Donor Country Profile: The Netherlands

RELATIONSHIPS BETWEEN WARDA and The Netherlands date back to at least 1986. Collaboration has been rich and varied. Here, we want to highlight just a few of the areas in which we have worked together, especially over the last few years.

For a geographically small country, The Netherlands has a big input to international agricultural research and development. WARDA is happy to be one of The Netherlands' beneficiaries—and benefit we certainly have, from senior advisers, seconded staff, core, capital and restricted funding, inter-institutional collaboration and trainees.

WARDA's Headquarters in Côte d'Ivoire

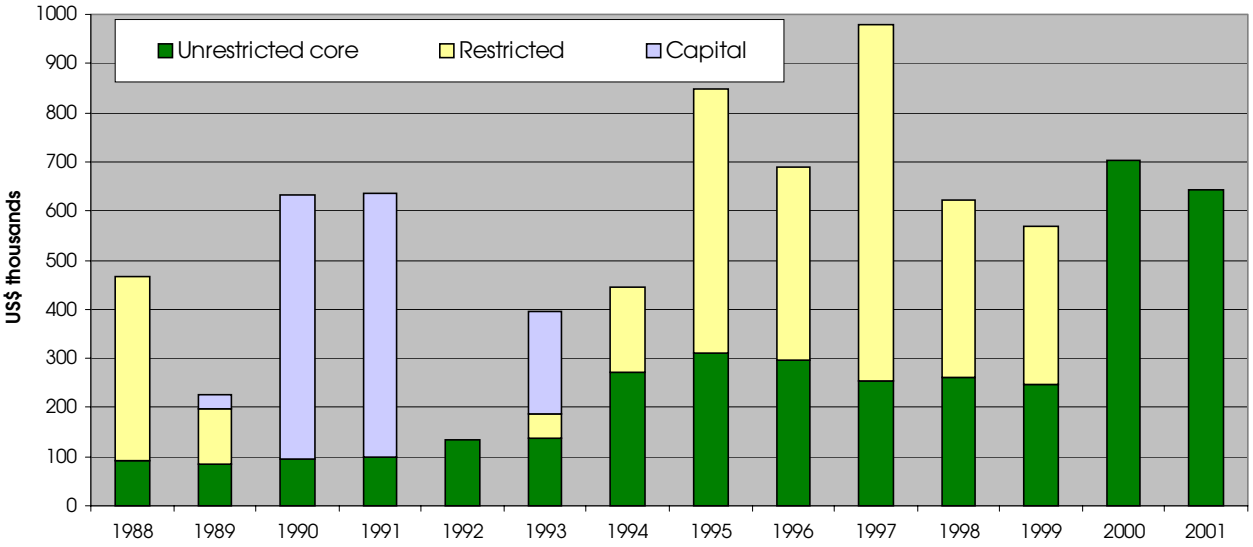
In 1987, WARDA's newly transformed Council of Ministers (previously the Governing Council of the Association, before WARDA joined the Consultative Group on International Agricultural Research in 1986) launched a study to choose a location for the new headquarters and main research center. The search began none too soon, as Liberia disintegrated into a state of civil war in 1988. Although the decision to relocate to the M'bé/Foro-Foro site north of Bouaké, Côte d'Ivoire was made in late 1987, preliminary ground surveys prior to construction only started in 1989. At that time, staff from the Winand Staring Centre for Integrated Land, Soil and Water Research (SC-DLO) worked with WARDA staff on a detailed soil survey of the entire site. The first period of construction of the Headquarters and Main Research Center extended through 1993. In 1990, 1991 and again in 1993, The Netherlands poured significant quantities of capital-development funds into the building project (*see* Fig. 13), thereby demonstrating their commitment to the 'new' WARDA.

"Subsequent to the first phase of building, The Netherlands has played a crucial role in supporting WARDA's research," says Director General Kanayo F. Nwanze. "When other donors were shying away from the CG System in 1993, The Netherlands actually increased its overall contribution to the Association's finances. Even more significantly, they increased their contributions to unrestricted core funding—levels that they have maintained to date."

People on the governing bodies

The late Frans Rudolf Moorman was a member of the last Scientific and Technical Committee of 'old' WARDA in 1986. He was also a member of the selection committee for WARDA's first Director General (in the same year), and thus played an important role while WARDA was in transition to becoming a CG Center. In 1987, Louise O. Fresco joined the newly-created Board of Trustees, and served us in that role through to 1992. Since the mid-1990s, there has been a plethora of Dutch scientists either seconded to WARDA from institutions in The Netherlands, or else directly recruited as core staff. Some of their work is highlighted below.

Figure 13. Dutch funding to WARDA, 1988–2001



Inland Valley Consortium—a long-standing partnership

The link between the Inland Valley Consortium (IVC) and The Netherlands is currently the longest running specific funding agreement between a donor and WARDA. The IVC was established, with WARDA as host institute, in 1993, while Dutch funding for the inland-valley work started in 1992! Until 1999, funding was direct to IVC under a special project arrangement with WARDA, although it amounted to 'core' funding for the IVC itself. Dutch funding to the IVC continues today, though it is now part of The Netherlands' 'core' funding to WARDA as a whole.

