



# International Programme for Technology and Research in Irrigation and Drainage

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## Poverty reduction and irrigated agriculture



## EXECUTIVE SUMMARY

**P**overty remains a persistent feature of many developing countries, despite over a century of debate and action and over forty years of international aid to transform the livelihoods of the poor. There is evidence that for many developing countries increasing agricultural productivity is a key to poverty reduction. High economic growth, increased incomes and improved nutrition have been linked to improvements in rural and agricultural development in many countries in Asia between 1970 and 1990. On the other hand, over the same period, several countries in Africa experienced real declines in agricultural growth and also showed the lowest growths in national GNP and an increase in poverty.

Irrigated agriculture provides 40% of world food production on only 17% of total cultivated land. The World Food Summit in 1996 estimated that 60% of the extra food required to sustain the world in the future must come from irrigated agriculture. Much of this increase must come from improvements in existing schemes, as new sites for development are scarce. Three-quarters of the total irrigated area of 260 million hectares is in developing countries where smallholder agriculture still predominates. The bulk of improvements in food supply from irrigation is expected to come from changes in a sector still dominated by small producers. The rural poor are not simply people deserving help and justice: small-scale irrigators are, and will continue to be, a vital part of future world food security.

Irrigated agriculture remains a resource that many poor producers want, and still ask for. It remains a vital activity in the livelihoods of many small producers who value the security it provides. It can also be a vehicle to provide basic needs for, and reduce the vulnerability of, poor people. People in the irrigated area can benefit directly by increased and more stable incomes from increased cropping intensities, improved yields, new farm enterprise/technology mixes, and the appreciation of the value of land with access to irrigation. Indirectly, they benefit from a more even spread of, and increase in, farm incomes/wages, lower food prices, better nutrition and more water for domestic uses that can improve health.

Irrigation benefits apply to the whole population but can be targeted at the poor by:

- employment-intensive construction, operation and maintenance practices, and
- approaches that allow greater access to water particularly in times of scarcity, (owning irrigation systems, selling water for profit, water rights, allocations of irrigable land and accessing small or marginal quality supplies).

To increase benefits of irrigated agriculture to the poor it is critical to understand the real social and economic benefits of irrigation development, the water environment where poor people live, their production preferences and what designs can allow poor people and smallholders to make the most of their opportunities.

Irrigated agriculture has been a strategy for poverty reduction and there is evidence that this can be achieved. Lessons have been learned about appropriate design and support in irrigated agriculture, and there are options to meet new challenges. Improved sharing of research results and a greater interaction among professionals can aid these understandings.

Designs that are sensitive to environmental and societal conditions will be essential to prevent repetition of past weaknesses in irrigation development. This is important, as future attention will be directed to the improvement of existing systems with new developments focussed at small-scale smallholder schemes. An improved awareness of the interventions and initiatives that can sustain irrigation, both physically and institutionally, will be important to prevent impoverishment of small irrigators and ensure food supplies. Greater study and exposure of initiatives involving landless people gaining access to irrigation benefits are required.

The aim of this paper is to show how the means to reduce poverty lies in: (a) the socio-economic conditions that irrigated agriculture can change; and (b) the way irrigation development is pursued. It is hoped that the paper will promote debate and act as a stimulant for new action to reach the poor through irrigated agriculture.

This is the first of a series of issues papers to be prepared by the International Programme for Technology and Research in Irrigation and Drainage (IPTRID) aimed at promoting debate, research, innovation and investment in irrigated agriculture.

