

- PARASITE -

Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment

An Integrated Programme

Funded by:

The Netherlands Organisation for Scientific Research, Science for Global Development (NWO-WOTRO)

Partners:

- **Wageningen University**
- **Africa Rice Center**
- **NARS of Benin, Côte d'Ivoire and Tanzania**

PARASITE: Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment

Project team

The project team consists of scientists of Wageningen University (WU), Africa Rice Center (AfricaRice) and NARS of Benin (INRAB), Côte d'Ivoire (CNRA)) and Tanzania (MARI):

Principal investigators:

Dr Lammert Bastiaans (WU)
Dr Gualbert Gbèhounou (INRAB/FAO)
Prof. Alfons Oude Lansink (WU)
Dr Jonne Rodenburg (AfricaRice)

Co-PI's:

- Louise Akanvou (CNRA)
- Juma Kayeke (MARI)
- Aad van Ast (WU)
- Matty Demont (AfricaRice)
- Laurens Klerkx (WU)
- Monique Mourits (WU)

Project advisor

- Ton Rotteveel (Plant Protection Service of the Netherlands: PPS)

PhD students:

- Simon A. N'cho (WU)
- Stella Kabiri (WU)
- Mwalimu K. Menza (WU)
- Gerald P. Kyalo (WU/AfricaRice)

Post-doctoral fellow:

- *To be recruited*

Promoters of PhD students:

- Prof. Alfons Oude Lansink
- Prof. Holger Meinke

Website:

<http://www.africarice.org/parasite/>

Rain-fed rice in sub-Saharan Africa



	Upland	Lowland
Area ($\times 10^3$ ha)	3,400 M ha	2,875
% total rice area	39 %	33 %
Yield (t/ha)	1.04	1.02
Weed-inflicted yield loss (%)	>16	>23
Min. annual production loss (10^6 \$)	259	342

- Past 30 years: 170 % production increase and 300 % area increase of rice in SSA
- Weeds are the most important biological production constraint
- Parasitic weeds are becoming more important

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- Most important parasitic weeds:
 - obligate hemi-parasitic witchweeds *Striga hermonthica* (Del.) Benth. (in West Africa) and *S. asiatica* (L.) Kuntze (in East Africa) and
 - facultative hemi-parasite *Rhamphicarpa fistulosa* (Hochst.) Benth.
- *Striga* spp. favor upland to hydromorphic soils
- *Rhamphicarpa* is well adapted to temporary flooded conditions
- Explorative stakeholder surveys: parasitic weeds are widely distributed and cause major constraints to rain-fed rice.



Problem description

- Parasitic weeds: affect the resource-poorest farmers
- Farmers: lack knowledge and means to address parasitic weeds
- Extension services: lack awareness on extent and nature of problem, and basic knowledge on weed ecology and management (particularly in case of *Rhamphicarpa*)
- Large time gaps exist between appearance of a parasitic weed problem and development and dissemination of appropriate strategies
- Future environmental and land use changes: parasitic weeds might spread
- Institutional innovations and improved stakeholder communication at the national crop protection level are prerequisites for timely response.

Main goal

Closing the knowledge gaps on the biology, ecology, economy and management of parasitic weeds in rice-based cropping systems in SSA and identifying and facilitating the institutional innovations required to timely address newly occurring biotic production constraints

