Controlling wild rice infestations in cultivated rice

RIU

Validated RNRRS Output.

New practices for managing infestations of wild rice species in lowland rice in West and East Africa have been developed and validated by farmers. Such infestations can reduce rice yields by up to 2 tonnes per hectare, and require a lot of labour for weeding. Plus, rice contaminated with seeds of wild species sells for only half the market price. In Ghana, farmers preferred to spray with glyphosate before planting, or to switch to transplanting in bunded fields if they couldn't afford herbicide. In Tanzania, farmers took up a reduced tillage-plus-herbicide system as it was a cost-effective labour-saving option that could even reclaim land previously abandoned to wild rice. These practical options are ready for out-scaling to large areas, and extension materials already exist.

Project Ref: **CPP31:**
Topic: **1. Improving Farmers Livelihoods: Better Crops, Systems & Pest Management**
Lead Organisation: **Natural Resources Institute (NRI), UK**
Source: **Crop Protection Programme**

Document Contents:

Description

CPP31

A. Description of the research output(s)

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

Geographical regions included:

Bangladesh, Ghana, Tanzania,

Target Audiences for this content:

Crop farmers,

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.

Wild rice management strategies

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

The outputs described here were validated by Crop Protection Programme funded projects. Salaries of partners and facilities to support this work were funded by Governments of Ghana, Mali and Tanzania. The recently released rice cultivar TXD 306 used in on-farm trials is an output from the Tanzania national 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.

R7345 [1999-2002]; R8198 [2002-2005]; R8477 [2005-2006]

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Kilombero and Kyela District Councils, Tanzania;

Savanna Agricultural Research Institute, Tamale, Ghana (Osman Gyasi)

Institute Economie Rurale, Office du Niger, Mali (Soungalo Sarra)

*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.*

Practices for managing infestations of **wild rice** species in lowland rice in West **Africa** and **East Africa** were developed and validated by projects that operated between 1999 and 2006. Replicated research trials followed by on-farm trials in **Ghana** and **Mali** demonstrated the efficacy of these **weed management** strategies in West Africa by 2002 with validation by farmers in two districts of **Tanzania** between 2002 and 2006. Outputs are:

R7345

Ø **Characterisation** of the impact of annual (***Oryza bartii*** in West Africa and ***O. punctata*** in Tanzania) and perennial (***O. longistaminata*** W. Africa and Tanzania) wild rice species in low-land rice systems. Infestations lead to farmers investing additional labour for weed control, reduce rice yields (estimated yield losses of 0.87 t ha^{-1} and 2 t ha^{-1} due to *O. longistaminata* and *O. barthii* respectively) AND where *O. longistaminata* has become dominant (due to government mechanization programmes in the 1960s) result in otherwise productive land being abandoned. *O. longistaminata* is a problem in subsistence production. *O. barthii* is a problem in marketing rice; in northern Ghana contamination of rice grain by seed of O*. glaberrima and O. sativa* "off types" reduces the market value by approx. 55%.

Ø **Participatory farmer evaluation** of wild rice management practices in Ghana and Mali established farmer preference for applying the **herbicide glyphosate** to *O. longistaminata* re-growth prior to planting rice or switching establishment method to transplanting in bunded fields. Where cost is an issue (as is the case in subsistence production), the latter control method was found to be more likely to be adopted. Farmers also expressed interest in dry-season vegetable growing as a method of control.

Ø Production of bilingual (French/English) **extension training leaflet** on identification and management of wild rice.

R8198 & R8477

Ø **Validation** by farmer groups in four districts of Tanzania, of the practicability and profitability of management practices for controlling *O. longistaminata* in rain-fed lowland and *O. punctata* in irrigated rice. A stale seed-bed technique with glyphosate applied to wild rice re-growth prior to direct seeding of rice with in-crop control of broadleaf weeds by the herbicide 2,4-D. The reduced tillage/herbicide system was selected by farmers as a cost-effective labour saving option allowing rice production to be re-established on areas of the flood plain previously abandoned to *O. longistaminata* infestations.

Ø **Extension materials** (KiSwahili language poster, leaflet and training of trainers manual) were prepared to support future up-scaling of promotion of wild rice management.

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				

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

These outputs are specific to lowland rice.

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				

*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 greatest impact of wild rice management will be achieved by farmers who also adopt other improved integrated crop management practices for growing rice, and therefore these outputs should be clustered with other rice production practices. This includes better cultivars of rice such as the medium maturity (120 days) aromatic cultivar TXD 306, released in 2003 by the Tanzania national programme, which produces higher yields than the widely grown Super India and is proving popular with growers; seed is currently only produced at KATRIN so mechanisms are needed to increase supplies of seed to farmers where wild rice management practices are promoted. This also includes row planting, to replace broadcasting, and use of 80 kg ha^{-1} N. These are standard recommendations for lowland rice from GoT which is currently providing subsidised fertiliser.