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## Contents

<b>EXECUTIVE SUMMARY</b>	<b>i</b>
<b>Poverty, hunger and food insecurity</b>	<b>1</b>
<i>Regional disparities</i>	2
<i>Rural-urban differences</i>	2
<i>Gender disparities</i>	2
<b>Recognition of poverty alleviation as a development priority</b>	<b>5</b>
<b>How irrigated agriculture can reduce poverty</b>	<b>7</b>
<i>Benefits to people in irrigated areas</i>	7
<i>Targeting the land-poor</i>	8
<i>Benefits to the region and nation</i>	9
<b>How to increase the benefits of irrigation to the poor</b>	<b>11</b>
<i>Living environment</i>	11
<i>Financial and economic aspects</i>	11
<i>Production preferences</i>	12
<i>Appropriate technology and systems</i>	13
<b>Strategies to reduce poverty through irrigated agriculture</b>	<b>15</b>
<i>Invest in irrigation</i>	15
<i>Extend participatory irrigation</i>	15
<i>Involve small-scale farmers</i>	15
<i>Increase opportunities for the poor</i>	15
<i>Promote and adapt affordable technologies</i>	16
<b>References</b>	<b>17</b>

## **Poverty, hunger and food insecurity**

In spite of over forty years of international aid, in most developing countries poverty remains a persistent problem. The causes of poverty are complex and context-specific, but in general poverty tends to be linked with factors such as poor national economic performance, an unequal distribution of income and political structures that render poor people powerless (Cohen & Reaves, 1995).

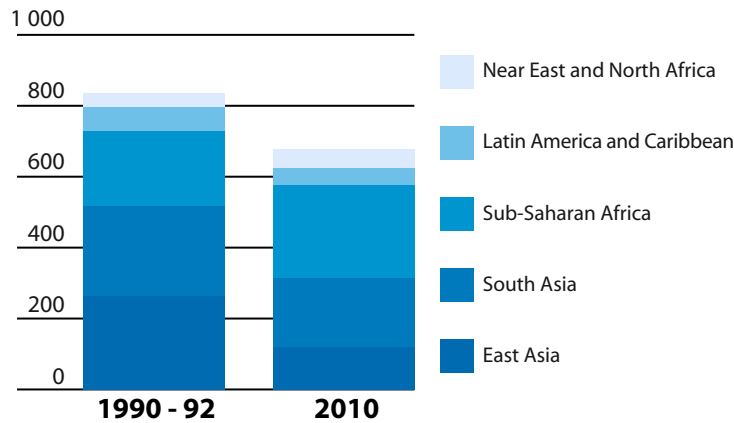
Poverty can be perceived in two broadly distinct ways: absolute poverty (lack of access to a basket of basic survival needs) and relative poverty (lack of access to the level of resources accepted as normal in a society). It is now widely recognized that poverty is multi-dimensional, embracing issues such as social exclusion, vulnerability and lack of participation. A strong case has thus been made for development interventions to give priority to reducing absolute poverty as relative poverty is only a concern once survival is assured. This approach supports the observed tendency for international organizations to measure the incidence of absolute, rather than relative, poverty in developing countries (Ravallion, 1992).

Absolute poverty is increasing. A recent estimate indicates that more than 1 300 million people are in this category. In Africa, the number of poor is projected to increase 40% between 1990 and 2000 (Pinstrup-Anderson & Pandya-Lorch, 1995). Among the world's poor, more than 800 million people are said to have inadequate access to enough food, with this number likely to exceed 1 000 million by the year 2000. With the world's population set to exceed 8 000 million people by 2025, and most of the increase occurring in developing countries, food needs in developing countries could nearly double, resulting in great pressure on agriculture to increase overall production and yields. While most of this increase in production will have to come from increased biological yields, appropriate forms of irrigation have an important contribution to make to increase food production in parts of the developing world.

An abundance of food at low prices in the world market does not ensure food security at the country or household level, nor does it help countries to purchase imports to supplement national food supplies (World Bank, 1996). The poor tend to spend a high proportion of their income, perhaps 50–80%, on food consumption and water (Lipton, 1983; World Food Programme, 1995). Hunger and poverty are therefore closely linked. In order to alleviate poverty, poor people need adequate means to obtain food in the quantities and qualities needed for a healthy life and greater access to skills, technology, markets and productive resources such as land and capital.