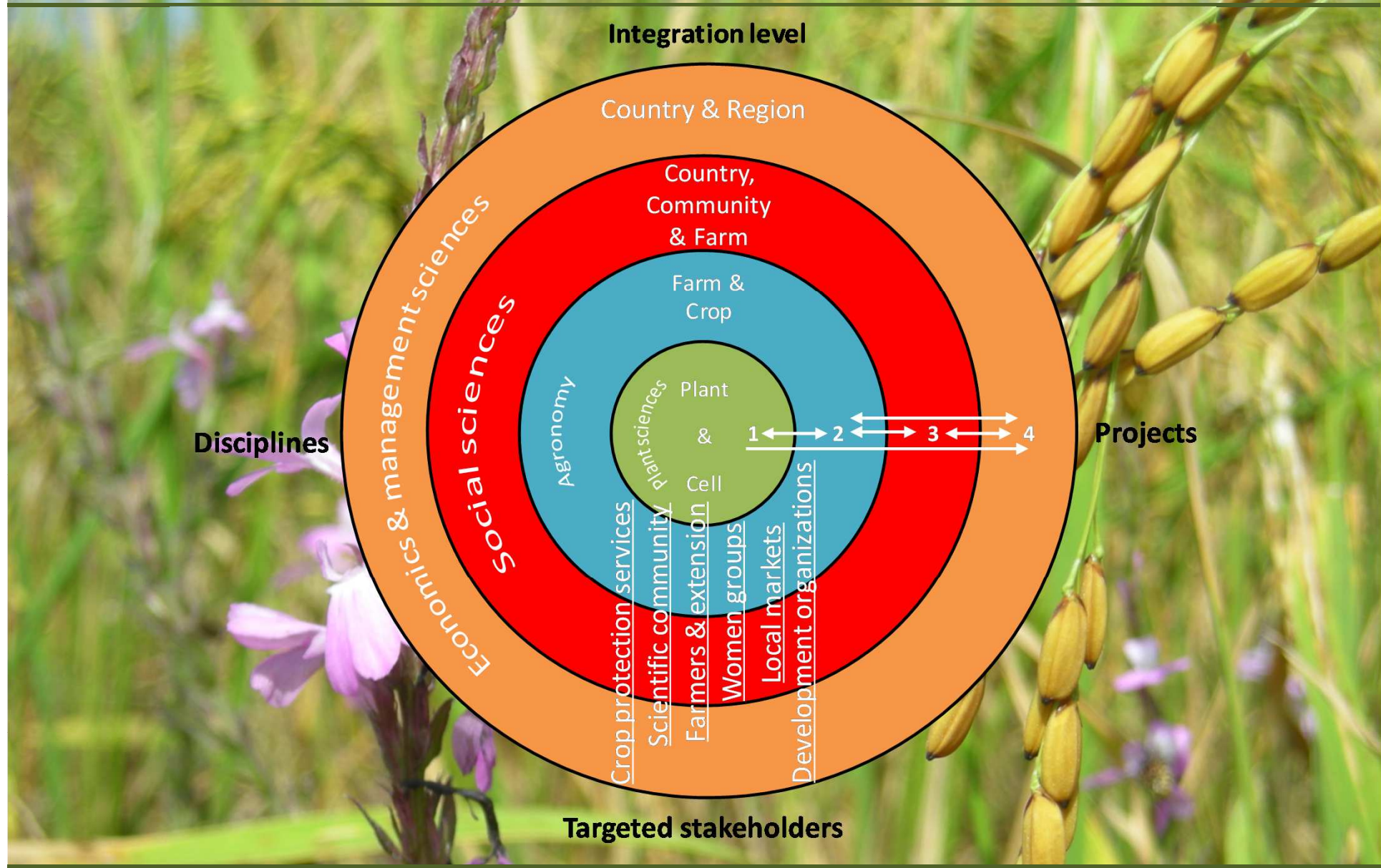


Objectives

- Understanding environmental effects on host-parasite interactions rain-fed rice
- Developing and disseminating locally adaptable management strategies
- Assessing current and future direct and indirect economic and social impacts of parasitic weeds in rice in SSA
- Developing institutional innovations in crop protection services



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Sub-project 1: Understanding how host-parasite interactions for economically important parasitic weed species of rain-fed rice in sub-Saharan Africa are differentially affected by environmental conditions

PhD student: Stella Kabiri (Uganda); Duration: 1 April 2011 – 31 March 2015

Aim

To unravel the ecology of the facultative *Rhamphicarpa fistulosa* and to establish similarities and differences with that of the obligate *Striga* species