In recent years, the IVC 'core' funds provided by both The Netherlands and France have been used for small research grants and to cover operational expenses of the national coordination units (NCUs) in each of the member countries and the Regional Coordination Unit (RCU) based at WARDA. "Such basic funding has been invaluable in the IVC's success to date," says IVC Regional Coordinator, Marie-Jo Dugué. "We cannot underestimate the value of such funding for the NCUs and RCU," concurs IVC Scientific Coordinator, Marco Wopereis (*see* Box 'IVC Small Grant Research Projects').

In addition, the IVC Scientific Coordinator position at WARDA headquarters is salaried directly by the Dutch Government and has to date been filled by Dutch scientists—Pieter Windmeijer from 1994 to 1999 (seconded from SC-DLO), and Marco Wopereis from 2000 to 2002.

The first phase of the IVC ran from 1993 to 1999/2000. Much of the work done then has already been reported in earlier reports—*see* 'Tooling Up for Inland Valley Development,' *WARDA Annual Report 1996*, pages 39–43, and 'Technology Generation and Dissemination: The Role of Agro-ecological Characterization,' *WARDA Annual Report 1998*, pages 23–31. In 1996, an external evaluation of IVC, led by Gerard de Bruijn of the Directorate General for International Cooperation (DGIS), commended IVC for its successes in strengthening research capacity and in strengthening cooperation between national programs and international institutions involved in the Consortium. At

IVC Small Grant Research Projects

"One of the advantages of the Consortium mechanism," explains IVC Regional Coordinator Marie-Jo Dugué, "is that we can make small amounts of money available to national researchers for research projects with regional relevance." All too often, national programs have inadequate funds for conducting the full range of research projects that their other resources might otherwise allow. The IVC enables competitive bidding for funds for national scientists to conduct small projects on subjects of wider interest to the Consortium membership. Much of the money channeled into these projects comes from The Netherlands.

From 1994 to 1999, researchers in the ten IVC member countries received funds totaling US$ 426,921 to conduct 70 such research projects. To give an indication of the kind of work carried out, the table below shows the range of small-grant projects funded via IVC in 2000.

Recipient	Project title
Benin	Participatory development of technologies in the inland valleys of Gankpétin and Gomé
Benin	Finalization and validation of an inland-valley database
Cameroon	Detailed characterization of the inland-valley ecosystem in Akak and Awae key sites in southern Cameroon
CIRAD	'Seed' money to develop a proposal for a regional project to validate and adapt the decision tool DIARPA
Côte d'Ivoire	'Seed' money to develop a proposal for a regional project on integration of aquaculture in inland valleys
Ghana	Comparison of the yield performance of rice under traditional and improved soil, water and crop management
Guinea	Detailed characterization of the Bayewolon catchment, Seredou, Forest Guinea
ILRI, IITA, WARDA	'Seed' money to develop a proposal for a regional benchmark project on land use diversification and intensification (livestock and crops—rice, maize, vegetables and others) in inland valleys
Mali	Evaluation of socio-economic and environmental impact of land development programs for small inland valleys in the Bougouni region
Mali	Improvement of productivity of women's rice fields through organic and mineral fertilization (Bougouni, southern Mali)
Sierra Leone	Socio-economic evaluation of inland-valley swamp rice technologies promoted by the national agricultural research institution
Sierra Leone	Increasing and sustaining sweet potato productivity in an inland-valley toposequence in western Sierra Leone
Togo	Characterization of farming systems in inland valleys of southern Atacora (Adeta pilot-site)
Togo	Collect and disseminate information on inland valleys by setting up a documentation and database unit
WARDA	Occurrence of iron toxicity in West African inland valleys

that time, however, the IVC was still quite young and recommendations were made to strengthen its structure and functioning. Since that time, the Consortium has implemented many of the Review's proposals and today is all the stronger for that valuable input. It was thanks at least in part to this positive review that the main donors (The Netherlands and France) agreed to continue into a second phase.

"The last year [2001] has seen phase 2 of the Consortium's work come on line in all the [IVC] member states, after almost two years of transition in 1999 and 2000," says Wopereis. "This second phase brings a lot of changes in the Consortium's activities and approaches." Not least of these was the decision to bring IVC activities under the umbrella of WARDA core program activities in 1999. "This new relationship with the host institution brings mutual benefits," explains Wopereis, "the wider WARDA community benefits from IVC's expertise and the partnerships that it has developed, while the IVC benefits from WARDA's expertise and relationships. In fact, more WARDA scientists have become involved in IVC activities in 2001 than ever before."

