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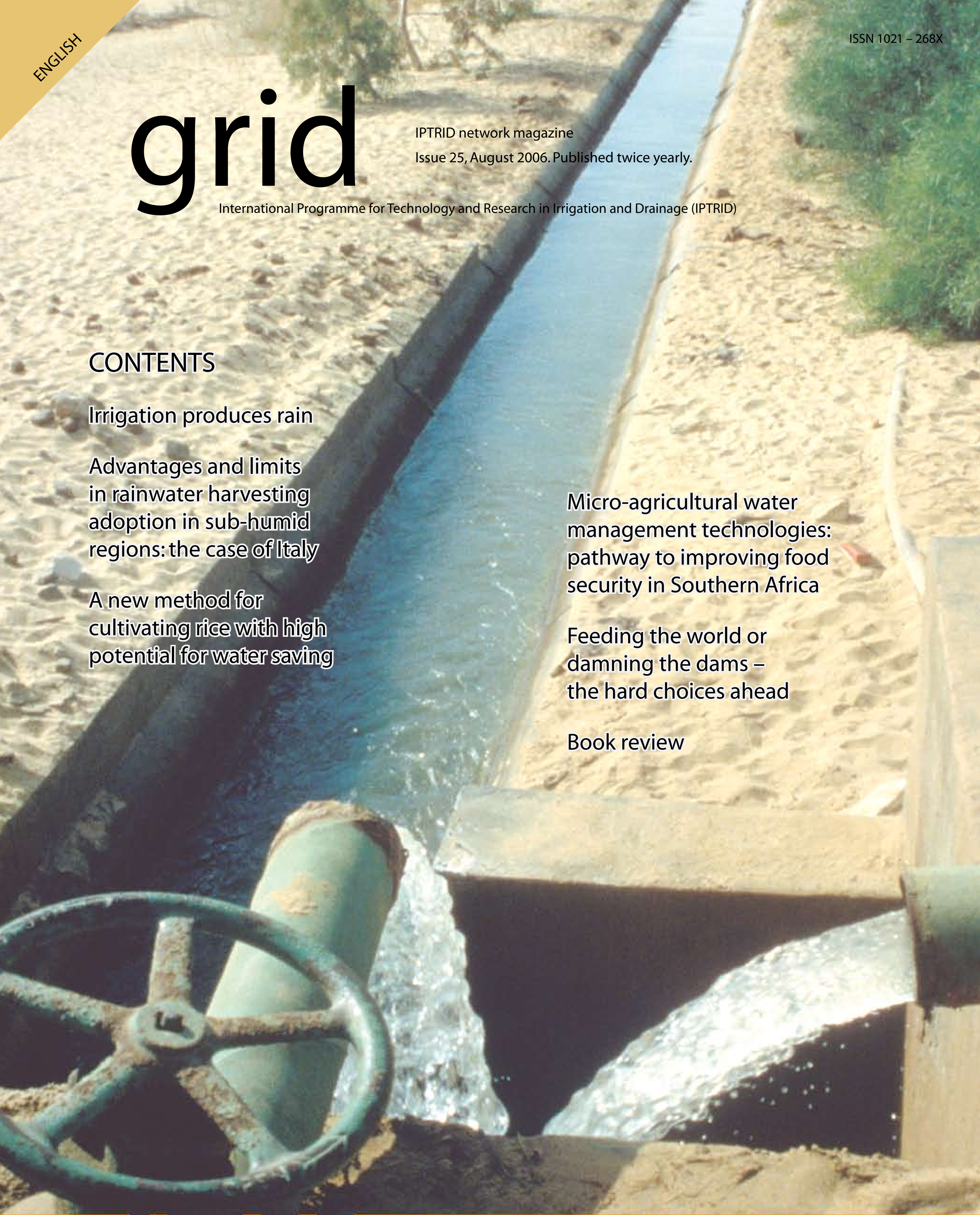

CONTENTS

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Submission of material
GRID invites short written contributions, principally for the Diary and Forum sections. They may include photographs or drawings, which must be of high quality and suitable for reproduction at reduced size. Contributions should be sent to: International Programme for Technology and Research in Irrigation and Drainage (IPTRID), Land and Water Development Division, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00100 Rome, Italy.

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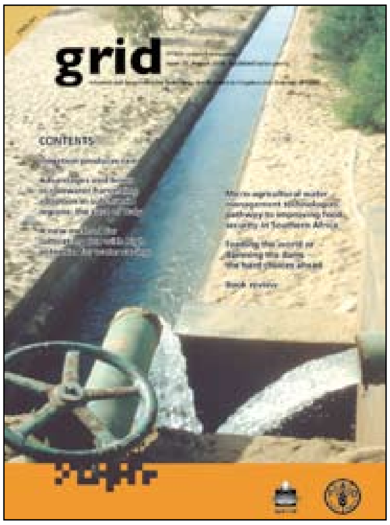


Treated sewage water mixed with underground water for irrigation purposes. *(FAO/21780/R.MESSORI)*

Aim and scope

GRID is published to assist communication between researchers and professionals in the spheres of irrigation and drainage. It informs readers about IPTRID activities and about research and development in irrigation and drainage with a view to stimulating international debate on these issues.

GRID is produced for professionals working or having an interest in irrigation and drainage projects in developing countries. It covers all relevant disciplines including engineering, agriculture and the social sciences.

CONTENTS

A welcome from the Programme Manager

Dear Reader,

On GRID

It is my pleasure to introduce our second issue of 2005. As in the first one, we have far exceeded the expectations on contributions which prevented us from scaling down on the number of pages as we had planned. In this issue, we have struck a better balance between contributions originating in developed and developing countries, and between local and central partners.

Our third interview featuring Ms Louise O. Fresco, former Assistant Director-General of the FAO Agriculture, Biosecurity, Nutrition and Consumer Protection Department, previously the Agriculture Department, and a strong supporter of our Programme, provides a candid view on IPTRID and its relation with our host. We welcome your comments on this section of our magazine and invite suggestions on proposed names for future interviewees.

In this issue we are introducing a new section, Research and Technology, in line with our renewed mission. We have very interesting contributions and hope to make this section a permanent feature of our magazine, if your feedback encourages us to do so.

Finally and once again, we want to request our readers to step forward and send their contributions on time to ensure their inclusion in the future issues.

Our work

The past six months have seen a flurry of activities taking place. IPTRID participated in the Fourth World Water Forum in Mexico and was very visible: we were on the podium as co-convenors of the session on "Capacity Development and Social Learning"; we participated in the session on "Financing Water for Agriculture" as a follow-up to the regional consultation held in Hyderabad, India on the subject and co-sponsored by the Programme as reported in our past GRID issue; and participated in a sideline session on "Water Research Institute Directors" with 16 worldwide centers represented, where IPTRID was asked to provide its experience in dealing with a network of water centres of excellence. Finally, the Programme distributed a large number of its publications among the 11 000 registered forum participants.

After Mexico, IPTRID went to Syria to support an international symposium on "Modernization of Irrigation Systems: Constraints and Solutions" upon the request of the Government which seeks to modernize 1.2 million hectares of irrigated land. More than 250 participants attended the three-day event that produced concrete recommendations on how the country can move forward on this major undertaking.

Other Programme activities during the period included an e-mail conference on the "Extent of Salinization and Strategies for Salt-Affected Land, Prevention and Rehabilitation" put together by our Virtual Water Center Project, CISEAU. Initiation of activities in Ethiopia in support of a Strategy on Research and Development needs, the signing of an agreement with our partner ICID on dissemination and promotion of results under their Country Policy Support Project (CSPS), the planning and execution of specialized training for middle and high level water professionals in Jordan, Yemen and Syria as continuation of similar efforts done already in Egypt; and last but not least, the addition of a senior staff member to our Secretariat under a generous and additional secondment of the Government of France.

Carlos Garcés-Restrepo
IPTRID Programme Manager

Interview with Professor Louise O. Fresco

The Interview has now become a permanent feature of the GRID Magazine. In this issue we wanted to acknowledge the strong support that IPTRID has always received from Ms Louise O. Fresco, former Assistant Director General of the recently renewed Agriculture, Biosecurity, Nutrition and Consumer Protection Department of FAO. Ms Fresco has in the meantime returned to the Netherlands to take up the position of Professor at the University of Amsterdam. The interview below had been prepared prior to her departure and is being published given the importance of her views on the various issues covered. The IPTRID Secretariat, Consultative Group and Management Committee extend their best wishes to Ms Fresco.

FAO's Agriculture, Biosecurity, Nutrition and Consumer Protection Department has hosted the IPTRID Secretariat since 1998. In this interview, the Department's former Assistant Director-General, Louise O. Fresco, discusses new challenges facing agriculture, the role of water and irrigation, and the place of IPTRID in FAO's programme on water...

On FAO, agriculture and water

What do you see as the major challenges facing world agricultural development?

The first of the Millennium Development Goals is to halve by

2015 the proportion of the world's population that suffers from hunger and poverty. To achieve that objective, we need sustained investment in agriculture, both in rural areas – were the most of the hungry and poor still live – and increasingly in and around cities, to meet the needs of the urban poor. At the same time, we have a global population that's expanding at the rate of 70-75 million people a year, rapid economic growth in most developing regions, and increasing – but also more discerning – demand for food and non-food products. The question is how the Earth's land and water resources, and the environment in general, will sustain a projected increase in food production in developing countries of about 67 percent between 2000 and 2030. We will need to develop the best possible production systems, especially ones that make optimum use of water, minimize negative impacts on the environment and ensure the highest rate of productivity. Another, more recent challenge for agriculture is to respond to rapidly changing food preferences and increasingly demanding standards on food safety and quality. So, the agriculture sector as a whole must broaden its vision to encompass the entire food chain, from production to consumption.

What are the main concerns of FAO member countries regarding water for agriculture?

During the last FAO Conference, in November 2005, water management issues were examined by a Ministerial Round Table that focused on Africa, the Near East and the Small Islands Developing States [SIDS], regions where agricultural water control is considered critical. In Africa, there is great scope for improved water control, but unit costs are still high. In addition to increasing water productivity, key factors identified for progress were secure land tenure and encouraging private investments in irrigation. The Near East delegates stressed, above all, increased water use efficiency and productivity - since countries in the region rely increasingly on desalinated water or treated wastewater, the priorities there are development of tools for water quality management and options for using unconventional water sources. For the SIDS, there was consensus on the need for developing best practices in agricultural water use, empowering water users and promoting small-scale water storage. Typically, these small island states require investment in rehabilitation of on-farm and small scale irrigation schemes. Regarding other regions, there is need in Asia for modernization of large irrigation schemes and innovations in their operation and management, while a key issue in much of Latin America is the lack of access to land and water resources, which exacerbates economic and social inequities. Addressing such a broad range of issues requires not only technical interventions in water management and water control, but also economic, social, policy and institutional support. We need to tailor solutions to specific needs.

You led the FAO delegation to the Fourth World Water Forum in Mexico City in March. What was FAO's message to the Forum, particularly in regard to irrigation?

First, we recognized that agriculture is by far the main user of freshwater, and has the largest impact on the environment, particularly aquatic ecosystems. But we pointed out that in order to meet food production targets, increases in water withdrawals are inevitable. What agriculture must do is produce more food of better quality using less water per unit of output, which is why irrigation has a strategic role. A continuing rise in productivity should make it possible to keep the increase in freshwater usage for agriculture over the next 25 years to about 14 percent. Limiting the impacts on water resources and ecosystems will depend on our capacity to develop and apply technologies and practices that ensure sustainable increases in productivity. Modernization of irrigation, through technological upgrading and institutional reform, will be essential in ensuring those gains, and will require substantial new investments. We also emphasized the essential role of civil society in ensuring that decisions on water use reflect local knowledge and priorities. NGO and private sector participation are particularly important in water valuation, which requires stakeholder dialogue and participation in deciding on acceptable values of water for different users.

On FAO and IPTRID

What are the advantages for FAO in hosting and supporting programmes such as IPTRID?

Trust fund programmes like IPTRID help to leverage additional funding for agricultural development and give donors the flexibility to concentrate on their preferred area of assistance, as well as to target specific countries or areas. They also add technical expertise to the Department, enhance networking within and beyond FAO and create synergies on particular topics of mutual interest.

What type of interaction would you like to see between IPTRID and the Agriculture Department's Water Resources Development and Management Service [AGLW]?

Meeting the targets we discussed earlier requires cooperation among institutions dealing with irrigation and drainage, and among units within institutions. AGLW and IPTRID need to reinforce synergies and complementarities in their work on water resources development and management, and on the uptake of research results and exchange of technology in the I&D sector. The new database on Capacity Development for Water in Agriculture [www.fao.org/landandwater/cdwa/], which provides developing countries with up-to-date information and guidance on the topic, is a very positive example of what can be achieved jointly by the two units.