Sub-project 1: Understanding how host-parasite interactions ... affected by environmental conditions

Specific objectives

- Identify environmental factors for germination and establishment of facultative and obligate parasitic weeds in rice
- Ascertain attachment strategies of facultative and obligate parasitic weeds in rice
- Determine the consequences of host parasite interactions on host physiology and yielding ability
- Determine the reproductive potential of parasitic weeds in the absence and presence of the host
- Obtaining insights in biology and ecology of parasitic weeds providing clues for adequate management and indicators for future spread.

Sub-project 1: Understanding how host-parasite interactions ... affected by environmental conditions

Methodology

Greenhouse and growth chamber experiments on different life-cycle stages of the parasite

Expected outputs

- ✓ Sound understanding of the biology and ecology of *R. fistulosa*
- ✓ Identification of major factors determining the prevalence of *R. fistulosa* and *Striga* species
- ✓ Provision of clues for rigorous control of both categories of parasitic weeds in rice



Sub-project 2: Strategies for prevention and damage control of parasitic weeds in rain-fed rice production systems in sub-Saharan Africa

PhD student: Mwalimu Menza (Kenya); Duration: 1 April 2011 – 31 March 2015

Aim

To develop locally adaptable and socially and economically acceptable strategies for prevention and control of parasitic weeds in rain-fed rice production systems



Sub-project 2: Strategies for prevention and damage control ...

Specific objectives

- To determine the current status of *Striga* and *Rhamphicarpa* infestation in rain-fed rice production systems of selected SSA countries (Tanzania, Benin and Côte d'Ivoire)
- To document and evaluate effectiveness of currently applied and newly developed control methods
- To develop appropriate parasitic weed control strategies in rice-based production systems

Sub-project 2: Strategies for prevention and damage control ...

Methodology

- Assess the current level of understanding and identify knowledge gaps, priorities and criteria for potentially suitable strategies
- broad selection of potentially suitable, single-component technologies evaluated in community demonstration trials
- con-joint analyses to narrow it down, followed by participatory technology testing

Expected outputs

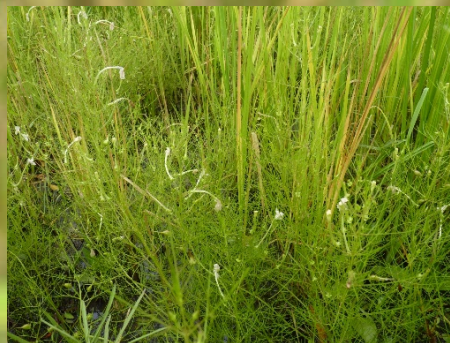
- ✓ Baseline information in Tanzania, Benin and Côte d'Ivoire on the current status of parasitic weeds infestation in rice
- ✓ Appropriate (cost-effective, culturally and socially acceptable) parasitic weed control strategies for rice farmers developed
- ✓ Information and training tools on management of parasitic weeds for extension and farmers developed

Sub-project 3: Assessing current and future economic, social and environmental impacts of parasitic weeds in rice in SSA

PhD student: Simon N'cho (Côte d'Ivoire); Duration: 1 April 2011 – 31 March 2015

Aim

Assess the main socio-economic impact of parasitic weeds incidence and their control in rain-fed rice systems of SSA to provide relevant information for developing and prioritizing weed management strategies and policies at regional and national level



Sub-project 3: Assessing current and future economic, social and environmental impacts ...