One major shift from phase 1 is the establishment of large 'benchmark areas' for research work, as opposed to the focus on 18 smaller 'key sites.' This, in part, reflects changes in emphases from static agro-ecological characterization work to characterization of dynamic processes, and from a focus on inland-valley lowlands to a holistic approach focusing on inland valleys as a whole, encompassing the upland–hydromorphic zone–lowland continuum. "The establishment of the benchmark areas has been a protracted process," says Wopereis, "but we do hope to have activities at two sites in 2002, where sites that straddle national borders reflect similar interests and joint research themes among countries." One site is shared by Burkina Faso, Côte d'Ivoire and Mali, while the other should be in the Benin–Togo border region. "We hope that some of our new sites will coincide with the benchmark sites of the CGIAR's Ecoregional Program for the Humid Tropics of Africa (EPHTA)," says Wopereis, "for example, the Benin–Togo site." This will speed up technology evaluation and dissemination, as EPHTA already has a mass of data on its sites.

A major component of the IVC phase 2 is indicated by Wopereis's official job title—Natural Resource Management Scientist. "Management of natural resources is crucial to effective crop management," says Wopereis, "so we are looking at integrated natural-resources management (INRM) for inland valleys in the region." With WARDA as host and lead institution in the Consortium, the entry point for inland-valley INRM will be rice. "WARDA's and IVC's research results are being put together into an INRM framework that we want to encourage all our partners to test, adapt and use in their own situations," says Wopereis. "To achieve impact, it is imperative that partnerships are built among inland-valley stakeholders, from farmers to decision-makers." The IVC is ideally suited for this approach as NCUs have already the right partners sitting around the table.

In February–March 2002, IVC and WARDA's technology transfer team conducted a training course on 'Participatory Learning and Action Research on Integrated Rice Management' for extension partners and farmers in Côte d'Ivoire and from IVC member countries. "The training modules are designed to enable extension services to conduct adaptive research," says WARDA Technology Transfer Agronomist Toon Defoer. "After all, technologies that have been developed at one site need to be verified and adapted at new target sites. The technical and facilitators' manuals that we prepared were tested during the course in Côte d'Ivoire, and will subsequently be refined for publication and wider use in all IVC member countries."

"In addition to these 'new' activities, we inherited several unpublished proceedings of IVC-sponsored scientific meetings from phase 1," says Dugué. "We are now in the final stages of producing a combined summary of the general meetings, and a full proceedings of the workshop on hydrology."

"We live in an information age," says GIS Specialist Mahaman Moussa, "and WARDA and IVC are not going to be left behind. In 2001, we developed a web-site for the IVC in both English and French editions." A distinction that gives IVC an 'edge' over every other project within WARDA! "IVC is now visible to the world," says Dugué, "but a major part of the working of the Consortium is communication *among* the members. To help in that respect, we re-launched the *Inland Valley Newsletter* in December 2000, with a further issue in July 2001." The IVC has also proposed that a special issue of an international journal be devoted to inland valleys, with emphasis on West and Central Africa—something that is still under consideration by the first journal approached—to provide a communication channel to peer researchers world-wide.

The IVC is also making the findings from phase 1 more widely available. The inland-valley characterization data from the 10 member countries have been put together in an information system (West Africa Inland Valley Information System, WAIVIS). Mahaman visited *Centre de coopération internationale en recherche agronomique pour le développement* (CIRAD) in Montpellier, France, for two months in 2001, where he worked with Michel Passouant. "My stay in France was very interesting," enthuses Mahaman, "as it allowed me to get acquainted with the latest developments. The growing volume of databases of different types places huge demands on archiving and structuring to provide users with fast and reliable information. This is especially difficult in the field of geographical information and interactive usage." Several options were explored taking into consideration such factors as cost, complexity and demands on programming skills and hardware. In the end, formats were chosen for ease of use on the Internet and CD-ROM platforms. The innovations coming out from this work are: (i) the utilization of conceptual and logical models to conceptualize, integrate and organize different types of databases; (ii) the utilization of Scalable Vector Graphics (SVG) format for dynamic web-publishing of GIS databases; and (iii) the utilization of meta-data techniques (use of key words) to provide a user-friendly tool for accessing information. "The results will be distributed to all member countries for a last check of the data," says Mahaman, "before official release on CD-ROM and the Web."

Soil degradation in irrigated rice fields in the Sahel

Piet van Asten is a Dutch Associate Expert in Soil Science. His time at WARDA's Sahel Station was somewhat of a special deal that he struck with the sponsoring agency, DGIS, before taking up post. "Before I took up my assignment in May 1998," explains van Asten, "the normal routine for DGIS Associate Experts was two two-year assignments, preferably with different hosting organizations and in different countries. It is also more usual for such positions to be less research oriented than they are with the CG centers." Van Asten saw in the research position at WARDA an opportunity to further his qualifications by pursuing a PhD. "The only problem there," he muses, "was that a typical PhD research program runs for three or four years, if I was only to stay two years it would not be practical." Van Asten approached DGIS with his proposal, and received the offer he was looking for. His tenure at WARDA ran from May 1998 through April 2002. The PhD itself is through Wageningen University (now part of the larger Wageningen University & Research Centre—*see* Box 'Wageningen University remodeled'), while the research is actually a UK-funded project.