On IPTRID's mission and activities

One of the main recommendations of the Triennial External Evaluation to IPTRID was that the Programme set up an informal group of donors, make a greater effort to expand its number of donors and increase dramatically its communication with them. What role do you think FAO could play in this direction?

I think it's very positive that IPTRID is now planning its first meeting with donors to mobilize additional resources. Such meetings also provide an opportunity to keep donors abreast of progress being made in the Programme's work and to propose new activities. That is very pertinent at this time, when many institutions, including the World Bank, have expressed their intention to re-engage in water for agriculture. I would also encourage IPTRID to work more closely with the FAO decentralized offices, both at regional and country level, in stimulating contacts with local donors, as well as for gauging governments' priorities and the kind of support they require in the water sector.

IPTRID places irrigation and drainage issues at the top of its list of priorities because we see them as a crucial element in the fight for poverty alleviation in developing countries. What is your view?

FAO will maintain a strong focus on irrigated agriculture as part of its overall strategy to alleviate hunger and poverty. Food production in the immediate future will continue to rely in large part on improved irrigation and drainage practices. So, by keeping I&D at the top of its priorities and remaining a demand-driven programme, IPTRID reaffirms and supports FAO's mandate.

As our flagship publication, GRID is intended to give IPTRID more visibility. Do you have any suggestions

[continue from page 5]

to enhance interest in GRID and attract a wider readership?

It's good to see that GRID is being published regularly in three languages and I'd hope to see it continue to be published also in Arabic and Chinese [see GRID 23] – it is very important for people in water-scarce countries of the Near East, for example, to keep abreast of knowledge and experience in irrigation and drainage. It's also a great pleasure to contribute to this new "interview" section, which is an excellent medium for providing your readers with information and viewpoints from the range of IPTRID partner institutions. ■

RECENT IPTRID PUBLICATIONS

Programme Reporting

- IPTRID Publications 1997-2006. 2006. CD-ROM. FAO/IPTRID
- IPTRID. 2006. Exchanging technology, up-taking research and management innovations in irrigation and drainage to serve the vulnerable farmers of developing countries. FAO/IPTRID [Leaflet]
- IPTRID 2006. Capacity development for water in agriculture, CapDevWater. FAO/IPTRID. [Leaflet]

Project reports

- IWMI. 2006. Manual on participatory rapid diagnosis and action planning for irrigated agricultural systems (PRDA). FAO/IPTRID

Many IPTRID publications are available as electronic versions at the IPTRID Web site: http://www.iptrid.org/landandwater/iptrid/index_en.html.

To request hard copies of these publications, contact: iptrid@fao.org

Irrigation produces rain

Large scale irrigated plantations in semi-arid environments may induce additional rainfall under particular conditions. This phenomenon has been observed and studied in a number of areas around the world. Capturing the rainfall 'surplus' in principle could reduce the need for external irrigation sources and eventually lead to self sustained water cycling.

The fact that land use and land cover change may affect weather and climate has been widely documented over the past 10-15 years, on both global, continental and regional scales. Many studies focus on land use – climate interactions in semi-arid regions. One of the more intensely studied systems is that of western Africa, where a large number of (modelling) studies revealed linkages between (human induced) vegetation degradation and the repeated droughts between 1970-2000 in the Sahel. However, not all parts of the globe show equal sensitivity to land cover-climate interactions

On these large scales the basic, simplified mechanism is that a significant increase of vegetation causes a larger fraction of solar energy to be absorbed at the surface (the so-called albedo decreases). At the same time, under well watered conditions vegetation transpires more water into the atmosphere (the Bowen ratio decreases). The resulting change in heat and moisture content of the atmosphere may –through a number of complex, interlinked processes – produce more rainfall, which in turn increases soil moisture reserves and further stimulates vegetation growth. Thus a positive feedback loop exists that also may work in the opposite direction (less vegetation less evapotranspiration less clouds less rain less vegetation).

Similar effects have been reported on smaller, regional scales as a consequence of irrigated agriculture. For a long time now the notion is prevalent that large scale irrigation may affect rainfall above or downwind of the irrigated area. Cases studied so far include the Texas High Plains in the USA, Southwest Israel and Northern India. In broad lines the relationships between weather or climate and irrigation are similar to those outlined above but the generally smaller spatial scales bring different mechanisms into play that critically depend on the size of the irrigated area.

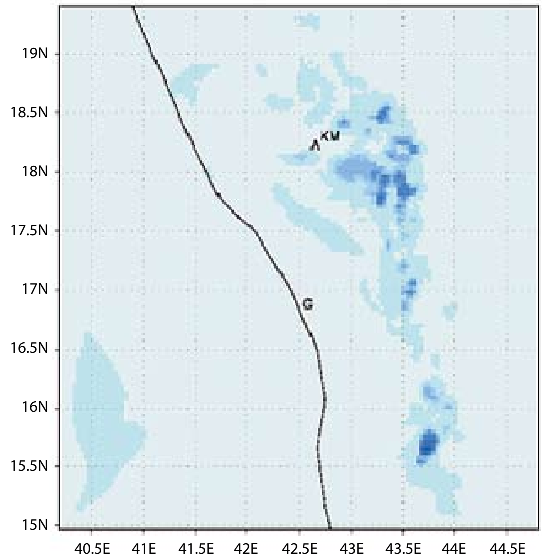
The extent to which irrigation produces additional rainfall differs case by case. In the context of irrigation induced precipitation enhancement is useful to introduce the concept of a recycling ratio: the fraction of evaporated water that is converted into precipitation. If this extra rainfall could be made to use, it may reduce the need for irrigation water from other less sustainable sources like deep wells or de-salinization plants. So far however, reported recycling ratios have not exceeded 25 - 50 percent, and in semi-arid areas are more likely to be from a few, maybe not more than 10 percent.

The mechanisms and issues discussed above can be illustrated with the help of a case study the authors made for Southwest Saudi Arabia where plans are in the exploratory stage of development to construct large-scale irrigation works in the coastal plains, based on freshwater produced from sea water through sustainable de-salinization techniques using solar or biomass energy. These narrow plains (100 km) are confined between the Red Sea in the west providing a lot of moisture laden winds, and the high Asir mountain range (3 000 m max altitude) to the east which forces the air to rise to levels where clouds and rain may form. Therefore, the area has the highest rainfall in the whole of Saudi Arabia, up to 250 mm annually. Some rainfed agriculture is practised in the mountains, while there is some groundwater irrigated agriculture in the coastal plains.

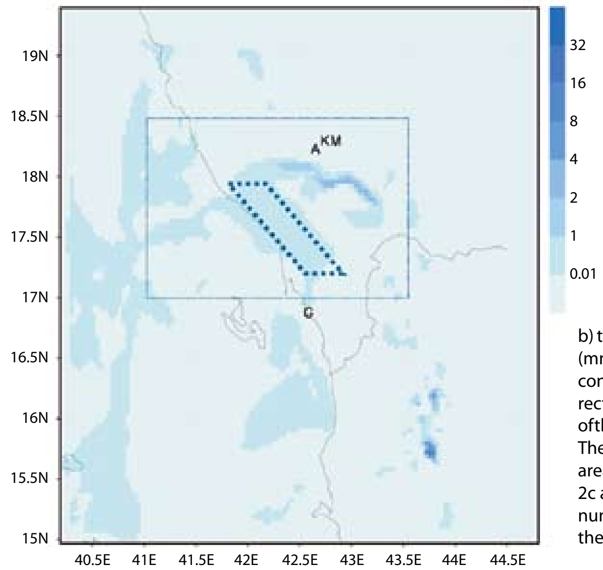
A numerical weather prediction model coupled to a detailed soil and vegetation model has been used to simulate the meteorology in the area. First a control run was made with current vegetation distribution in the area in order to validate the model. Then a hypothetical large irrigated agricultural area (~320 000 ha) was introduced to study its effects. In the model vegetation replaced bare soil and an irrigation application of 10 mm a day was given. Validation of the model results has been done against observations from a few meteorological stations in the area, as well as against rainfall data from the TRMM satellite. These validation results justify confidence about the simulated effects of irrigation.

Obviously the evaporation over the irrigated plantation is much higher (~5 mm/day) than over the bare soil (<0.5 mm/day). As a result air temperature dropped by ~3°C and humidity increased by 10-15 percent. Since the irrigated plantation in that area decreases the thermal contrast between land and sea, the sea breeze weakens both in magnitude and directional change.

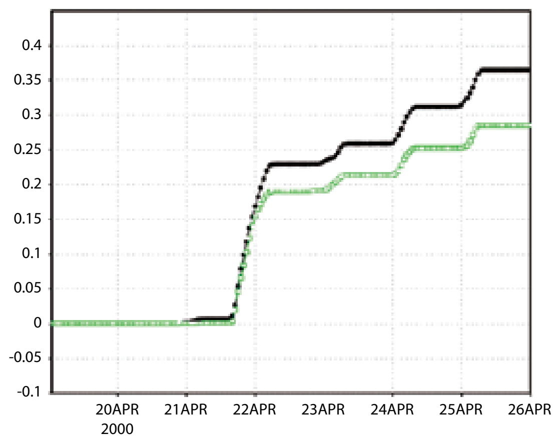
The figures present an analysis of the impact of the vegetation and soil moisture change on precipitation for one particular week in April. For this particular week precipitation was well simulated: observed Khamis (KM in



a) total rainfall (mm) for control run;



b) total rainfall *difference* (mm) for 'irrigation' vs control runs. The skewed rectangle depicts the area of the irrigated plantation. The square outlines the area for which the Figure 2c applies and for which numbers are given in the text;



c) areal average rain (mm) for control (black filled circles) and irrigation (green open circles) runs.

Case study of 1 week simulation for 19-26 April 2002.

the figure) rainfall in this week was 31.7 mm and for Gizan (G) 0 mm. The figure shows that the irrigated plantation increases precipitation on the windward side of first mountain ridges. As the time series in the inset shows, total rainfall increased by 34 percent. It also shows that most rainfall occurs at night. Detailed analyses using animation of the time series showed that the following process is responsible. During the daytime a significant 'blob' of wet air develops over the irrigated plantation. With the onset of the sea breeze this starts being transported by the wind in an easterly direction, uphill to the Asir Mountain range where, in the early evening, fog starts to develop. Later at night, light rains develop which stop as soon as the sun rises. The same mechanism occurs in the simulation with no irrigated area, with moist air from the Red Sea being blown by the sea breeze onto the mountains. Apparently, the extra moisture in the 'blob' originating from the plantation leads to the extra rain.

Conclusions

For the last week of April the total prescribed irrigation application in that period was 193 x 10^6 m^3. This led to an increase of evapotranspiration of 115 x 10^6 m^3. The extra atmospheric moisture resulting from this increased rainfall by 2.3 x 10^6 m^3. This occurred downwind but still on the same side of the water divide in the mountains, theoretically allowing capture of this rain and feeding it back to the irrigated area. Two conclusions can be drawn from these numbers. The first is that irrigation of 10 mm per day is too much. Potentially transpiring vegetation in our simulation uses about 5-6 mm per day. Secondly, recycling of this water is limited to just 2 percent. On one hand this additional rain is too limited and too dispersed to re-capture and return to the irrigated area by itself. On the other hand it falls in an area where rainfed agriculture occurs. There, though small in absolute numbers but big in relative numbers (~30 percent), the extra rain may increase crop productivity or reduce the risk of crop failures and thus be important to local agriculture.