Specific objectives

- Assess current situation of parasitic weeds infestation and management strategies in rain-fed rice system of SSA and related socio-economic impact
- Identify the agronomic and socio-economic factors that explain the incidence of *Striga* and *Rhamphicarpa* in rice-based production systems and the related magnitude of damage
- Assess ex-post, the impact of *Striga* and *Rhamphicarpa* infestation on rice yield (losses), production cost and revenue of rice farmers
- Assess the economic efficiencies of various control strategies currently used by rice farmers and those newly developed
- Identify rice farmers' preferences for management strategies and factors associated to their choices

Sub-project 3: Assessing current and future economic, social and environmental impacts of parasitic weeds in rice in SSA

Methodology

- Base-line survey and participatory work (field and household): multistage stratified and random sample, farmer interview using well-structured questionnaire, con-joint analyses (farmer choices)
- Econometric approaches: generalized double-hurdle model (key factors), ATE framework (impact), DEA methods and Tobit (efficiency)

Expected outputs

- ✓ Evidence of the main socio-economic impact indicators provided
- ✓ Magnitude (%) of yield losses in farmers' fields identified
- ✓ Economic impact of parasitic weeds infestation and control options on rice yield, production cost and revenue assessed in Benin and Tanzania
- ✓ The cost and efficiency of currently used and the new developed management strategies of parasitic weeds assessed
- ✓ Rice farmers' preferences for different options of parasitic weeds management strategies identified

Sub-project 4: Evaluating and addressing the institutional organisation and preparedness of crop protection systems in SSA for emerging biotic constraints under future changing environments: an innovation systems perspective

Post-doctoral fellow: to be recruited; Duration: 1 April 2012 – 31 March 2015

Aim

To reduce or avoid a time gap between the start of a biotic problem and initiation of research and extension initiatives for addressing this constraint



Sub-project 4: Evaluating and addressing the institutional organisation and preparedness of crop protection systems in SSA ...

Specific objectives

- To highlight strengths and weaknesses in the institutional organisation of national plant protection services
- To use this information to generate institutional innovation leading to higher preparedness to emerging biotic stresses

Sub-project 4: Evaluating and addressing the institutional organisation and preparedness of crop protection systems in SSA ...

Methodology

- Analyse communication pathways between field and policy levels
- Analyse developmental history of a biotic stress outbreak, from emergence to reporting and from investigations to implementation of phytosanitary regulations
- Exchange visits between crop protection services of SSA and The Netherlands

Expected outputs

- ✓ strengths and weaknesses in the institutional organisation highlighted
- ✓ institutional innovations in the three countries in SSA generated
- ✓ a model for timely pest outbreak alerts developed

Survey: regional distribution and agronomic and economic importance of parasitic weeds in rice in SSA

Lead researcher: Lammert Bastiaans, Wageningen University

Co-investigators: Gualbert Gbehounou, Juma Kayeke, Louise Akanvou, Matty Demont, Jonne Rodenburg

Methodology

- Consulting national and international data bases on rice and weed distribution and economic importance
- Extensive region-wide expert poll
- Questionnaires
- Feed-back exercises to verify information