Much of van Asten's work has already been reported (*see* 'A Holistic Approach to Irrigated Rice Farming Problems Uncovers More Than Just Soil Degradation,' *WARDA Annual Report 1999*, pages 30–37), so here we will summarize the early findings and bring the story up to date.

Wageningen University remodeled

For many years, Wageningen Agricultural University (WAU) has been considered one of the foremost agricultural universities in the world. In addition, the city of Wageningen hosted several other research institutions involved in agriculture-related work, one of them being the Winand Staring Centre for Integrated Land, Soil and Water Research (SC-DLO). With their close geographical proximity, these institutions often linked up with WAU in dealings with collaborators such as WARDA.

In 2000, the decision was made to bring all the disparate entities together under a single umbrella, and so the Wageningen University and Research Centre (WUR) came into being. The university—now simply Wageningen University—retains its academic identity and continues to be the awarding body for postgraduate degrees. However, students may be sponsored by external agencies, including the broader WUR itself. WAU has been the awarding institution for at least six postgraduate students that have worked in collaboration with WARDA.

Founder and active members in IVC, the 'Wageningen Group' actively participates in meetings and workshops, providing a strong scientific background and support, especially on methodological aspects. It is also represented on the Consortium Management Committee. Wageningen scientists contributed to scientific excellence and public awareness through written articles and support of publication under the IVC logo. The Group also provides consultancies on 'cutting-edge' issues such as modeling. Currently, WUR is actively involved in IVC phase 2 priorities of dynamics of biodiversity, benchmark-area research, and will be involved in the aquaculture work when it starts in earnest. Thus, the collaboration between WAU, SC-DLO and IVC that started in 1994, continues today with WUR.

One half of the project is based in the Sourou Valley of Burkina Faso, where farmers complained of unproductive patches, or pockets, in their fields, associated with calcareous deposits (often in the form of nodules) or drainage problems. By the end of 1999, the only relief had come from the application of either manure or compost, thereby improving the organic-matter content of the soils, although application of fresh straw had no effect. At that time, van Asten was inclined to blame the low productivity of the pockets on zinc deficiency.

At the other project site—Foum Gleita in southern Mauritania—alkalinization had been detected in shallow soils, as a result of carbonate release from the schist bedrock. However, improved crop management resulted in significant increases in rice yields, and farmers were becoming less inclined to blame soil degradation for their poor performance. Significant yield increases were being achieved with the use of phosphate fertilizer, but that fertilizer was not easily available for rice in Mauritania.

The following season's trials in Burkina Faso confirmed van Asten's suspicions. "On the plots where we applied zinc," he enthuses, "we saw uniform crops—no patches with weak rice plants and no two- to three-week delay in harvesting the rice on the unproductive pockets. In 29 farmers' fields, application of 10 kg of zinc sulfate per hectare resulted in average grain yields increasing from 3.3 tonnes per hectare to 6.0 tonnes!" The research team was also rather pleased to discover that these low doses were all that was needed—application of 20 kg zinc sulfate did not give a better yield response than the application of 10 kg. "This means that the farmers do not have to apply large quantities of zinc to their crops," explains van Asten, "and therefore the cost of 'fixing the problem' is not as high as it might have been." Meanwhile, the potentially even cheaper option of using straw to increase organic-matter content, and thereby yields, was investigated further. "Given the failure of fresh straw to improve the situation," says van Asten, "we opted for harvesting, rotting for one season, and then spreading the partially rotted straw on the fields." This option alone increased average on-farm yields to 5.3 t/ha, and therefore offers itself as a viable relief mechanism for those farmers who might prefer to use straw rather than zinc.

"The latest developments in the Sourou Valley story are extremely encouraging," says a jubilant van Asten. "The national agricultural research institute, *Institut de l'environnement et des recherches agricoles* (INERA),

and the local extension service, *Autorité de mise en valeur de la vallée de Sourou* (AMVS), are setting out plans with farmers' cooperatives to adopt zinc fertilization as soon as possible—the farmers no longer need convincing, they just need access to the fertilizer." Meanwhile, the research and extension staff are approaching fertilizer company representatives and traders with a view to encouraging them to formulate suitable products for rice and make them available to farmers on a wide scale.

Further nutrient studies at Foum Gleita revealed that the recovery rate of both nitrogen and phosphate fertilizer was much lower on the shallow alkaline soils than on the deeper non-degraded soils. This implied that larger amounts of nitrogen and phosphorus fertilizer were needed on the degraded soils in order to obtain yields equal to those on the non-degraded soils. Van Asten decided to follow the low fertilizer recovery rates through a series of field straw trails. Incorporation of fresh straw (5 t/ha) led to an average 1.1 t/ha yield increase irrespective of soil type or fertilizer dose (Fig. 14). The straw affected the soil in a way that enabled the plants to take up more of the applied fertilizer (Fig. 15). These rice plants then grew better and yielded more than those without straw. Farmers often burn the straw after harvest or use it as fodder for their cattle at the end of the dry season. These results show that farmers can incorporate the straw into their fields to improve yields without incurring additional costs.