To strengthen such conclusions better statistics on more rainfall events (patterns?) are needed. We therefore are currently extending our simulations to cover at least a full year and have plans to repeat these also for different regions around the world. ■

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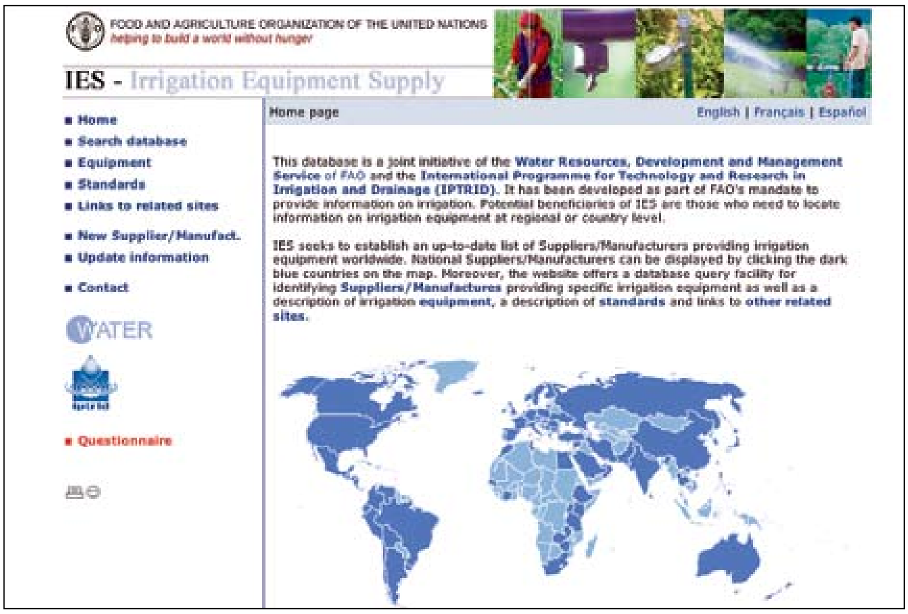


Visit the
Irrigation Equipment Supply Database web site at:

www.fao.org/landandwater/ies/

Advantages and limits in rainwater harvesting adoption in sub-humid regions: the case of Italy

Rainwater Harvesting (RWH) includes a wide range of solutions for precipitation water conveyance and storage, traditionally adopted in drought-prone areas of Africa, Middle East and Asia. In agriculture, the wise use of collected water contributes to reduce the effects of rainfall fluctuations on crop production, improve farmers' financial conditions, increase food security and allow crop diversification. Notwithstanding RWH implies investment and maintenance costs, catchments can be financially suitable in subsistence agriculture, where most of the labour is available within the family.

Annual rainfall of 700-800 mm is commonly considered as the upper limit for the convenient introduction of RWH. However, experiences demonstrate that runoff storage can be advantageously adopted even in sub-humid regions. Under high-productive agriculture, irrigation is among the major inputs, and therefore RWH can be a financially profitable integration or alternative to over-exploited water resources.

Specific problems can arise from RWH adoption in sub-humid regions of developed countries: the high-technological context and the positive financial conditions do not necessarily guarantee efficient water use and long-term sustainability of the system.

Case-study

A 35 hectare drip-irrigated orchard in Italy is herein analysed as an example. In the 1980s a private reservoir of 40 000 m^3 capacity collecting runoff from a 55 hectare surface was built on the farm, since no groundwater or surface resources were available. After 25 years, the farmer judges RWH a reliable technique in the specific environment: an average annual precipitation of 760 mm allows the reservoir to fill up before the beginning of the irrigation season (June to August), even in relatively dry years. Moreover, RWH is perceived as a low-cost technique as limited annual expenditures are required to supplement initial investments.

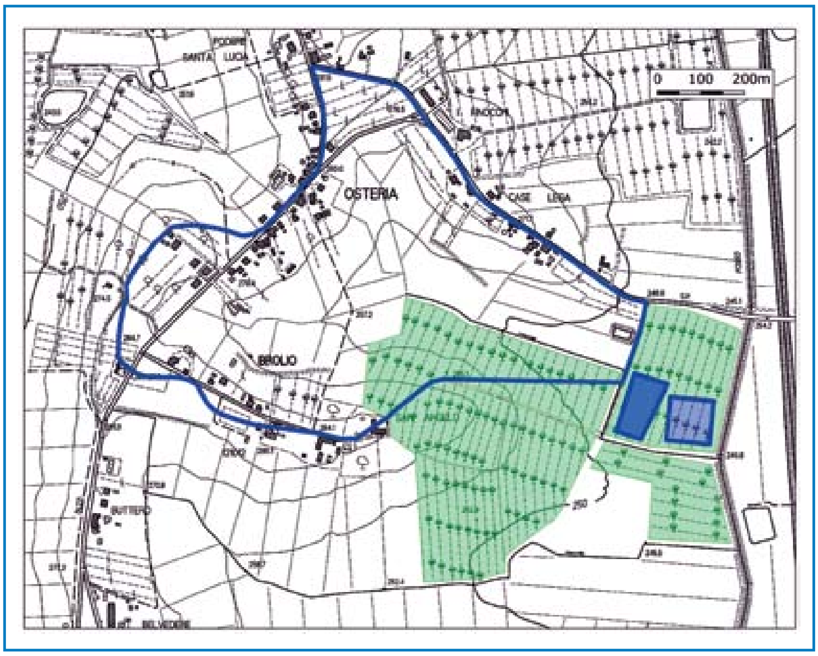
Some water-related problems need to be faced in the near future. According to the farmer, the water currently available is not sufficient if compared to overall needs, the average seasonal irrigation volume (42 000 m^3) exceeds the current storage capacity. Moreover, the foreseen introduction of sprinkler systems for frost protection will increase water needs. The solution to this problem was found in the realization of a second reservoir of 40 000 m^3, collecting water from the same runoff area. The basin, currently under construction, requests an investment of about USD100 000 totally covered by the farm.

System evaluation

The pros and cons of RWH are assessed under the actual conditions, collecting information on downstream water use.

Contrary to the expected high technological level, irrigation is carried out on a "feeling" approach, without any type of internal or external support. This attitude, unfortunately widespread even in the developed world, usually leads to over-watering.

Plot-scale trials carried out between 2002 to 2005 demonstrated that a tensiometry-based irrigation management can effectively reduce water consumption, with minimal changes in farmers' ordinary attitude. The improved scheduling based on tension readings delayed the beginning of the irrigation season, taking full advantage of the water stored in the soil. Together with shorter applications throughout the season, it



resulted in water savings ranging from 42 to 65 percent. No stress occurred and comparable productions were recorded.

Notwithstanding the great interest showed by the farmers, the improved scheduling strategy was not implemented at the farm level, despite the fact that its adoption would result in reducing seasonal irrigation volumes between 15 000– 25 000 m^3, meeting overall requirements through the existing reservoir.

Farmers' choices

Farmers' preference to increase water availability through a consistent investment in RWH, rather than reduce water losses thanks to a more precise scheduling, can be explained considering the common tendency towards the minimum risk.

RWH is a technique experienced by the farmer, reliable in the actual context and easily self-managed. Financial resources are available for the construction of the new basin and no loans are necessary.

On the contrary, more efficient irrigation applications are felt as time and resources consuming. The improved scheduling is "risky": mistakes in water availability assessment can induce water stress and affect production. Moreover, over-watering can compensate for the negative effects of disuniformities, occurring in the actual farm context due to obsolete drip lines with emission uniformity close to 50 percent. Improving irrigation scheduling without upgrading the system would induce stress in those parts of the field receiving less water.

According to the farmer, it is preferable to face RWH costs than the uncertainty of investing time (precise scheduling assessment) and money (changing of drip lines, installation of tensiometers) for water saving.

Conclusions

RWH can be profitably adopted in both arid and semi-arid regions and in sub-humid ones, where rising competition among sectors for limited water resources enhances the use of alternative techniques. In high-farming of sub-humid regions, reservoir construction can guarantee a reliable and affordable water resource.

However, RWH cannot secure the long-lasting system sustainability, which can be achieved only through a wise water use. Low-cost water availability through RWH can reduce farmers' attitude to water saving. In the case study, the increase up to 3 times of the water use efficiency through the tensiometry-based scheduling was not felt as an advantage justifying the requested efforts, the construction of a second reservoir being preferred. However, water losses can induce well-known problems of pollution; energy used for pumping additional water leads to unjustified costs, which will rise in the coming future due to worldwide energy constraints; and the water wasted is subtracted from alternative uses.

The adoption of techniques such as RWH should be enhanced among farmers in sub-humid regions, together with suitable management techniques at field level. The farmer should be made acquainted with the whole technology package, from water collection to distribution, offering support to identify bottlenecks limiting wise water use. Improvements can be achieved only enhancing farmers' sensibility towards the water resource, so that decisions would not be taken only on a cost/benefit basis. ■

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A new method for cultivating rice with high potential for water saving

Introduction

Rice is one of the most important summer crops in the Egyptian agricultural system. It is a main staple food for the majority of the population and has become a cash crop. Farmers are therefore very interested in cultivating rice. All the rice cultivated in Egypt is lowland rice. For this reason, despite the free cropping pattern policy which has been adopted in the 1980s, rice remains an exception such that the areas entitled to cultivate rice are defined by the Ministry of Water Resources and Irrigation (MWRI) and amount to about 460 000 hectares per year.

Nonetheless, the areas cultivated with rice in Egypt have been increasing steadily in violation of the above mentioned policy. About 50 percent of the increase in the total rice area has been witnessed between the late 1980s and 2004. This augments the pressure on the limited water resources in the country and sometimes causes irrigation water shortages during the peak summer seasons.

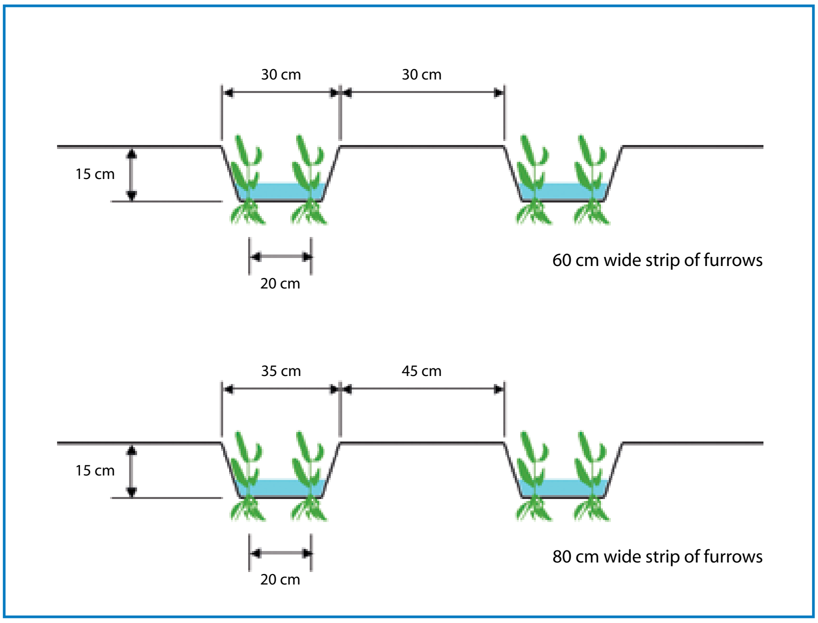


Diagram of strips of furrows.

New rice varieties and irrigation methods

The research on rice-related subjects receives special attention from most of the concerned research organizations in Egypt. These research activities can be classified into two main categories: 1) derivation of new rice varieties with better characteristics; and 2) changing rice irrigation method and scheduling to increase the water use efficiency.

The most important improvement in the new varieties is the shortening of their growing period from 150 days to about 110–120 days, which results in reduction in seasonal water requirements. The yield has also increased from an average of slightly less than 6 to 9.9 tonnes/ha.

Research has been conducted to improve the irrigation method and scheduling of rice. Many experiments were carried out to test the impact of changing the depth of applied irrigation water between 0.05, 0.07 and 0.1 metres. The results of those experiments showed that the change of irrigation method and scheduling has negative impacts on the yield; hence it is difficult to convince the farmers to adopt such changes.

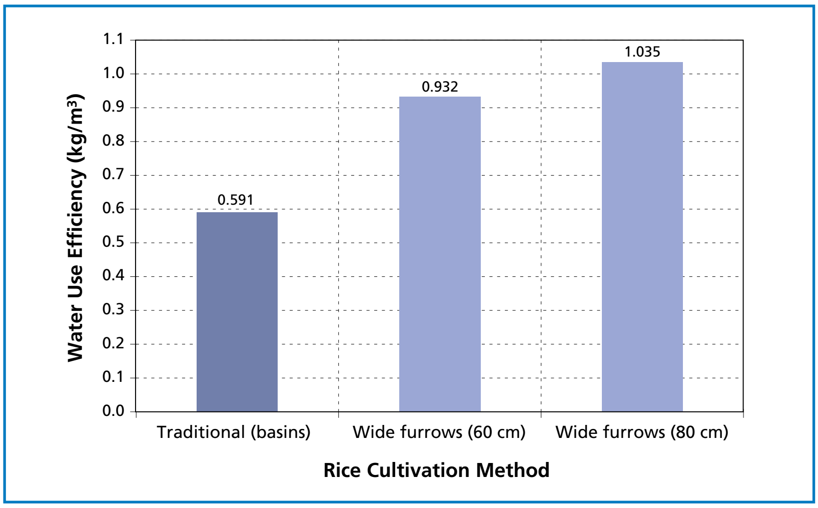
The Water Management Research Institute (WMRI) of the National Water Research Center (NWRC) in Egypt has been conducting research on improving rice water use efficiency without causing negative impacts on the yield, for two consecutive summer seasons. This method consists cultivating rice in wide furrows instead of cultivating it in basins as is traditionally practised.

