding for food security and disaster relief, funded both Save the Children and SARRNET to multiply and distribute local cultivars with tolerance to CBSD that has earlier been identified by the CPP project. Over 5 years this material reached more than 1 million people.

The methodology outputs are being used by numerous CBSD research programmes in eastern and southern Africa, as well as at Danforth Centre in the USA.
Methodology and CBSD-tolerant varieties are being used by the NARS [Government institutions], both in continuing multiplication programmes [Eastern and Southern Zones of Tanzania], and in breeding programmes funded by Rockefeller Foundation and implemented through IITA.

*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 CBSD resistant varieties are being widely grown throughout eastern and southern Africa. In southern Tanzania the project was able to provide planting material directly for 12 villages and 6 schools were used as community multiplication sites. In eastern Tanzania distribution in three villages by the NARS has been supplemented by collaboration with the EZCORE [agricultural extension] project in Muheza which is funded by Irish Aid and involves more than 20 villages. In the Provinces of Nampula and Zambezia Mozambique, distribution has taken place much more widely to over 1 million people through NGO and SARRNET programmes funded by US AID.

Methods for research and management of CBSD have been adopted by all programmes now working on the disease: National Root Crops Programmes in Tanzania, Mozambique, Kenya, Uganda and Malawi. IITA's work on biology of CBSD and breeding for disease resistance has been funded mainly by the Rockefeller Foundation and has adopted methods developed by the project. These programmes are based at Mikocheni Agricultural Research Institute in Dar es Salaam and at the sugarcane Research Institute, Kibaha, Tanzania.

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

Over a million people will have received cuttings from the various programmes but CBSD affects food security for up to 10 million people in the areas surrounding centres, where CBSD-resistant varieties have been distributed. Use of the CBSD-resistant varieties is still spreading and accelerating as more material becomes available. The cuttings are highly marketable and surplus is sold by farmers to their friends and neighbours. Cassava planting material is bulky and the multiplication rate is much slower than with crops grown from seed. Starting from scratch the Save the Children Programme in Mozambique reached 100,000 households [approx 500,000 people] after 5 years at a cost of $ US 5 million.

*15. What programmes, platforms, policy, institutional structures exist within the DFID PSA countries to assist with the promotion and/or adoption of the output(s) and in terms of capacity strengthening what do you see as the key facts of success? **(max 350 words).***

Cassava promotion in southern Africa is supported by SARRNET. The emphasis is on commercial development but CBSD because of its effect on root quality which is a major constraint to the production of high quality flour. High quality cassava flour is the basis of many other value-added products currently being promoted. SARRNET based at Chitedzi Agricultural Research Station in Lilongwe, Malawi, would be interested in further collaboration with the DFID research programmes to validate and disseminate CBSD-resistant varieties, particularly in Malawi, where less has been done than in Tanzania and Mozambique.

In Tanzania, it is government policy, implemented through District Agricultural Offices that each household should grow at least an acre of cassava. District Extension Officers are therefore incentivised to work with programmes that promote cassava.

In Uganda there is strong government support for the distribution of virus resistant cassava due to the success of the efforts to combat the CMD epidemic. CBSD poses a new threat there to communities dependent on cassava and just recovering from the CMD epidemic.

The main implementing agency at present for CBSD work is IITA with Rockefeller Foundation, the principle funding agency.

The key to success has been creation of awareness about CBSD and teaching farmers, extensionists and researchers to recognise the foliar symptoms and associate those with root necrosis. Although present at incidences approaching 100% in parts of Mozambique, CBSD was not recognised until the CPP project conducted a survey there in 1999. Our results led to a massive input of funding from US AID to multiply and distribute the tolerant varieties. The CPP projects were also responsible for developing research methodologies that have been adopted by a number of programmes now being undertaken in Africa [e.g. ARI Mikocheni in Tanzania] and the USA [Danforth Centre], with funding from a wide variety of sources.

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 main environmental benefit is from good crop coverage which protects the land from erosion. Where planting material had been lost in Mozambique, fields were often left unplanted leading to loss of topsoil by wind and rain. Also the carbon sequestration benefits of good crop coverage were being lost.

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 100 words)***

Growing cassava increase food security and protects households from the effects of drought where maize crops may be lost. Growing a plot of cassava increases household resilience and should be an adaptive response to the increase in drought that is predicted as an effect of climate change.