If all this isn't enough, we find that van Asten is one of those young scientists who just loves to follow clues and ideas, and see where they lead him. He takes up the story: "It was clear that alkalinity is a present problem at Foum Gleita—the shallow soils are alkaline as a result of the underlying parent rock, and the irrigation water used is one of the most alkaline known to date in West Africa." A review of various reports from the 1970s onwards revealed, however, that there has been no secondary increase in alkalinity over the last 30 years as

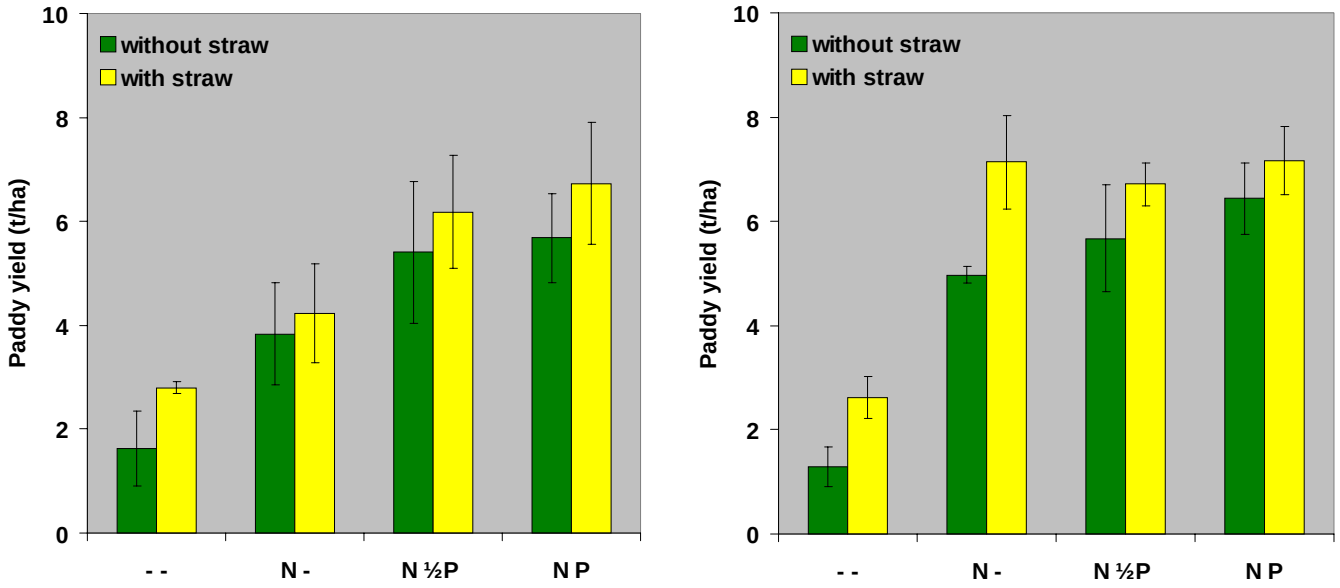


Figure 14. Effects of straw and fertilizer application on yield of rice on 'degraded' (left) and 'non-degraded' (right) soils, Foum Gleita, 2000

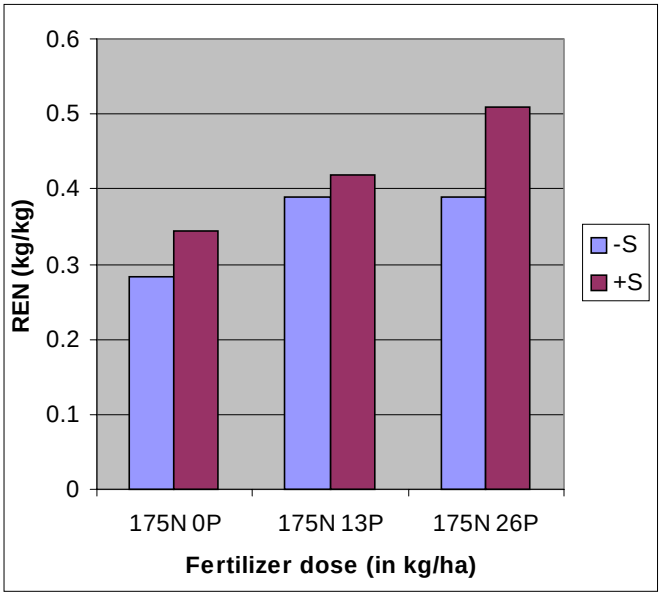
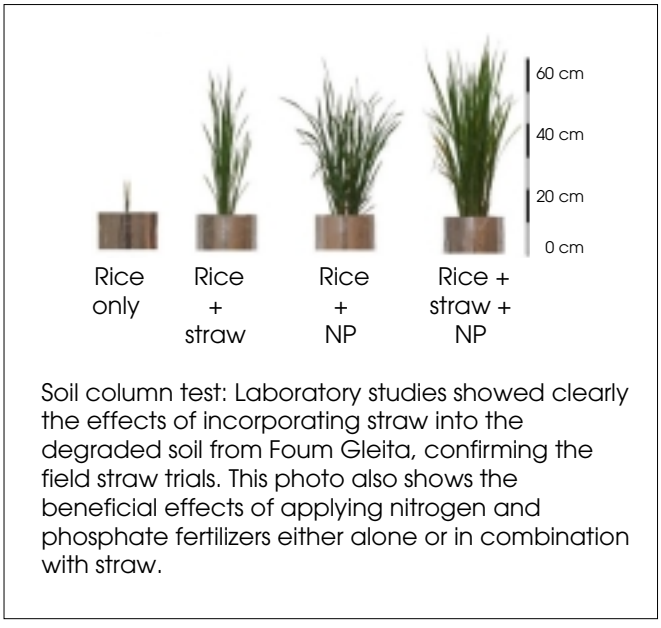