Rice cultivation in wide furrows

The traditional method for rice cultivation requires that rice seeds be first soaked in sufficient water for 24 hours and then incubated for 48 hours in order to enhance germination. The seeds are then manually broadcasted in the nursery. After thirty days, the seedlings are transferred from the nursery and transplanted in the permanent field after puddling. The field is usually divided into basins. To irrigate the rice in the field, farmers usually apply water to maintain a pond of about 0.07 metre above the soil surface.

In the new method seeds are prepared and planted in the nursery following the same procedure of the traditional method. Field preparation is different in the new method where 0.8 metre wide furrows are constructed as illustrated in Figure 1. Rice seedlings are transplanted in the bottom of wide furrows 0.2 metre apart. Irrigation water is applied in the furrows to maintain a depth of 0.07 metre of water. Because irrigation water is applied to the furrows only, namely to a smaller area of the field compared to the basins, a significant saving in the seasonal water requirements for rice is achieved. On the other hand, because the recommended density of rice plants per unit of land is maintained and the crop is adequately irrigated, the yield is not affected.

This new method for rice cultivation has been tested in four research stations



Water use efficiency of the different rice cultivation methods.

located in the lower Nile Delta in order to assess its performance under the different soil and environmental conditions in those areas. The same rice variety was cultivated using the traditional and the new method in two adjacent fields in each research station to compare the results. Different furrow widths have been tested to select the optimum one. All inputs, except water, and agricultural practices were the same in the two methods. Irrigation water applied to each plot was measured using calibrated water meters. The whole experiment was repeated in two consecutive summer seasons in order to verify the results. The data was statistically analyzed to test the significance of the results.

The general conclusion from the experiments is that the new method for rice cultivation in wide furrows is superior to the traditional method. The optimum width for the wide furrows is 0.8 metre as it achieves the highest water use efficiency (see previous graph). The most significant advantage of the new method is its high potential of saving between 30 to 40 percent of the water used by the traditional method, with no decline in rice yield. Other advantages of the new method are the reduction of irrigation time and labour, higher efficiency of fertilizer application in the wide furrows and easiness of weed control. The new method does not require puddling the field during land preparation; however, it requires more labour for land preparation in constructing the furrows. Research is still going on in order to further improve this new method with emphasis on how to make it attractive to the farmers. ■

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Micro-agricultural water management technologies: pathway to improve food security in Southern Africa

Introduction

The Comprehensive Africa Agricultural Development Programme (CAADP) advocates spending 68 billion dollars by 2015 to expand, operate and maintain the area under sustainable land management and reliable water control systems. Most of these funds would go to expanding formal irrigation. While irrigation is an important investment for long term development, are there more cost-effective investments that could make a significant and faster contribution to reducing poverty and improving food security?

IWMI has just completed a study in nine Southern African countries that concludes there is reasonable though not conclusive evidence that there are indeed such investments –"micro-agricultural water management" (micro-AWM) technologies and practices. Specifically, the study found that treadle pumps, as well as low-cost drip irrigation kits, clay pot irrigation, conservation farming practices that integrate nutrient and water management, and a variety of in-situ and ex-situ water harvesting and storage technologies have a significant potential for enabling poor farmers to improve household food security and incomes, and therefore reverse the vicious cycle of declining intake of calories and worsening nutritional and health status in rural Southern Africa.

The study was commissioned by the Investment Centre of the Food and Agriculture Organization of the United Nations (FAO), and the Southern Africa Regional Office of the Office of Foreign Disaster Assistance, United States Agency for International Development (USAID). FAO is assisting the African Development Bank and the Southern Africa Development Community (SADC) to design a regional investment and capacity building project, while USAID wishes to improve the effectiveness of its current programmes implemented through NGOs.

The methodology involved several activities: IWMI designed the terms of reference and inventory format for obtaining country-level data through partners in Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Tanzania, Zambia and Zimbabwe. The partners interviewed key informants, reviewed local literature, and drew on their own experiences. IWMI also commissioned an in-depth impact assessment of treadle pumps in Malawi (see box), and a global literature review through the internet.

Treadle pump models (from left) - Balaji metal treadles/pulley; MG Industries/pulley; Advaith, wooden treadles; Zim metal treadles/pulley; MG Industries/bicycle cog & chain; Pipeco, Mw wooden treadles/ rubber pulley; Balaji metal treadles/pivot (Photo: Z.Jere, Total Landcare Malawi & H.Phombeya, Land Resource Centre Malawi)

Experiences with micro-AWM

The major impediment to raising food production in Southern Africa is the low average rainfall that is seasonal, highly variable and unreliable. This is compounded by other problems, both natural (e.g. poor soil fertility) and human-created (e.g. lack of support services and infrastructure). Improving the reliability of water supply for agriculture is therefore a necessary though not sufficient condition for reducing poverty and malnutrition and generating faster agricultural growth. However, the tremendous diversity of conditions in the region means there is no single cook book approach or sure-fire universal panacea that will work everywhere.

Given this diversity, it is no surprise that there are no cases of successful massive scaling up and out of specific micro-AWM technologies and practices. Adoption, adaptation or rejection decisions are a function of many factors including lack of information or access, lack of fit between the technologies on offer and the capacities and needs of households, inefficient promotion strategies, flawed assumptions about households' needs and capacities and the real costs and benefits from their perspectives (for example, the assumption of surplus labour availability), ineffective targeting and lack of credit. There are also many organizations promoting different technologies, but no mechanism for sharing lessons and assessing outcomes and impacts. All these problems are compounded by unfavourable and inconsistent government policies which discourage innovation and scaling out.

Unfortunately, there are too many cases where inappropriate micro-AWM technologies are promoted (and rejected). To overcome this, a participatory approach is needed in

The 'brim' around the raised bed prevents water flowing in the footpaths during a rainstorm from overtopping the sides and thus damaging the bed or plants. The soil in the footpaths is undisturbed and thus very hard, while the brims and soil inside the bed is very soft, because it is very high in organic matter. The beds are made narrow enough to avoid having to step into them, which would cause soil compaction. (Photo: Marna de Langa)

which people are offered a 'menu' of potential technologies and supported to combine and adapt what is appropriate. Further, there has been a failure to take an integrated approach, in several senses: households have a multiplicity of household water needs; there are potential synergies from integrating micro-AWM technologies, for example combining treadle pumps, efficient application technologies and soil conservation practices; and implementation strategies that integrate attention to support services (inputs), production processes and outcomes in terms of both household food security and nutrition and access to markets.

Recommendations

The study makes 13 recommendations; only a few can be highlighted here. A basic premise is that it is poor people themselves, not governments and donors, who will achieve (or not) the Millennium Development Goals. Therefore, we strongly recommend supporting people's creativity. This requires participatory approaches, offering choices and menus that can be adapted and combined as needed, empowering users to make their own decisions, and providing support services that reduce risk and make available resources that are not otherwise at hand.

Effective targeting of the poorest and most food-insecure is a huge challenge. It is critical to focus on supporting those who are most hungry and risk-averse; living with HIV/AIDS; relying on rainfed agriculture with little prospect of getting access to irrigation plots in the near future; and need access to sufficient staple foods and sources of nutrition especially for young children and pregnant women. In many cases this will be households headed by women or in which women play the critical role in producing and providing food.

However, such targeting creates a dilemma: there is currently much emphasis on improving access to markets and production for markets to generate profits and promote agricultural growth. This is indeed important, but in the short to medium term does little to help the poorest and hungriest people. We therefore recommend that far more resources be allocated to targeting and assisting the very poor. Helping them achieve basic food sufficiency will make it possible for many to take the next steps into market-oriented commercial production; others will be able to use income from off-farm employment for other essential needs like school expenses. Most people will be able to improve their health and labour productivity, enabling them to participate more effectively in productive and educational pursuits and lead better lives.

We support investing in infrastructure for water and other needs. However, micro-AWM technologies and practices offer a relatively faster and more cost-effective way to achieve the MDGs than, for example, major irrigation investments. Many micro-AWM technologies are far less expensive per household than formal irrigation, their benefits begin immediately upon acquisition, and they are not plagued by all the management problems, transaction costs and negative externalities often characterizing formal irrigation. Of course, for poor people living in areas where there is no adequate source of water, infrastructural development is necessary to bring water close to the people in need.

Micro-AWM technologies are "divisible"; namely they can be used by individuals or small groups directly. They also lend themselves to provision by the private sector. However, local markets in most SADC countries are too small for a competitive micro-AWM industry to develop. Therefore, while recommending that governments encourage private sector firms, we recommend that at the SADC level, a regional market be created to capture economies of scale. India provides a model in this regard – there is a healthy competitive and profitable industry catering to a large and diverse market, providing low-cost micro-AWM technologies, and innovating to improve quality and lower costs. This industry contributes to improving the productivity and profitability of agriculture and itself creates jobs and contributes to overall economic growth. Governments can also consider "kickstarting" the micro-AWM industry by a limited-term consistent policy of providing large numbers of subsidized units to create a market for support services including repair, spare parts and future replacement.

We recommend that NGOs and governments currently promoting micro-AWM technologies as part of their relief efforts move away from short-term relief to long-term development. We have found cases where well-meaning provision of technologies like drip irrigation kits has had no impact, because of the lack of longer term service provision and training. This is not a good use of scarce resources.

Finally, we strongly recommend more investment in monitoring, assessing impacts and cost-effectiveness, pilot testing innovations and sharing the lessons learned more widely. Creating "learning alliances" among interested partners is one effective way to achieve this. We see great potential from sharing experiences between Asia (especially India) and SSA. ■

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The final report, Malawi case study and country reports are available from IWMI's Southern Africa Office on a CD-ROM (iwmi-africa@cgiar.org)

Impact of Treadle Pumps in Malawi

Professor Julius Mangisoni compared 50 treadle pump adopters to 50 non-adopters in two districts of Malawi. Adopters had significantly higher incomes, better food security and were creating employment. Non-adopters (using watering cans) were significantly poorer and had a far higher risk of falling into poverty than adopters. These results are consistent with less rigorous results from Kenya, Tanzania and West African countries and strongly support the recommendation to increase support for treadle pump provision in Africa.

Irrigation investment in the "Commission for Africa Report" – A framework for intervention

The Commission for Africa was launched by Tony Blair in order to give recommendations for G8 and EU under UK presidency in 2005. Dr Bruce Lankford was asked to produce an analysis of irrigation investment for the Commission.

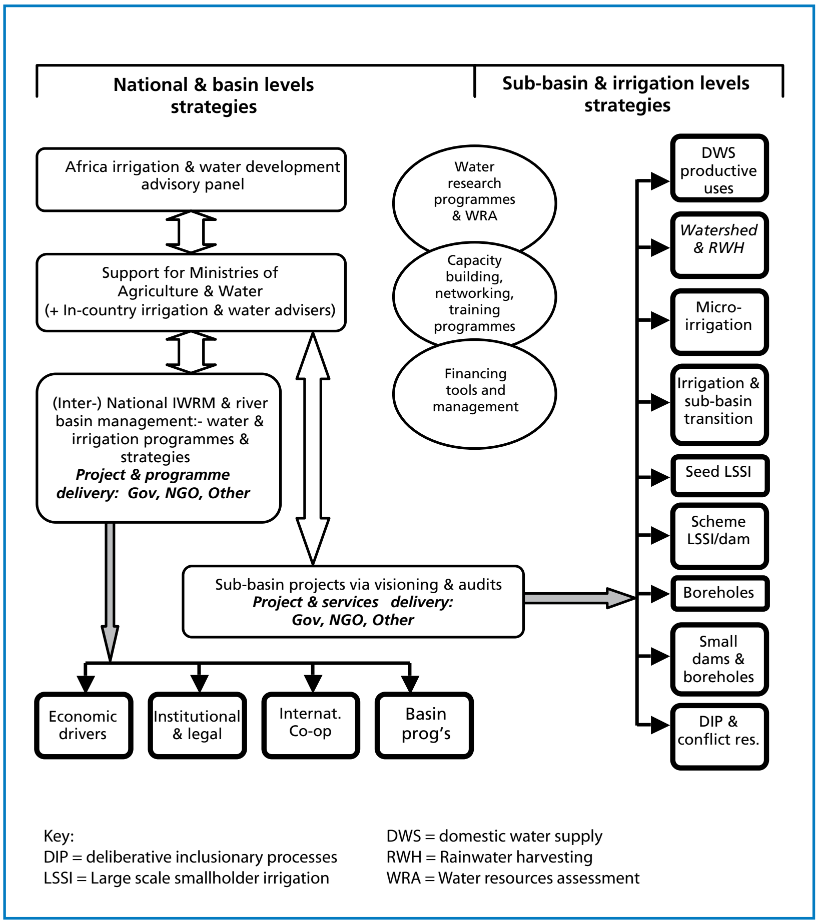
Recommendations of the Commission for Africa's report (Chapter 7 - Going for Growth and Poverty Reduction) "As part of a wider set of measures to promote agricultural development, Africa must double the area of arable land under irrigation by 2015. Donors should support this, initially focusing on funding a 50 percent increase by 2010, with an emphasis on small-scale irrigation. This should bring an additional 5 to 7 million hectares of arable land under irrigation by 2010, and would cost in the region of US$2 billion per year. Appropriate micro-irrigation systems and technologies are already in use in East and Southern Africa, and extending them to a wider area and network of producers should not be unmanageable in this time frame.".