There may be the potential for clustering the outputs of these projects with those of projects which are developing vegetable growing, in the light of the potential for using dry season vegetable growing for control of *O. longistaminata* in Ghana.

In relation to communication and dissemination of new control techniques to farmers, outputs of projects which have developed methods to disseminate new knowledge and methods, particularly where these relate to rice-growing or weed control will be important. This could be in relation to the use of radio, which has been found to be an effective means of communication within this project.

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)**.*

Suppression of wild rice by a combination of tillage and pre-plant applications of the herbicide glyphosate was initially evaluated in on-farm trials in W. Africa, working with scientists and social scientists at SARI, with the herbicide dose rate confirmed by a replicated research station trial in Tanzania, working with scientific staff at KATRIN. Following up on this, on-farm trials, including farmer-managed trials, were carried out in N. Ghana and in Tanzania, in which different control methods were compared, including the application of glyphosate, other methods new to farmers and farmers' own methods. After harvest farmers met to discuss the results and participate in participatory budgeting in-order to assess the profitability of wild rice management options. The trial sites used in the validation exercise also doubled as demonstrations for neighbouring farmers.

In the final season of validation in Tanzania, farmers were provided with seed of the newly released cultivar TXD-306 and fertiliser so that they were able to assess the impact of both wild rice and soil fertility management when used with a high yielding cultivar.

Post-ploughing application of glyphosate, prior to harrowing and seeding, reduced *O. longistaminata* populations - by 50% in Tanzania - and significantly increased rice yields. Farmers estimated that glyphosate use reduces labour for weeding by 50%. Similar yield increases and season-long wild rice control was also achieved on *O. punctata* infested land.

However, the effectiveness of glyphosate application does not mean that it is necessarily the most likely control method to be adopted. If the crop is intended for sale, glyphosate adoption makes economic sense. In Tanzania, at the 2005 rice farm gate price, the cost of treating one ha with glyphosate is covered by the sale of 130 kg paddy, just 3.6% of the total yield. However, where the crop is intended primarily for subsistence production, the cost of glyphosate is a significant barrier to adoption. This was found to be the case in the trial site of Fumbisi in Ghana. Here, an assessment of farmer responses to researcher-managed on-farm trials and farmer-managed trials found that whilst farmers ranked glyphosate application as the most effective strategy for control of *O. longistaminata*, only 26.7% of them said that it was the most likely method they would adopt, because of the cost involved. The method of control most likely to be adopted was found to be bunding and transplanting; 66.7% of farmers said after two years of on-farm trials that they would be most likely to adopt this.

*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)**.*

On-farm trials to assess the impact of pre-planting applications of glyphosate were undertaken in 2000 and 2001 on *O. barthii* and *O. longistaminata* infested flood-plain farmers-fields of the Niger valley of northern Mali, at Niono, Kogoni and Macina, areas administered by the Office de Niger. Trials were also undertaken with farmers in southern Mali in the region of Sikasso and in the areas of Longorolo, M'Pegnesso, Zoloko and Laminibougou.

In 2000 and 2001, trials were implemented on *O. longistaminata* iinfested fields in Bontanga, Kadia, Tono and Fumbisi in the Northern and Upper East regions of northern Ghana, which included farmer-managed trials and participatory evaluation.

Validation trials/demonstrations were implemented in 2003, 04 and 05 with farmer groups in four districts of Tanzania. Work was undertaken with groups cultivating the *O. longistaminata* infested flood-plains of the Kilombero Valley in Kilombero District and the Lake Nyasa flood-plains in Kyela district. Work to validate/ demonstrate practices to increase the productivity of annual wild rice infested land (*O. punctata)* was implemented in Morogoro region, Eastern Zone in Dihombo village and on fields recently allocated to smallholders at Dakawa and Ruvu, two irrigated farms previously operated by a parastatal farming concern.

Farmers in most of the areas covered by the project, which are rainfed, hold land under customary tenure; those within irrigation schemes at Dhakawa and Ruvu irrigation schemes (Tanzania) and Tono (N. Ghana) hold land under lease.

The majority of farmers involved in the project would be classed as “moderate poor”, and some would be classed as “extreme vulnerable poor”. However, within the irrigation schemes some growers produce primarily for the market, and are not poor; for example within the Ruvu irrigation scheme in Tanzania some landholders are professionals from Dar es Salaam.