Figure 15. Effects of straw (S) and fertilizer application on nitrogen recovery rate



Soil column test: Laboratory studies showed clearly the effects of incorporating straw into the degraded soil from Foum Gleita, confirming the field straw trials. This photo also shows the beneficial effects of applying nitrogen and phosphate fertilizers either alone or in combination with straw.

a result of irrigation activities. Together with Claude Hammecker of IRD, van Asten used computer simulation (program PHREEQC) to predict the likely future for Foum Gleita. The model showed that most soils in Foum Gleita have a strong buffering capacity against alkalinization processes. It is not yet clear whether this buffering capacity will eventually run out in the long run (decades). Van Asten continues: "Many of the processes that are related to alkalinization in irrigated rice soils are still poorly understood. Simulation tools are available, but none of them fit to the very special conditions found in irrigated rice soils." Dutch MSc student Arjan van't Zelfde (from Wageningen University) conducted soil-column tests that showed that rice cropping can de-alkalinize West African alkaline soils, and that straw incorporation enhances this process, providing there is some drainage. Van Asten concludes that the results of these tests are of great help in verifying and improving results of simulation modeling (PHREEQC is not a fixed model), so that the evolution of these soils can be better predicted under both current and alternative management strategies. "So far," van Asten concludes, "the results of our research and research elsewhere seem to indicate that irrigated rice cropping and incorporation of organic matter into the soil both contribute to decreasing or preventing further alkalinization."

Human health

In 1999, DGIS seconded Olivier Briët to WARDA headquarters to work as Associate Expert in Medical Entomology with the Human Health Consortium. Briët helped researchers from Côte d'Ivoire and Mali to analyze their entomological and epidemiological data on malaria and schistosomiasis. He also helped disseminate the Consortium's results through a web-page, co-organizing a conference on water and health held in Ouagadougou in 2000, and by assisting in the writing and preparation of research articles for publication.

Briët co-authored an article that demonstrated that rice cultivation in the savanna zone of Côte d'Ivoire does not

seem to affect the population density of the principal malaria vector (mosquito *Anopheles gambiae*), while in the forest zone a strong linear correlation was evident between surface area of cultivated rice in the vicinity of villages and mosquito population density. Further results from the Consortium are summarized in the Box.

Postgraduate trainees

Wageningen University is perhaps one of the best-known agricultural universities in the world. It is not surprising, therefore, that strong links have been established between Wageningen and WARDA. A number of postgraduate students have come directly from Wageningen to conduct their field studies at WARDA; others have made the Wageningen–WARDA connection by other routes. Piet van Asten is just one example (*see above*). Piet Keijzer is another: "My particular case is probably unique," he explains.

After his transfer to headquarters as Natural Resource Management Scientist with IVC in 2000, Marco Wopereis maintained collaborative links with Wageningen University. This collaboration led to Wopereis encouraging Keijzer to visit WARDA to carry out field studies as part of the latter's MSc research. However, circumstances intervened and Keijzer's work with WARDA was delayed until 2001. "After some discussion," explains Production Economist Olaf Erenstein (coincidentally, also Dutch and from Wageningen!), "we decided to have Piet work on the peri-urban project funded by GTZ, which looks at the effects of market access on rice-based land use systems in a 25-km radius around four urban centers—Korhogo, Bouaké and Daloa in Côte d'Ivoire, and Sikasso in Mali." In each area, village- and lowland-level surveys were conducted; in all, over 1000 lowlands. Keijzer arrived during the finalization phase for the initial database.

Keijzer provides the details: "I visited rice-growing lowlands around Daloa and Sikasso, which took several weeks, to collect data to complete the database and

Human Health Consortium (1994–2000):† Summary of Findings

Sahel (Mali)
Villages with irrigated rice fields showed constant, low-level transmission of malaria, and recorded 0.7 cases per 1000 child-days year-round. In villages without irrigation, no malaria transmission was detectable in the dry season (malaria fevers were still detected); malaria showed a high peak incidence in these villages during the rains—3.3 cases per 1000 child-days in the rainy season. Overall, malaria incidence was 2.2 times higher in the non-irrigated zone than in the irrigated zone, on an annual basis.

Meanwhile, rice double-cropping led to an increase in schistosomes, but no clear-cut difference from other systems in snail population dynamics or transmission pattern.