Lankford explains here the main points he defended against the commissioners' views:

Stay reasonable on the programme ambition: a target of the expansion of 5 million hectares should be seen as an optimistic upper limit since this represents a considerable increase from the present rate expansion of one percent per year to the proposed 3.8 percent per year envisaged for the next 10 years.

Do not charge the farmers too much: Pursuing a total or partial cost recovery of such a large programme is problematic, except for some technologies, e.g. treadle pumps, which can be sold to farmers. Policy makers may have to recover costs via cross subsidization from wealthier water users and from a general growth in economic activity and taxation rather than by directly burdening poor rural populations for water and infrastructure that generates further administrative costs. Enhancing ownership and responsibility for projects at the user level will also assist in the long-term sustainability and benefits of this programme.

Defend the case for irrigation investment and recognise that many opportunities for improving irrigation in Africa exist, however keep in mind that irrigation in Africa is complex and manifold. Irrigation expansion can bring conflicts during the dry season even where the full utilization of water in the wet season has not occurred. Variation between dry years and wet years also suggests that irrigation interventions might have to first examine improved management, equity and access rather than seek further expansion. Thus, although benefits will come from a new enlarged programme of irrigation support, there are four main risks: poorly targeted projects, including capture by elites; high costs; low project sustainability; and depletion of water for other sectors, particularly the environment. It is these problematic dimensions of irrigation that need managing within a comprehensive governance framework of water and irrigation, rather than recommend an approach which emphasizes one particular technology.



Comprehensive Framework of Irrigation and Water Development for Africa.

Such a framework should:

1) Combine different strategies related to scalar and organizational levels. The programmes should identify projects at the national, basin, sub-basin or irrigation system levels.
2) Tackle broad strategies as well as selective interventions that in turn are appropriately identified by conducting detailed multi-disciplinary audits of individual sub-basins and irrigation systems. Targeting is important because a successful technology in one locality may not translate well to others. The emphasis is on a mixture of approaches designed to solve identified problems with productivity, expansion and access rather than to utilize an 'irrigation improvement' methodology based on 'normative' irrigation engineering.
3) Be based on participation of all stakeholders. In order to focus on environmental and institutional sustainability and on economic and agricultural productivity indicators – human resources will equal land and water resources in this regard. ■

A full PDF of the irrigation analysis can be downloaded from http://www.commissionforafrica.org/english/report/background/westby_et_al_background.pdf

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Transforming irrigation concepts in Asia through Capacity Building: FAO's experience

FAO's regional irrigation modernization training programme in Asia

Irrigated agriculture is the basis for the livelihood of rural populations and national food security in most developing countries in Asia. Agricultural water management is thus an indispensable aspect of rural planning and development. Asian large surface irrigation systems, which serve most farmers, suffer however from a legacy of poor design, degraded infrastructure, poor management and stagnation in the face of rapid transformations of agriculture and pressure on their water supply. Irrigation planners and managers face the considerable challenge of transforming and managing these systems economically for good performance and adequate service to farmers.

FAO has been calling for re-training of engineers and managers in irrigation agencies, consulting firms and Irrigation Service Providers in Asia, to disseminate knowledge on ways and means to meet this challenge. This emphasis on capacity building arose from: (i)_ the mitigated success of previous modernization efforts due in part to the lack of knowledge of proper options; (ii) the disappointing performance of irrigation management transfer and participatory irrigation management, partly attributed to the failure of these reforms to improve service to farmers, and lack of attention to operation and design of irrigation systems; and (iii) the need for better tools for appraisal of initial conditions and performance of the systems.

The FAO Regional Office for Asia and the Pacific has developed over recent years a Regional Training Programme on Irrigation Modernization. This programme aims at disseminating modern concepts of service-oriented management of irrigation systems in member countries with a view to promoting the adoption of effective irrigation modernization strategies in support of agricultural modernization, improvement of water productivity and integrated water resources management. FAO has developed training materials and detailed curricula, a specific tool for the appraisal of irrigation systems for benchmarking (the Rapid Appraisal Procedure – RAP) and the development of appropriate modernization plans for irrigation systems, and a web site for dissemination of information and experience (www.watercontrol.org). The first training workshop under the programme was organized in Thailand in 2000 and, since that time, Vietnam, the Philippines, Nepal, Thailand, Indonesia, Malaysia, Turkmenistan, Pakistan and India have benefited from support of the Regional Training Programme to organize national training workshops on irrigation modernization and benchmarking. More than 500 engineers and managers have now been trained with support from the Programme, which is being expanded to the People's Republic of China in 2006, and tools, concepts and training curricula have been adopted in a number of agencies.

The irrigation systems appraised during the training workshops

All irrigation systems appraised on the occasion of the regional training programme were large-scale rice-based systems. They were typically designed for supplementary irrigation of rice during the rainy season (with the exception of Turkmenistan, which is under an arid desert climate). They are public managed in a supply-driven mode. General management policies are typical of public institutions in the region, with few effective systems for rewarding or sanctioning performance. Design standards and operation have not changed in many countries for 20-30 years. Field-level operators are often very poorly paid and it is difficult for management and engineers to control how they actually operate the structures, which often differs form official rules and policies. How structures are actually managed is often directly responsible for instability of the system. Water user associations have been created in a number of countries but they do not play a meaningful role in the management of the systems. Water level control in the canals is poor and a main factor in very low quality of service delivery to water user associations and farmers. Participatory design procedures are being introduced, but they frequently focus on details of layout of the canal networks or positions of the offtakes, rather than on more important issues of service and performance objectives and design criteria.

A general assessment of the appraised systems is that the level of chaos (difference between stated policies and actual policies) and of anarchy (subversion of policies) varies but is generally high, particularly at lower levels of management. Recent investments following established or official standards or investment strategies have poor results in terms of performance, control and service and are actually typically not focused on farmers and managers' concerns. Lack of discipline and managerial and institutional issues do contribute greatly to this situation, but many of the problems can be traced to:

- Problems in initial design
- Exporting of design concepts outside of their area of validity
- Difficulty to control and operate the systems
- Layouts with confused hierarchies
- Serious flaws in operation strategies
- Inconsistencies between operating rules at various levels
- Inconsistencies between operating rules and farmers' requirements
- Changes in farmers' requirements not reflected by changes in system policies
- Poor quality of water delivery service to farms
- Lack of flexibility at all levels

The challenge

The challenge is to transform these systems into demand-driven responsive systems, improve their financial, environmental, technical and service performance to significantly increase control, reliability, equity and flexibility to allow them to adapt to changing or more variable water allocations, enable farmers to boost agricultural and water productivity, be more responsive to market opportunities, and adopt new and diversified water management practices on their farms. System-level objectives need to be determined on a case-by-case basis based on both water balances and basin-level considerations within the context of agriculture-related service objectives. While generally present system service achievements are over-estimated by management, system efficiencies are usually under-estimated, both by managers and by agency-level planners.

Water management response options need to explicitly address scale issues (farm, irrigation system and basin level institutions, law, policy and supporting infrastructure). A system's approach is essential to determine water balance related objectives and water management strategies to achieve them. These strategies and changes should aim at improving water control, equity, reliability and flexibility of service to give farmers water management and crop choices. Improvement strategies should be supported by strategic planning and management approaches with a service orientation.

Modernization proposals for the irrigation systems that were appraised, prior to the training workshops, usually failed to establish a linkage between system-level objectives and proposals and stated objectives for the introduction of improved or innovative irrigation technologies at farm level, or between new performance objectives and proposed reform of the management and institutional setup. At the institutional level, the challenge is to develop new frameworks that can manage the complexity of the hydrological cycle, the multiple roles of irrigation systems and deliver irrigation and drainage service to farmers in a responsive, accountable and efficient manner. Financing all this would require considerable investments while rice prices are expected to remain low in the medium term and present financing arrangements do not cover operation and maintenance costs, let alone investments in upgrading of management capacity and infrastructure. It is imperative that increased attention be paid to the quality and type of investment.

Conclusion

The challenges faced by irrigation planners, managers and farmers of Asia are numerous and complex. Uncertainties abound but the uncertainty itself is a positive piece of information for planners and managers to consider in the decisions they have to take today to face the challenges of tomorrow. Irrigation systems and their management have to evolve towards flexibility to adapt on a continuous basis to face increasing variability in water supply, climate and markets. New financial instruments are required to cover not only O&M but also upgrading of management and infrastructure assets at all layers of agricultural water management. This strategic investment need not be more expensive than previous infrastructure rehabilitation or canal lining programmes.

The Programme has shown that, when irrigation planners and managers are presented with new options, focus on operation and service issues and work together in developing proposals based on a detailed appraisal of the systems, they embrace new approaches: the irrigation modernization plans trainees prepare at the conclusion of the training workshops differ very significantly from their previous plans.

The main lesson from the Programme is a paradox: the challenges are both under-estimated and over-estimated. Under-estimated: because there has been in the recent past excessive reliance on policy reform, institutional reform, improved control technology, economic incentives and instruments or on-farm water management as measures which would singlehandedly deliver improved performance or service: a complex and articulated mix of changes in all these fields would be in fact required. Over-estimated because there exists a considerable potential for significantly improving system performance and service with the adoption of simple and low-cost measures, provided that an increased focus on all details of operation, management and design is adopted, and that planners and managers are aware of better options that are now available. ■

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Errata Corrige

Please note the correct email address of Ms Zavgorodnyaya who contributed to GRID 24 with the article:

Water Users' Associations in northern Uzbekistan: opportunities or constraints for development? (p. 15-17)

daryaz@web.de

Applied water research: value for money

This is our first article under our new section on Research and Technology. Should you have similar experiences as the ones described in this contribution, please inform IPTRID as we would like to compile these into a future IPTRID Knowledge Synthesis publication. [Editor's note]

Introduction

This article describes how applied research can be "value for money". The "mechanism" for this to happen is that the cost of investment in water infrastructure is huge. Applied research can predict the consequences and impact of the measures foreseen to be implemented and often the planned investments have to be revised and expenditure can be saved. Saving 10 percent on an investment agenda of US$50 or 100 million is a major achievement and easily outweighs the cost of research. Research results have proven this mechanism, and the conclusion therefore is that research in planned and ongoing implementation projects can have a far-reaching impact on the actual implementation of those projects, and the planning and design of future investments in such projects. For reasons of space, we give only two examples here, namely, interceptor drains and lining of canals.

For any "industry" to survive, it should invest about 1-3 percent of its budget in research and development. However, the rural poor of the world are unable to do this for their agricultural operations. If there are profits beyond the subsistence level, they would rather visit a doctor or spend it on education for their children. IPTRID was established in 1991, with the idea in mind that the required water research could very well be facilitated by Technical Assistance grants, to guide the large-scale implementation of water projects. The premise was that research would pay itself back. This article shows that the idea was excellent and that indeed research can be "value for money".

Background

Seepage from canals, that recharges groundwater, is often quoted as one of the major contributors to waterlogging. This often leads to the recommendation to install recharge-reducing measures as interceptor drains and canal lining. The research presented here is from Pakistan, done within the framework of the bilateral cooperation between the International Waterlogging and Salinity Research Institute in Lahore, Pakistan (IWASRI) and Alterra-ILRI. The work concentrated on the Fordwah Eastern Sadiqia (South) Irrigation and Drainage (FESS) project, located in the south of the Pakistani Punjab. That was a unique project because it was the first ever project with a real "IPTRID approach": starting with a first phase with in-built research capacity; obvious improvements were being implemented in the area anyhow, and there was a parallel research phase in which the effectiveness of and necessity for certain investment was to be established.

Interceptor drains for seepage reduction

Interceptor drains can be considered in irrigation systems for one or more of the following reasons:

- To intercept a significant part of canal seepage to reduce drainage requirement of adjacent lands.
- To relieve an area from waterlogging due to a canal.
- To provide supplemental water for irrigation.
- To have a beneficial effect on the stability of the side-slopes of a canal.