Current Situation

C. Current situation

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

Current use of outputs is by farmers in Tanzania who participated in the validation exercise described in sections 10 and 11, and other members of the communities where these demonstrations were undertaken who learnt of the outputs by farmer to farmer spread of knowledge. Extension officers in participating districts continue to use the training they received in wild rice management in on-going extension work. Political leaders, including district commissioners, are telling farmers to use agricultural inputs to improve productivity at every opportunity throughout the country. Pesticide stockists are using information provided by CPP projects to make farmers aware of herbicide use for wild rice control in order to increase their sales of herbicides.

*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).***

Current use of outputs is known to be taking places in the areas where validation took place in Tanzania i.e. Kilombero and Kyela districts, Dihombo Dhakawa and Ruvu irrigation schemes. Five pesticide dealers in Ifakara are now selling glyphosate and 2,4-D and are informing farmers about wild rice control. Herbicides are now also available from a co-operative in Kyela town.

In the Kilombero valley individual farmers are visiting the zonal research centre at Ifakara to seek information about how to control wild rice with herbicides.

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

No survey has been made to ascertain the scale of current use. At Ruvu Irrigation scheme that was severely infested by *O. punctata* most of the 1000 growers who were allocated plots are now reported to use glyphosate prior to transplanting. The first use of the herbicide on research plots here was in 2003. Pesticide dealers are unlikely to provide accurate information on their sales for fear of being levied tax. Three stockists of agricultural inputs based in Ifakara (Kilombero district) were asked to provide details of herbicide sales during the period the project was active. Sales of both 2, 4-D amine and glyphosate (Round Up) increased annually from 2003. While the use of 2,4-D was already known by some farmers for control of broadleaf weeds and sedges, sales increased from 250 litres to 1,178 litres in 2005. The supply of glyphosate increased from 75 litres to 620 litres. All stockiest complained of lack of capital to maintain sufficient stocks to supply the customers' demand. Very few farmers claim to go outside Ifakara town to search for similar products. Demand in 2006 was also said to outstrip supply.

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).***

Adoption that has taken place to date has been as a result of demonstrations set up by the partnership of zonal research and district agricultural extension staff in Kilombero, Kyela and at Ruvu. Engaging district council staff in this process from the outset, including policy makers and extension managers has ensured on-going commitment and involvement of district subject matter specialists and village level extension officers. At village level the participation of farmer groups to undertake field evaluations and demonstrations provided the platform for farmer learning and farmer to farmer spread of knowledge on wild rice management practices. In addition pesticide dealers were involved in meetings with farmers to evaluate technology options so they also learnt "best bets" and market opportunities for inputs that will increase rice productivity. Lead farmers and their village extension workers were provided with short course training on rice production practices at the Moshi Agricultural College at the beginning of the on-farm validation process. This provided them with knowledge and confidence to lead evaluation work in their groups. Posters displaying key aspects of knowledge on wild rice management were distributed to extension workers, lead farmers and pesticide dealers and have proved useful in raising awareness of herbicide use in target communities.

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 associated with the control of perennial wild rice (*O. longistaminata*) is that cultivation of rice can resume on infested areas of the floodplain that were previously abandoned. Commonly these areas have fertile soils and a good depth of water in the growing season and once cleared of wild rice are favourable for rice production. Where these are abandoned farmers must clear additional land from woodland at the edge of the flood-plain. A further potential benefit is a reduction in fossil fuel made possible as the number of tractor tillage passes to prepare land for seeding is reduced when herbicide is used.

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

Use of herbicides carries with it a degree of environmental risk. However used at recommended doses glyphosate is much less toxic than many registered insecticides. Glyphosate also has a favourable environmental toxicity profile. But in rice systems the herbicide is used in the aquatic environment so it is essential that users are made aware of the potential hazards, such as water contamination from inadvertent spills. The agro-chemical industry has a key role to play in disseminating information on safe use to the agriculture community. Training of pesticide dealers who interact with farmers should be an integral part of any promotion of herbicides for wild rice management in the future.

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)***

Climate models predict that rainfall by 2100 will decrease by up to 20% in Tanzania with national grain production falling by 10% by 2080, with particularly severe yield reductions in maize, the major staple crop in the country (see Downing, 2002; In Brining, J.C. and Downing, T.E. [Eds.] *Managing the Earth: The Linacre Lecture.* Oxford University Press, pp 5-34). Increasing rice output in lowland areas where rainfall accumulates will be one contribution to ensuring that as maize production falls or becomes less reliable, poor consumers have continuing access to home produced cereal grain through the operation of the strategic grain reserve which has been largely reliant on grain output from dryland areas.

While model predictions of future rainfall scenarios for W. Africa are equivocal there is some indication of lower precipitation inland of the Gulf of Guinea (see: Caminade *et al*. 2006, Climate Dynamics 26 : 531-547). As in East Africa this may also increase the importance of improving output from lowland rice in countries such as Nigeria and Sierra Leone where wild rice is an important constraint.