Savanna (Côte d'Ivoire)
Yearly total transmission of malaria was about the same in villages with irrigated rice fields and those with unimproved wetlands. Some seasonal variation in incidence was recorded, but overall annual incidence was similar in villages with unimproved wetlands, single rice crop and double rice crop.

No differences were detected in the incidence of schistosomes in the three village types.

Forest zone inland valleys (Côte d'Ivoire)
The population density of one malaria-mosquito species (*Anopheles gambiae*) was correlated with surface-water availability in rice fields. This was apparently related to the availability of breeding sites (open water) exposed to sunlight.

Rice cultivation had no effect on the schistosome populations. In fact, there was some correlation between schistosome population and area of *uncultivated* wetlands.

Overall, it appears that introduction and subsequent intensification of water management for rice cropping has no major negative effect on either of the diseases studied—malaria and schistosomiasis—on an annual basis.

† The Human Health Consortium was funded by Denmark (DANIDA), the International Development Research Centre (IDRC, Canada) and Norway, and ran from May 1994 to June 2000.

Natural and human-induced soil degradation affecting rice cultivation in the Casamance, Senegal

Anneke Fermont came to Saint Louis, northern Senegal, at the end of 1998 accompanying her husband, Piet van Asten. The first year or so she worked on the program of Mohammed Kebbeh in Mauritania. Then she saw a possibility to start her own project.

In 1999, van Asten and research assistant Salif Diack conducted a two-day workshop for farmers in the Casamance region (southern Senegal) on rice cultivation. This was at the invitation of an NGO—*Fondation pour le développement des projets à petite échelle* (FDPPE)—that was working on environmental degradation in the region, and which already had a connection with The Netherlands. Multiple constraints to rice production were identified during the workshop, many of them related to soil degradation problems. This led Fermont to write a joint project proposal between FDPPE and WARDA. The project was jointly funded by the Dutch Embassy in Dakar and the Van Rumpt Foundation in The Netherlands in 2000; in 2001, the foundation funded the project alone. Meanwhile, WARDA provided Fermont with office space, soil-sample analysis, technical advice-cum-backstopping, administrative support, daily transportation (to and from the Sahel Station) and a computer. The project sites themselves are in the Bignona valley, which has a watershed of some 800 square-kilometers, and currently about 2500 ha of rice.

"In the first phase of the project," explains Fermont, "we wanted to identify the soil-degradation problems that the local farmers were reporting, and how these problems were affecting the rice crop." Thus, Fermont and her team took a two-pronged approach of sampling the soils, while obtaining farmers' perceptions of the problem through interviews with the farmers themselves, participatory rural appraisals (PRAs), and interviews with local organizations with a vested interest in the rice-farming community.

"The inventory phase proved most revealing," says Fermont. "Decreasing rainfall since the 1970s has led to increasing salinity problems and a lowering of the groundwater table by 30–40 cm. The latter, in turn, has resulted in moderate acidification of the soils in the valley bottom containing pyrite."

In 1987, a Chinese project closed the Bignona valley with a dam. Although the dam succeeded in reducing salinity problems in the valley, its impact has been devastating. "Before the dam," continues Fermont, "the valley contained some water all year—partly due to back-flow from the Casamance River. Now, the valley dries up completely during the dry season." This has resulted in severe soil acidification on a large scale. "The whole scene is one big ecological disaster," mourns Fermont. "The Bignona River now has a pH of 3 (that is the same as a human stomach!) (Fig. 16), one-and-a-half *thousand* hectares of mangrove have been lost, and so has a lot of the area formerly suitable for rice cultivation." In fact, the combination of drought affecting the upland soils, and the recent soil degradation processes affecting the lowlands, has resulted in 50% of the rice area in the valley being abandoned!

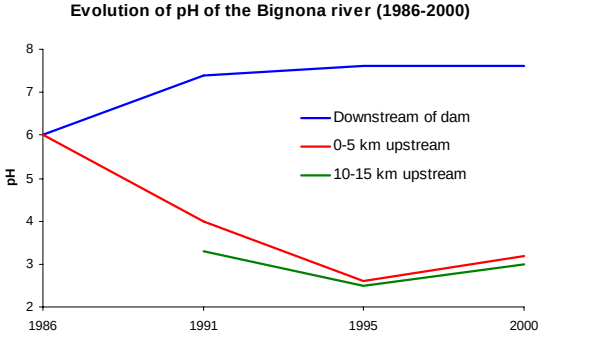


Figure 16. Effect of construction of large anti-salt dam (1987) on water quality of the Bignona river

Farmers assessing rice variety BW 234-1, Bignona valley, Casamance, Senegal

During interviews, it appeared that few local experts had a good understanding of the actual soil problems in the Bignona valley. Contrary to the general opinion, soil surveys showed that soil acidity is the main production constraint in the lowland and salinity is no longer a problem in the Bignona valley. The widespread belief that salinity is still the main production constraint was due to the existence of large barren surfaces covered with salts. However, the sodium chloride (common salt) that used to dominate these surfaces, has been replaced by a range of acidic salts.