An interceptor drain is a drain (either an open ditch or a buried pipe) to intercept seepage from a neighbouring parallel canal or stream. Such drains can be installed on one side (often on sloping land) or on both sides of the canal (usually in flat areas). The drains connect to a sump from where the water is pumped into a surface drain for further disposal. Because the irrigated lands of the extensive Indus plains are very flat, drainage is usually pumped in Pakistan and interceptor drains are no exception to this. The upstream and downstream lines (parallel to the canal) connect to a sump from where the water is pumped.

The logic of interceptor drains is that with interception of seepage, the waterlogging of adjacent lands will cease. Interceptor drains for seepage recovery have been installed at a few sites in Pakistan, and were also planned for the Fordwah Eastern Sadiqia (South) Irrigation and Drainage Project. The total cost budgeted for interceptor drains in FESS was about US$20 Million.

The IWASRI research results point out that interceptor drains should not be used as a standard measure to recover seepage from canals in order to save on construction costs of adjacent drainage systems. The two main reasons are that: the influence of interceptor drainage on the field drainage design discharge for the adjacent lands would be too small; and that it would also lead to excessive operation costs, far beyond the available O&M funding for the drainage system. Interceptor drains will be particularly ineffective in conditions of a deep aquifer and flat lands. Interceptor drains may be effective to a certain extent when the aquifer is shallow and on sloping lands.

In the FESS project about US$10 Million were saved by not implementing ineffective interceptor drains. The findings have also saved tens of millions of US dollars for other projects where interceptors were planned. For the FESS project, the decision of not implementing the interceptor drains also prevented an estimated annual cost for ineffective re-circulation of water of about US$1 million.

Lining of canals for seepage reduction

Canal lining is installed in many irrigation systems, for one or more of the following anticipated benefits:

- Reduced seepage, that will reduce the danger of waterlogging and salinization.
- Reduced cross-section because the lining material has less friction than the previous earthen channel.
- Less bank erosion and limited weed growth, resulting in less costly maintenance.
- Improved hydraulic conditions leading to better canal operation and equity of distribution.
- Less health risk due to elimination of small water bodies.

Very large investments have been made in the past to control seepage from irrigation canals through lining with rigid materials (concrete or brick). The benefits obtained from these massive investments are frequently far below what was expected. Seepage tests indicate that the effectiveness of lining could quickly deteriorate over time, but the development of new lining technologies with the use of geo-membranes has considerably improved the returns on these investments.

Measurement of seepage losses in Fordwah-Sadiqia, Punjab, Pakistan.

The economic feasibility of lining minor canals under the FESS project was based on the seepage value of 8 cfs/million ft^2 commonly accepted in Pakistan for unlined canals (equivalent to about .20 m/day). During implementation of the project, intensive research was carried out by IWASRI to analyse the impact of lining on seepage losses. Two types of lining were installed: the "standard" lining (in about 150 km, also referred to the "production" lining) and the "experimental" lining (in about 30 km of canal) in order to test the effectiveness and practicability of a number of lining options with different geo-membrane and protection materials.

The IWASRI research results include:

- Use of rules-of-thumb to estimate components of the water balance of irrigation systems in designing drainage can be very misleading. The measured seepage was lower than assumed rule-of-thumb values (with the results of the ponding tests nearly twice higher than measured with the inflow-outflow method). It is therefore important to measure the actual seepage losses from the canals before lining. The measured low seepage values for the Malik Branch canal (equal to 1 percent of the inflow at its head, ponding method) caused the plans to line a part of the Malik Branch to be cancelled.

- Interceptor drains as well as lining do not significantly reduce the drainage requirements nor, in other words, prevent the need for the installation of a drainage system, and therefore the effects of both recharge reducing measures such as interceptor drains as well as lining do not always justify the large investments involved.
- Lining with geo-membranes, if well selected and installed, provides a long-term solution to the control of seepage losses from canals.

The FESS canal lining research component was not only benefiting Pakistan, it was also a catalyst for experts from the Water Resources Bureau from Xinjiang Province in China, who visited the FESS project in 1990. The canal lining technology in that Province was upgraded with remarkable impact on the volume of water saved for environmental purposes, and the reduction of waterlogging in the Tarim II basin. The old technology of lining with very thin geo-membrane panels placed with overlapping was replaced by a technology using thicker welded geo-membranes protected with different local materials. The canal lining component of the Tarim II project consisting of lining about 500 kilometres of large and medium capacity canals with a total area of over 5 million m^2 has saved an estimated volume of 600–700 million m^3 annually. The small additional cost for the higher quality geo-membrane was highly offset by the benefits in water saving and improved conditions in the project area.

Conclusions and recommendations

A lot of site-specific, practical research is still needed to find efficient and effective solutions for the pressing land and water problems all over the world.

The IPTRID "model" (reserving 1-2 percent of large infrastructure works for research) has proven itself to be very valuable in Pakistan, as well as for other areas in the world.

Realising that potential savings, in hindsight, and actually saved expenditure by a better design, is not cash in hand, we are confident that applied research, linked to investment programmes, is value for money. ■

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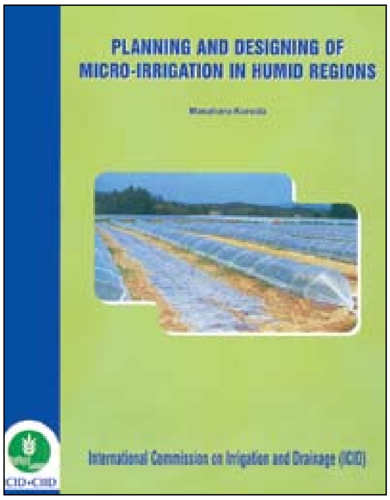
www.fao.org/landandwater/iptrid/index.html



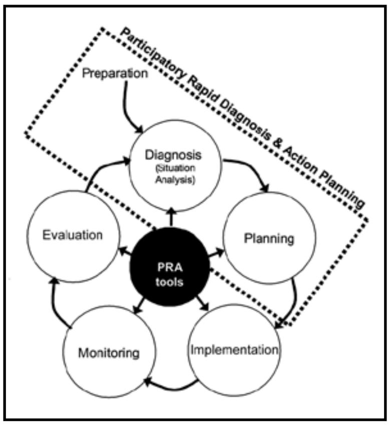
Planning and designing of micro-irrigation in humid regions

by Masaharu Kuroda

This publication by the International Commission on Irrigation and Drainage (ICID) is the product of its Working Group on On-farm Irrigation Systems (WG-ON-FARM) which has a mandate "to promote the science and art of on-farm technology (mechanized and micro irrigation) to improve irrigation management ..." The booklet is one of a series of guidelines/manuals based on worldwide experiences and best practices that the Group has set out to document. The publication is intended to fill an existing gap on the planning and design pertaining to micro-irrigation in humid environments. It provides information on computation of consumptive use/ crop water requirements in this type of climate presenting different layouts of micro irrigation and giving special attention to the conditions in Japan. The author also provides a detailed mathematical analysis for the planning and design of a farm pond in support of the irrigation system.

The guide is divided and organized into six brief sections dealing with: i) the Concept of irrigation plans; ii) the Consumptive use of water; iii) the Irrigation plan; iv) the Composition of drip irrigation facilities; v) the Planning of a micro-irrigation system; and vi) the Planning of a farm pond. In addition, the publication offers a number of relevant photographs on the set up and layout of this type of system, under both field and greenhouse conditions. Unfortunately, no consideration is given in the text to the costing of establishing such type of irrigation system.

The guide is targeted for irrigation professionals who assist farmers dealing with or who would like to establish this type of irrigation on their farms. The publication is available in the ICID webpage (www.icid.org) or can be purchased directly from their Central Office in New Delhi, India.

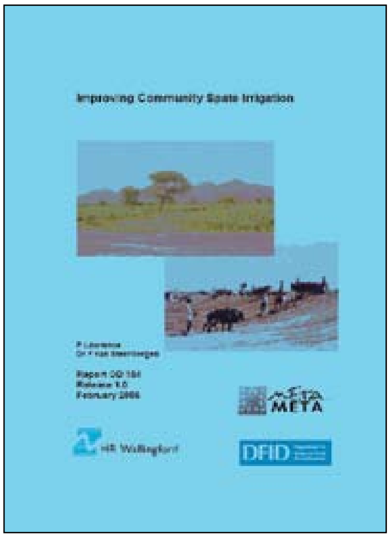


Manual on participatory rapid diagnosis and action planning for irrigated agricultural systems (PRDA)

by M.L. van der Schans and P. Lempérière

This publication by the International Water Management Institute (IWMI) with the collaboration of the IPTRID Programme, has been prepared under the project "Improving Irrigation Performance in Africa", better known by its French acronym APPIA. The APPIA is a follow-up of the project "Identification and dissemination of good irrigation practices in West Africa" (Identification et diffusion de bonnes pratiques d'irrigation en Afrique de l'Ouest) formulated and implemented by IPTRID between 1999 and 2001 in five West African countries. The APPIA project seeks to promote African expertise to produce, disseminate and use information for improving irrigation performance at local, national and regional levels. As per design, the project covers two regions: West and East Africa. This manual was developed by IWMI in East Africa. A draft version of this manual, or parts thereof, has been field-tested by 69 irrigation professionals on 18 selected irrigation schemes in Ethiopia and Kenya as part of the APPIA project. Their experiences and comments have been used to write this improved version. Most examples used in this guidebook are taken from the selected schemes.

The publication comprises the main text organized in five chapters dealing with the different steps of the rapid diagnosis and three annexes: i) description of tools, ii) reporting sheets, and iii) a brief presentation of the PRDA Training in Ethiopia and Kenya. This manual is published for the benefit of technicians of public services, NGOs, farmer organizations and practitioners wanting to plan and implement solutions responding to farmers' needs as well as to the requirements for thrifty and integrated water resources management. It offers a participatory and practical methodology based on practices, experience and thinking of many farmers and irrigation professionals in Ethiopia and Kenya. The publication is available on the IPTRID webpage www.fao.org/iptrid.



Improving Community Spate Irrigation

by Philip Lawrence
and Frank van Steenbergen

Spate irrigation is a type of water management, unique to arid regions bordering highlands. Spate irrigation (also called flash irrigation, flood water spreading or rod kohi) is found in South Asia, the Middle East, North Africa and the Horn of Africa. Floods originate from sporadic rainfall in macro-catchments, are diverted from ephemeral rivers and spread over agricultural land. After the land is inundated crops are sown, sometimes immediately, but often the moisture is stored in the soil profile and utilized later. The spate irrigation systems support farming systems, usually cereals and oilseeds, but also cotton and even vegetables. Besides providing irrigation, spates recharge shallow aquifers (especially in the river bed), they fill (cattle) ponds and they are used to spread water for pasture in some places.

Uncertainty is the overriding characteristic in spate irrigation. The number and sequence of floods vary from one year to another. Good years alternate with bad years. A bad year may be caused by a drought or by the arrival of a very huge flood, taking out diversion structures and making it impossible to control water. If they reach the command area they can cause severe damage, destroying flood channels and creating deep gullies that cause the depletion of soil moisture or simply make it impossible to command a sub-area. A second important characteristic in spate irrigation is that sedimentation is as important as water management. Rivers in spate lift and deposit huge quantities of sediment. As a result there is constant change in bed levels, both in the river system and in the distribution network. This results in frequent changes and adjustments. Farmers often actively use the force of these sedimentation and scour processes. They may deepen the head reach of a flood channel in order to attract a larger flood that will further scour out the channel. In other cases farmers may block a flood channel to force the bed level to come up. Sedimentation is also used to build up new land.

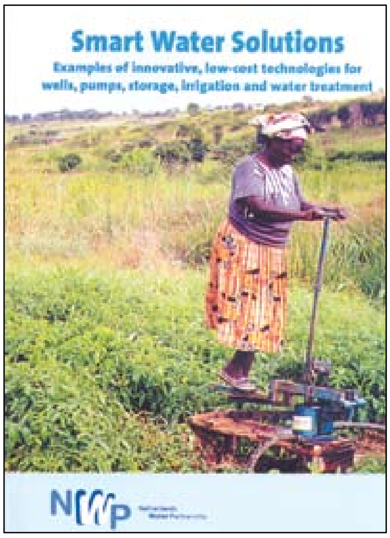
Under support from DFID, Community Spate Irrigation Guidelines were prepared by HR Wallingford and MetaMeta Research. The guidelines were prepared on the basis of experiences and practices in Eritrea, Ethiopia, Pakistan and Yemen. The publication is the first major publication on spate irrigation in more than fifteen years. It discusses approaches to: modernization and improvement of spate irrigation, the socio-economics, hydrology and sedimentation, soil and water management, agronomy, water rights and water distribution rules, organization and management of spate systems, diversion and control structures and spate irrigation and river basin resource management.