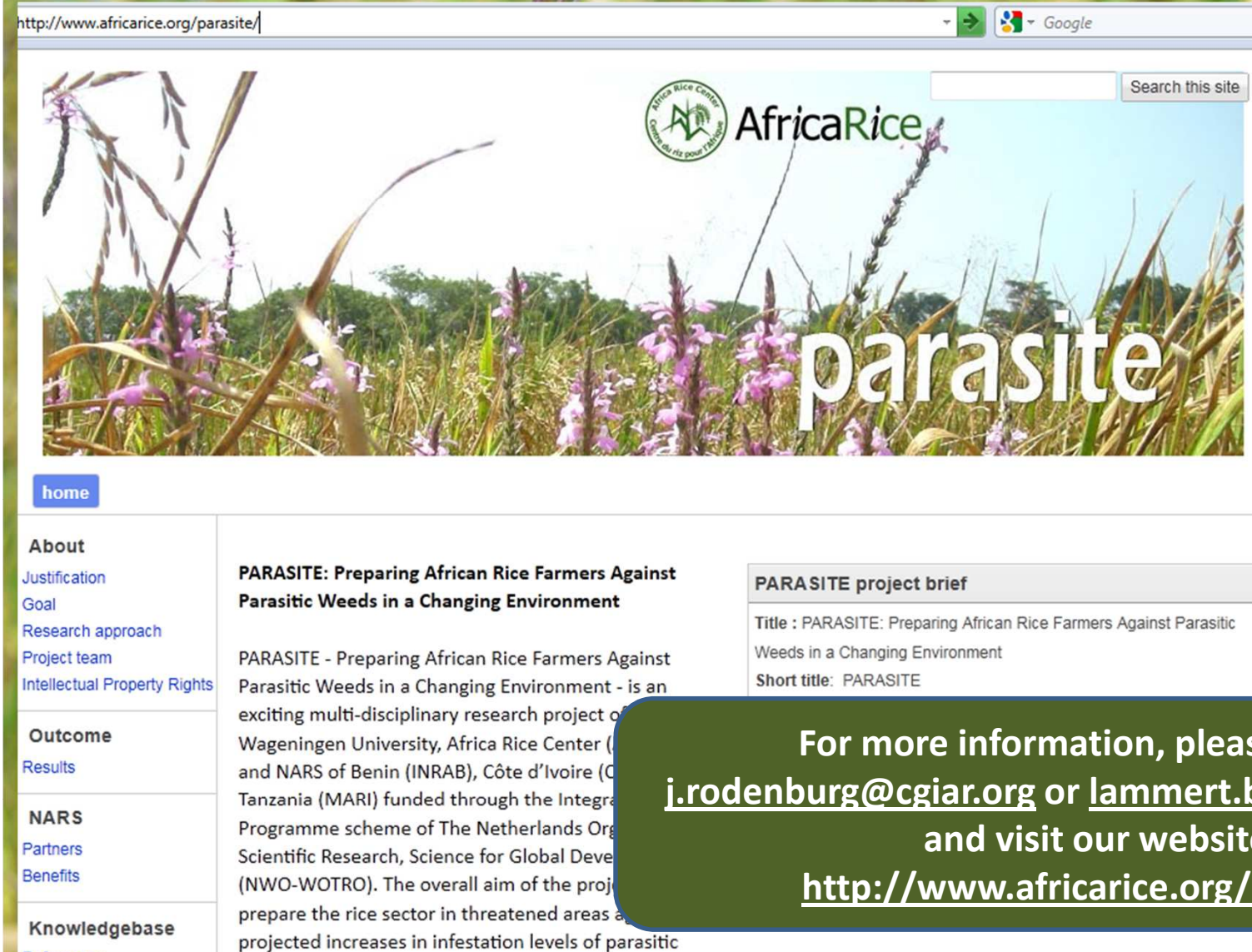
Expected outputs

- ✓ Reliable figures on current and potential extent of the problem

Expected project outputs

- ✓ Figures on current extent of the problem
- ✓ Future scenarios with respect to parasite success (reproduction, spread, germination), agronomic and socio-economic impacts as affected by direct and indirect effects of climate change
- ✓ Better insights in biology and ecology of parasitic weeds (in particular *Rhamphicarpa fistulosa*)
- ✓ Effective and socially acceptable management strategies
- ✓ Improved communication and institutional organization of plant protection services

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PARASITE - Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment - is an exciting multi-disciplinary research project of Wageningen University, Africa Rice Center (CIRAD) and NARS of Benin (INRAB), Côte d'Ivoire (CIRAD) and Tanzania (MARI) funded through the Integrated Programme scheme of The Netherlands Organisation for Scientific Research, Science for Global Development (NWO-WOTRO). The overall aim of the project is to prepare the rice sector in threatened areas against projected increases in infestation levels of parasitic

PARASITE project brief

Title : PARASITE: Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment
Short title: PARASITE

For more information, please e-mail:
i.rodenburg@cgiar.org or lammert.bastiaans@wur.nl
and visit our website:
<http://www.africarice.org/parasite/>

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Thank you / Merci /
Grazie