During participatory rural appraisal workshops, Fermont found that farmers unanimously identified soil-related problems such as acidity, iron toxicity, poor soil fertility and poor water availability as the main constraints to rice cultivation. "It was encouraging," says Fermont, "to find that, although farmers often use the wrong terms to indicate specific soil degradation problems, they can identify the characteristics and locations of the different problems in detail." This particularly applied to the women, who are responsible for transplanting and harvesting, and the young men who have received a higher level of education than their parents.

Casamance farmers tilling rice field with local *kayando*

The second phase of the project involved trials with farmers in the search for solutions to the problems at hand. Protocols were established by the research team for different zones, but the trials themselves were decided upon and conducted by the farmers. "We held workshops," Fermont explains, "to make our proposals to farmers' groups, but then the farmers decided which zones should be given priority and which trials they wanted to conduct." Thirty-three farmer trials were established across the three project sites in 2000.

Although the team's proposals included trials that addressed crop-management issues, which are easy to adopt, farmers decided to conduct only fertilizer and variety trials. "It was also interesting to note," says Fermont, "that farmers were principally interested in targeting acidic or drought-prone soils to try to improve production on them. However, we found that the response of rice to fertilizer application was greater on non-acidic lowland soils than on acidic soils"—yield increases from application of 30 kg phosphate/ha plus 75 kg nitrogen/ha were 90% and 78% on non-acidic and acidic soils, respectively (Fig. 17). In the drought-prone upland, neither fertilizer nor cultivar had any significant impact.

"One of the outcomes of the first-year trials," says Fermont, "is the need to get the idea across to the farmers that they should use inputs only on good soils, where the returns to investment are much greater. In addition, we found that average yields from trials with no fertilizer were significantly higher than farmers' average yields in the same zone. This is an indication that, even without fertilizer use, farmers can increase rice production by improving their management (early operations and weeding) and using appropriate varieties."

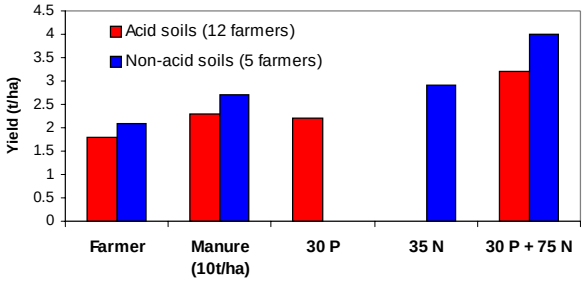


Figure 17. Fertilization trial on lowland soils, Bignona valley, Casamance, Senegal

Happy with the first-year's results, farmers' interest increased in 2001, so that 60–70 farmers conducted trials that year. "What is more," says an enthusiastic Fermont, "the farmers *did* show a shift of interest from the problem to the non-problem soils!"

When asked about the future, Fermont is upbeat: "My final step in the project was to develop extension materials to get these messages to other rice farmers in the Bignona valley." This was done in collaboration with Potin Dieme of FDPPE and fieldworker Ansoumane. "It is good that we were able to make these materials," says Fermont smiling. "Our time here ends in May 2002, and it is good to know that the work is going to continue for the benefit of all the farmers that I've come to know over these two years."

typology analysis." The geo-referenced database is used to characterize land use in the lowlands around urban centers on a north–south gradient. In the next stage, representative lowlands are selected for further in-depth characterization and diagnosis, through surveys and participatory studies. At the same time, farmer-participatory adaptation and validation will be going on. The research is expected to improve targeting of policy recommendations and available production technologies to these key environments.

The future

"We were very pleased to learn in early 2002 that DGIS is offering us five Associate Experts under the revised scheme," says WARDA Director General Nwanze. "You can be sure that we will take full advantage of the offer."

"Over the years, The Netherlands has played a crucial supporting role to WARDA," says Nwanze. "Their consistent support to the IVC in both funding and seconded experts has been a rewarding experience for us. We look forward to continued fruitful collaboration in the years ahead."

The Netherlands, Holland and the Dutch

It has become generally recognized that 'The Netherlands,' rather than 'Holland,' is the correct name of the homeland of the *Dutch* people. Still, however, the nomenclature (at least in English) is almost as confusing as that relating to the United Kingdom and Great Britain (*see WARDA Annual Report 1999,* page 50).

Some definitions of the entities are:

- The Netherlands = the name of the country (in English); however, the *Kingdom* of the Netherlands comprises the European country (The Netherlands per se), and the Netherlands Antilles and Aruba in the Caribbean!
- Holland = former autonomous country comprised of the modern provinces of North and South Holland of The Netherlands; historically, the region of Holland has played a dominant role; South Holland is still the most densely populated among The Netherlands' 12 provinces.
- Dutch = adjectival form, "of or pertaining to The Netherlands"; especially used in reference to the language and people; Dutch is one of the Germanic languages, and is spoken throughout The Netherlands. The origin of the word seems to be in dispute: some claiming it has origins in the Dutch language itself, others claiming it is a corruption of 'Deutsch' (German).