Some of the main recommendations of the work are that spate systems can be very productive, the key being moisture conservation and concentration in the command area. In spate systems in Eritrea sorghum yields of up to 7 tonnes/ha are achieved. Spate irrigation can also sustain the production of a range of crops, including vegetables.

In diversion often the improvement of traditional structures has been most effective, because they are able to deal with heavy floods and sedimentation. "Modernization" through the construction of civil head works has, moreover, in many cases seriously disturbed existing water distribution rules. In general river engineering approaches driven by farmer organizations and local government have worked best in improving spate irrigation.

Parallel to the development of the guidelines a web site has been set up: www.spate-irrigation.org. The web site contains a library with many grey documents (much grey literature) on spate irrigation and also features the Spate Irrigation Network, a network of professionals and practitioners working in this special field. Registration in the Spate Irrigation Network is free at www.spate-irrigation.org/network/networkhome.htm.

Philip Lawrence and
Frank van Steenbergen
"Improving Community Spate Irrigation".
ODI Report 154,
HR Wallingford and MetaMeta.
(downloaded from: www.spate-irrigation.org/guide/guidehome.htm)



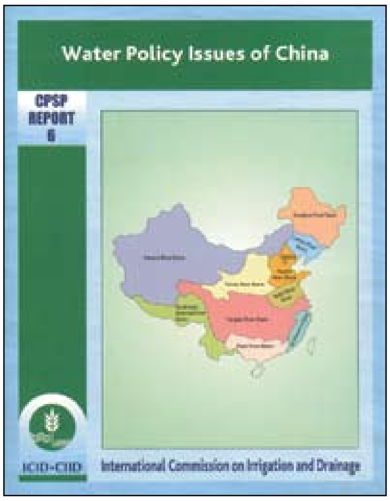
Smart water solutions – examples of innovative, low-cost technologies for wells, pumps, storage, irrigation and water treatment

by the Netherlands Water Partnership

This publication was drafted as a contribution to the 3rd World Water Forum in Kyoto in March 2003. This 3rd edition has been published in English, Spanish, French and Portuguese on the occasion of the 4th World Water Forum in Mexico in March 2006. The booklet is a collaborative effort by eight organizations from The Netherlands: NWP, The PRACTICA Foundation, International Water and Sanitation Center (IRC), SIMAVI, AGROMISA, NCDO, Aqua for All (A4A), and Partners for Water. It is one of a series of Small Smart Solution booklets on small-scale low-cost water and sanitation technologies. This publication gives examples of innovative solutions such as treadle or rope pumps to reduce maintenance problems, rota-sludge or stone-hammer well drilling to reduce the cost of wells, or lay-flat hose, sprat-head or easy drip for irrigation. Successes described by this booklet have in common that the technologies are produced and sold by the private sector using local skills and materials.

The publication is divided and organized into five brief sections dealing with: i) wells, ii) pumps, iii) storage/recharge, iv) irrigation, and v) small-scale low-cost treatment technologies. In addition, for each of the presented technologies, photographs, web sites to find further information, areas and importance of dissemination, and cost of the technologies are indicated.

The publication is available in the PRACTICA Foundation webpage (www.practicafoundation.nl/smartwater/). You are invited to contact NWP or the PRACTICA Foundation, if you want to share experiences that fit the concept of "Small Smart Solutions" to be added to the successful examples given in this publication.



A note on food supply and demand in China using CAPSIM Model: Annex 2 in CPSP Report 6 on Water Policy Issues of China

The Country Policy Support Programme (CPSP) was launched in 2002, as an initiative of ICID, to assess and integrate water needs for food, people and nature for the present and near future (up to the year 2025). The Programme focused initially in China and India and is now being implemented in Pakistan, Egypt and Mexico as well. As part of CPSP activities, the Basin Wide Holistic Integrated Water Assessment (BHIWA) model was developed to quantify and integrate sectoral water uses and simulate scenarios including water consumption. An early output of the Programme was the CPSP Report 6 on Water Policy Issues in China. As part of this Report and presented in Annex 2, the Chinese Agricultural Policy Simulation Model (CAPSIM) was applied to simulate the food requirements (grain demand) in 2025 by projecting the population growth, the ratio of the population in urban centres and the per capita income evolution in urban and rural areas.

In developing countries, especially when the food deficit is a recurrent event, planners are challenged to establish food demand and supply needs and thus have to deal with all parameters interfering – continuously or casually – with the management of food security. In China, the design and implementation of the CAPSIM model has permitted the analysis of the trends during the last two decades on food grain production and demand; taking into account all relevant factors and their specific influence.

The past trends analysis demonstrated that:

- Between 1980 to 2000 China turned from a food grain deficit situation to one of surplus. This was mainly due to the positive impact of the introduction, during the early 1980s, of "individual household responsibility contracts" that allowed farmers to produce more.

- In a period of food self sufficiency, the consumers pay more attention to the quality of food. A side effect of the satisfaction of needs was a significant improvement of the diet but which widened the differences between rural and urban people.
- During the same period, grain yields increased from 2.86 tonnes/ha to 4.60 tonnes/ha; quite a remarkable achievement at world level.

The application of CAPSIM allowed visualization of the prospects for the next two decades:

- The grain demand is highly dependant on the population growth even if the food grain consumption per capita decreases. The total demand of food grain will amount to 507 Million tonnes.
- The modelling reflects the various factors influencing the grain yield which combines advanced technology, physical and economic factors especially the cost of agricultural inputs, and market price. Assuming that the total cropped area remains at 153 Million hectares of which 85 percent as grain area, the total cereal and grain production will amount to 520 Million tonnes.

The agricultural policy is based on the figures established from CAPSIM. The combination of the results of the BHIWA and CAPSIM models should facilitate further formulation of water policies regarding the food sector. ■

Feeding the world or damning the dams – The hard choices ahead

The world is facing a crisis of conscience of unprecedented magnitude and it seems that no one cares. Half of the world's population (3 billion) is living in perpetual poverty on less than two dollars a day, with most of these poor (1.3 billion) living on less than a dollar a day. Those at the bottom end of less than a dollar a day do not have access to clean drinking water, adequate sanitation, no electricity, poor health and educational services and more than half of them go to bed hungry every night.

In numbers, we find that more than 850 million suffer from chronic hunger; 1.2 billion do not have access to clean drinking water, and 2.4 billion lack adequate sanitation. Most of these people live in the rural areas or the slums of towns and cities in Asia, Africa and Latin America. The reason for their plight is very simple; at best they have a poor piece of real estate, or they simply have nothing at all. The basic ingredients of water and land are in very short supply. One product, food, is a rare commodity for many.

In the rich world we see the abundance of food in such a way that obesity is embarrassingly a major problem, and being over weight is a major concern of many millions who are spending billions to get rid of extra body weight. Their counterparts in the poor world are surviving on the minimum caloric intake available to them. When they drink they are putting their lives at risk and every day 14 000 die from preventable water borne diseases.

None of these millions will ever read this article.

The world food production today stands at roughly 2 billion tonnes of cereals with most of it (92 percent) consumed within the countries where it is produced. The international trade in cereals is taking place between exporting countries, basically rich countries, and other rich countries plus some not so rich but able to pay because they have some natural resources such as oil or minerals to sell. Other importers are the newly emerging economies, such as China. The poor countries and poor people are simply out of the international loop, and they cannot pay for imported food. A number of countries like China and India managed to harness a great deal of their resources over the last six decades making strides to feed their own burgeoning population and wiping out chronic starvation. Other parts of Asia, and Africa did not manage to achieve the same. The Fourth World Water Forum that took place in Mexico in March 2006 revealed clearly the local actions and the lack of it in facing these daunting challenges.

In the next fifty years the population will increase by 50 percent and we need to double the food production in the same period. Why double the food production while the population is growing by 50 percent only? Lets first account for feeding the hungry, the malnourished of present populations that accounts for 15 percent, then feed the new arrivals (50 percent), and then add an additional 15 percent to cover for the improved diets of those populations in countries experiencing fast economic growth, and finally some measures of improved standards of living worldwide (20 percent). To produce this additional 2 billion tonnes of grains we need more lands to be cultivated particularly in the humid regions. This is not possible. All the suitable lands in the temperate humid regions are already under cultivation leaving only the rain forest in the tropical and sub-tropical regions, the carbon sink of the world. The only areas left for expanding agriculture are those in the arid and semi-arid regions. These regions have vast tracks of uninhabited barren lands but lacked the most essential ingredient, that is: water. Without water no crop can be grown. Agriculture in the world consumes huge quantities of water, as it is the largest user of all freshwater accounting for 70 percent of all withdrawals worldwide or the equivalent of 6 000 km³. To bring the water to the parched lands of the arid and semi-arid regions will require a great deal of infrastructure to capture the water during the wet season in the humid regions, store it until needed, convey it for long distances and have it delivered to the farmers' fields. There it can be used to grow crops and livestock that constitute the food for the people. There are already 250 million hectares of lands under irrigation producing 40 percent of the food output. With added increased productivity through the application of efficiency measures, better management, better crop selection and use of high yielding varieties plus expanding the land base, the world can feed itself and stamp out starvation, hunger and malnutrition.

Water storage facilities alone will be first order of priorities, building the equivalent of two Aswan High Dams per year for the next thirty years to store the equivalent of 6 000 km³ of water needed for irrigation of 240 million hectares of new lands. The poor cannot do it alone, no matter how self-reliant they are and how determined they can be. Massive investment is needed and increased capacity will be required plus a great deal of transfer of technology and a high dose of policy reforms in the public sector. A new set of rules for the private sector engagement will be required.

There is no freedom for the hungry and it is not a great honor to be poor either. The rich should not simply be content with their wealth; they should bear the responsibility for caring for the poor. We cannot simply damn the dams for this or that leaving the poor to get poorer and the hungry to starve and the starving to die. We must dare to care and make the hard choices to change the course of the status quo and make a difference for a better world for all. The rich nations will not get poorer if they extended the generous assistance to the poor ones. The top priority should be fixing the crumbling water infrastructures, extending and building new ones to irrigate new fields, generating clean renewable hydro power, mitigating the floods and droughts by storing the water and distributing the water to farmers' fields, and piping it to every household. A world that is free of hunger, malnutrition and water borne diseases can be really free, healthy and capable of breaking the vicious cycle of poverty. The rich have the moral duty and obligation to do it so that we all enjoy the dignity and security we deserve and can earn. If we fail, the crisis will go on its full course to a full disaster. ■

For more information contact,
Aly M. Shady, P. Eng. President Honoraire ICID:
president-2@iwra.net

CapDevWater Web site:
www.fao.org/landandwater/cdwa

IPTRID present at the 4th World Water Forum

The Fourth World Water Forum which took place in Mexico City from 16 to 23 of March 2006 provided an opportunity for IPTRID to be present and contribute in a number of ways to this main water-related event held every three years. In the words of the organizers the Forum is "an initiative of the World Water Council that has the aim of raising the awareness on water issues all over the world. As the main international event on water, it seeks to enable multi-stakeholder participation and dialogue to influence water policy making at a global level, thus assuring better living standards for people all over the world and a more responsible social behavior towards water issues in-line with the pursuit of sustainable development."

We would herein like to inform briefly our readers of our involvement in this important event. The IPTRID Programme was present as a co-convener of a session under the cross-cutting theme on Capacity Development and Social Learning together with the Institute of Water Education of the Netherlands (UNESCO-IHE), the Water Research Commission of South Africa and the Water Center for Arid Zones of Latin America and the Caribbean (CALZALAC). IPTRID also participated in the session on Financing Water for Agriculture under Theme 4: Water Management for Food and the Environment where the Programme had played a significant role as sponsor of the First Regional Consultation in Hyderabad, India. This was one of three events leading to the Forum's special session on the subject. We were also invited to take part in a special session on Professionals for Action: Meeting of Directors of Water Research Institutes. This provided an opportunity for 15 senior leaders of professional research and development institutions, representing an equal number of countries, to discuss the challenges facing the

Science, Technology and Knowledge community and to seek ways to work together in resolving water issues.

Finally, and of equal importance, was IPTRID's sharing of a stand with FAO, IFAD and the IAEA. There, we gained visibility through the distributions of a wide sample of our publications and by being able to explain our efforts and activities to interested stakeholders. It also provided a venue to meet with potential partners and donors and, in general, to assure the global water community that IPTRID is playing its role towards meeting the Forum's objectives. ■

For more information on IPTRID's role and participation at the Forum contact the Programme Manager at Carlos.Garces@fao.org

International symposium on irrigation modernization: constraints and solutions

28–31 March 2006 – Damascus, Syria

Taking into consideration the severe water conditions in the country, the Government of Syria is embarking on a second phase of its ambitious National Plan for Irrigation Modernization which is to include more than 1.2 million hectares and aims to increase the water use efficiency in the agricultural sector at the national level to more than 75 percent by the year 2015. In this context and in support to the National Strategy on Irrigation Modernization in Syria IPTRID, in collaboration with local partners, regional and international organizations interested in the subject matter, organized and co-sponsored the "International Symposium on Irrigation Modernization: Constraints and Solutions".

The event was held at the Rida Said Center for Conferences at the University of Damascus from 28 to 31 March 2006. The opening ceremony, under the leadership of the Honorable Ministers for Agriculture and Agrarian Reform (MAAR) and for Higher Education, was attended by approximately 450 persons – national and international. the last day was dedicated to visits to irrigation and drainage systems in the Orantes Basin.

The general objectives of the gathering was to: i) discuss the actual state of irrigation and drainage modernization in Syria; ii) prioritize issues and challenges in the modernization of irrigation that need to be addressed in support of the Syrian Government's efforts to improve the performance of its irrigated agriculture; iii) review achievements and experiences realized at the International level leading to sustainable and effective measures for irrigation modernization, with particular attention to efforts in the Middle East; and iv) provide a forum to share knowledge, exchange experiences and seek common approaches towards the modernization of irrigation and drainage.

The more specific objectives were to: i) identify constraints to irrigation modernization in Syria covering technical, economic, social, institutional and environmental aspects and draw specific recommendations for their solutions; and ii) produce a Declaration of Support to the Government of Syria's plan for irrigation and drainage modernization.

The event was sponsored by IPTRID, International Center for Agricultural Research in the Dry Areas (ICARDA), Mediterranean Action Plan of the United Nations Environment Programme (UNEP-MAP), German Technical Cooperation (GTZ), University of Damascus and Supreme Council of Science in Syria (SCOS). Substantial input and support was provided by the Water Resources Development and Management Service (AGLW) of FAO. At the local level, the event was organized by the Network of Syrian Scientists, Technologists and Innovators Abroad (NOSSTIA) in close collaboration with the FAO Representation in Syria, the General Commission for Scientific Agricultural Research (GCSAR) of the Ministry of Agriculture and Agrarian Reform (MAAR) and the Ministry of Irrigation (MoI).

The event was organized around six priority areas for consideration under an irrigation and drainage modernization process, that led to respective sessions: i) Policy and Legal Implications; ii) Technical Considerations; iii) Monitoring, Evaluation and Performance; iv) Institutional Modalities and Financial Implications; v) Capacity Development; and vi) Environmental issues. ■

For more information on the Symposium, contact Mr Maher Salman, IPTRID's Technical Officer at: Maher.Salman@fao.org

Staff changes

STAFF ARRIVALS

Dominique Durlin is a French Government seconded Technical Officer and has joined IPTRID for a two-year appointment. He will assist the Programme Manager in the implementation of activities related to the uptake of research and exchange of technologies. He will also contribute to the organization of technical missions, and provide technical support to the on-going projects of IPTRID having a capacity development component. Mr Durlin is an Agricultural Engineer with over 30 years experience, including different posts as Adviser to the Minister of Water and Environment in Chad, Manager of the Food Aid Fund programme of the Ministry of Agriculture in Egypt, Program Manager/Team Leader of water-related projects in West Africa and Asia and an project evaluation expert for the European Union, IFAD, USAID and Asian Development Bank in various countries such as in Senegal, Laos, Rwanda, Bangladesh, Indonesia, Madagascar, Niger, Nepal, Syria, Algeria and Yemen among other.

STAFF DEPARTURES

Sonia Tato joined IPTRID in September 2002 as an Associate Professional Officer under the sponsorship of Spain (Ministerio de Agricultura, Pesca y Alimentación–MAPA) a position she held for two and a half years. In April 2005 she became an IPTRID Technical Officer until her departure in February 2006. Sonia handled the relations between Spain and IPTRID and was actively involved in different phases of the identification, formulation, implementation and monitoring and evaluation of projects. Among others, she participated, in related activities in Senegal, Egypt, India and Cuba. She was also responsible for the provision of technical support on Institutional Mapping under the Project Evaluation Study of Paddy Irrigation under Monsoon Regime (ESPIM) in its activities in Viet Nam and Cambodia. Finally, Sonia was instrumental in the Programme's activities dealing with the Capacity Development related Workshop series held in Moscow (2004) and Beijing (2005).

Federico Patimo joined the IPTRID Programme as Clerk in September 2005. His main activity was the updating and running of the new IPTRID Database. Also, Federico was responsible for handling the Programme's publications including updating and dispatching IPTRID publications upon request, to forthcoming events and to support workshops. He left on 30 April 2006 to take up an assignment in another department.

IPTRID

The uptake of Research and Exchange of Technology and Innovations in irrigation and drainage for a sustainable agriculture

The International Programme for Technology and Research in Irrigation and Drainage (IPTRID) is a multidonor trust fund managed by the IPTRID Secretariat as a Special Programme of FAO. The Secretariat is located in the Land and Water Development Division of FAO. The IPTRID acts as a facilitator mobilizing the expertise of a worldwide network of leading institutions in the field of irrigation, drainage and water resources management.

IPTRID aims at improving the uptake of research, exchange of technology and mamagement innovations by means of capacity development in the irrigation and drainage systems and sectors of developing countries to reduce poverty, enhance food security and improve livelihoods, while conserving the environment. The Programme therefore is closely aligned with the Millennium Development Goals.

Together with its partners, the IPTRID Secretariat provides advisory services and technical assistance to countries and development agencies, for the formulation and implementation of strategies, programmes and projects. During the last ten years, it has been supported by more than twenty international organizations and government agencies. The present programme is co-financed by the Food and Agriculture Organization of the United Nations (FAO), the United Kingdom, the Netherlands, France and Spain, the World Bank and the International Fund for Agricultural Development (IFAD).

DIARY

4-6 September 2006
Eighth International Conference on Modelling, Monitoring and Management of Water Pollution (Water Pollution 2006). Bologna, Italy.
Contact: Conference Secretariat Water Pollution 2006, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, United Kingdom
Phone: +44 (0)238 029 3223
Fax: +44 (0)238 029 2853
E-mail: zbluff@wessex.ac.uk
Website :http://www.wessex.ac.uk/conferences/2006/water06/index.html

5-7 September 2006
First International Conference on Sustainable Irrigation Management, Technologies and Policies. Bologna, Italy.
Contact: Olivia Waters, Conference Secretariat Sustainable Irrigation 2006, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, United Kingdom
Phone: +44 (0)238 029 3223
Fax: +44 (0)238 029 2853
E-mail: owaters@wessex.ac.uk
Website:http://www.wessex.ac.uk/conferences/2006/irrigation06/index.html

10-14 September 2006
International Water Association World Water Congress and Exhibition. Beijing, China.
Contact: Tom Williams, Alliance House, 12 Caxton Street, London SW1H 0QS, United Kingdom
Phone: +44 (0)20 76545500
Fax: +44 (0)20 76545555
E-mail: 2006beijing@iwahq.org.uk
Web site: http://www.iwa2006beijing.com/

11-13 September 2006
Environmentally Sound Technology in Water Resources Management. Gaborone, Botswana
Contact: IASTED Secretariat, #80, 4500 16th Ave. N.W. Calgary, AB. Canada T3B 0M6
Phone: +1 403 288 1195
Fax: +1403 247 6851
E-mail: calgary@iasted.org
Web site: http://www.iasted.org/conferences/2006/Botswana/estw.htm

18-22 September 2006
IWA Dipcon Tenth International Specialized Conference on Diffuse pollution and sustainable basin management. Istanbul, Turkey.
Contact: Melike GUREL, Istanbul Teknik Universitesi, Insaat Fakultesi, Cevre Muhendisligi Bolumu, Maslak, 34469 Istanbul - TURKEY
Phone: +90 212 2853792
Fax: +90 212 2856545
E-mail: dipcon2006@itu.edu.tr
Web site: http://www.dipcon2006.itu.edu.tr/contact.htm

26-28 Septembre 2006
Third International Symposium on Integrated Water Resources Management. Bochum, Germany.
Contact: Conventus Congress Management & Marketing GmbH, Markt 8, 07743 Jena, Germany
Phone: +49 3641 35 33 221
Fax: +49 3641 35 33 271
E-mail: water@conventus.de
Web site: http://conventus.de/water/

9-15 October 2006
International Conference on Water, Ecosystems and Sustainable Development in Arid and Semi-Arid Zones. Urumqi, China.
Organizers: Xinjiang University, China; University of Tehran, Iran; Practical School for High Studies, France
Contact: Béatrice Argant
E-mail: watarid@ephe.sorbonne.fr
Website:http://www.ephe.sorbonne.fr/watarid/watarid_en.htm

16-18 October 2006
Third APHW Conference "Wise Water Resources Management towards Sustainable Growth and Poverty Reduction". Bangkok, Thailand.
Organizers: National Research Council of Thailand (NRCT); the Association of Researchers (AR); the Asia Pacific Association of Hydrology and Water Resources (APHW).
Contact: Conference Secretariat
E-mail: kanae@iis.u-tokyo.ac.jp
Web site: http://www.thirdaphw.org/

30 October–1 November 2006
Efficient Management of Wastewater, its Treatment and Reuse in the Mediterranean Countries (EMWater). Amman, Jordan.
Contact: Ismail Al Baz, Project Director, EMWater Project, InWEnt–Capacity Building, International, Germany
Fax: +962 6 5686184
E-mail: ismailalbaz@nets.com.jo
Website:http://www.emwater-conference.org/

1-3 November 2006
Third International Conference on 'Water Resources in the Mediterranean Basin (WATMED 3). Tripoli, Lebanon.
Organizers: Lebanese University, Lebanon; Lebanese Committee for Environment and Sustainable Development, Lebanon
Contact: Jalal Halwani
E-mail: jhalwani@watmed.com
Web site: http://www.watmed.com

27 November–1 December 2006
Fifth FRIEND World Conference – Water Resource Variability: Processes, Analyses and Impacts. Havana, Cuba.
Contact: Eduardo Planos Gutierrez
E-mail: planos@met.inf.cu
Web site: http://www.friend-amigo.org/conferencia2006/

30 November–1 December 2006
International Symposium on Water Resources and Renewable Energy Development in Asia. Bangkok, Thailand.
Contact: M. Bourke, Hydropower & Dams, Suite 34, Westmead House, 123 Westmead Road, Sutton, Surrey SM1 4JH, UK.
Tel: +44 20 8643 5133
Fax: +44 20 8643 8200
E-mail: mb@hydropower-dams.com
Web site: www.hydropower-dams.com

13-16 February 2007
Sixth International Research & Development Conference on Sustainable Development of Water & Energy Resources – Needs and Challenges, Lucknow, India
Contact: G.N. Mathur, Secretary, Central Board of Irrigation and Power, Malcha Marg, Chanakyapuri, New Delhi 110 021, India
Phone : +91 11 2611 5984, 2611 1294
Fax : +91 11 2611 6347
E-mail: uday@cbip.org or cbip@cbip.org
Web site: http://www.cbip.org

2-5 May 2007
The Fourth Asian Regional Conference & Tenth International Seminar on Participatory Irrigation Management. Teheran, Iran.
Contact: Iranian national Committee on Irrigation and Drainage (IRNCID)
No. 24 Shahrsaz Alley, Kargozar St, Zafar St, Tehran, Iran
Tel: +982122257348
Fax: +9821 22272285
E-mail: info@pim2007.org
Web site: http://www.pim2007.org

IPTRID Central Partners

FAO, Italy

The World Bank, United States of America

IFAD, Italy

Ministry of Foreign Affairs, The Netherlands

Ministry of Foreign Affairs, France

DFID, United Kingdom

Ministry of Agriculture, France

Ministry of Agriculture, Spain

ICID Central Office, India

IWMI, Sri Lanka

HR Wallingford, United Kingdom

Cemagref, France

Alterra-ILRI, The Netherlands

IAM-BARI, Italy

US Bureau of Reclamation, USA

CIDA, Canada

IPTRID has cooperated with more than 60 organizations in 40 countries

iptrid

Contact information

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Food and Agriculture Organization of the United Nations

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e-mail: iptrid@fao.org
Web site: www.fao.org/landandwater/iptrid/index.html