Over the last 25 years, there has been progress in improving the living standards of people in developing countries. However, even today when the world is producing enough food to provide every person with more than 2 700 calories per day, there are still over 800 million people in the developing world who suffer from chronic under-nutrition. This is because many people do not have the ability to buy the food they need and often people living in absolute poverty are unable to express their demands fully. This explains why hunger and food surpluses can co-exist (FAO, 1996a). Consequently, the number of poor and hungry people in the world is

### Millions of undernourished people, 1990 - 92 and 2010



Source: FAO, 1996 b

*Hunger is not just a manifestation of poverty; it perpetuates poverty, and has been the major stumbling block to efforts aimed at eliminating poverty. Food security is therefore an essential factor for breaking the vicious circle of poverty and malnutrition. In order to eliminate hunger, concerted efforts are required to accelerate agricultural and rural development in the countries where poverty and under-nutrition exists (FAO, 1996a).*

constantly rising and about 15% of the world's population are hungry, undernourished or malnourished.

#### Regional disparities

Poverty, suffering and deprivation are becoming more regional — concentrated more in those countries which are least able to improve conditions (Chambers, 1995). Rural poverty is an endemic problem in Sub-Saharan Africa (SSA) and South Asia, with 50% of the population in these regions estimated to be living in absolute poverty between 1985 and 1990. It is expected that SSA will overtake Asia as the region with the largest population of poor and food insecure people in the near future as, unlike Asia, SSA has not experienced the benefits of the Green Revolution.

#### Rural-urban differences

The distribution of poverty is uneven. The rural poor still account for more than 75% of the poor in many Asian and Sub-Saharan African countries and more than 50% in Latin America (Pinstrup-Anderson & Pandya-Lorch, 1995). However, high rates of urbanization mean that an increasing proportion of the poor now reside in urban areas. The poor and hungry in the rural areas include the landless, and those who live in areas with low agricultural potential or areas which are environmentally fragile. Unemployed and underemployed urban dwellers constitute the remaining poor, or those who have less than one dollar per day to live.

#### Gender disparities

Recent evidence suggests that women are disproportionately represented among the poor. About 550 million women live below the poverty line (60% of the world's rural population). This represents a 50% increase for women over the past 20 years, compared with a 30% increase for men (IFPRI, 1995b). At present severe economic and social inequities prevent women from reaching their full potential as food producers, wage earners, and guardians of household food and nutrition security (IFPRI, 1995b).

Throughout the developing world, women generally have less access to or own less land than men. Since irrigated land is often used for cash crops and as a major source of collateral in developing countries, women's lack of rights to land prevents them from obtaining credit. Women's access to land, especially irrigated land, therefore needs to be improved. Other factors behind the higher incidence of poverty amongst women include the lack of appropriate technology, low participation in agricultural extension programmes and fewer educational opportunities than men receive.

In many developing countries women are responsible for generating food security for their families and therefore also play a significant role in national agricultural production. An untapped source of productivity could therefore lie in addressing gender disparities in agriculture (Brown *et al.* 1995). Also women's incomes tend to have a far greater impact on household food security than men's incomes. In order to improve women's incomes and thus nutrition, women need to have their own income-earning activities and should participate more in the identification of their needs and priorities and should have equal access to co-operative and credit facilities (Carr, 1991).

### **Employment-intensive construction — an example**

During the 1980s, a public works project in Borletar, Nepal, used employment-intensive construction practices to provide irrigation to all cultivable land in the project area. Production potential increased by over 300% and income by over 600% making a considerable contribution to improved food security. Total labour demand has more than doubled overall, for both men and women. The project reduced irrigation inequalities between farmers although inequalities associated with landholding size still remain (Martens, 1989).

## Recognition of poverty alleviation as a development priority

In the early 1990s, the World Bank (1990 & 1992) stressed the primary importance of poverty reduction. Further, in the International Year for the Eradication of Poverty, they published a report which recognized the links between food security, rural development and poverty reduction.

*“If we want to reduce hunger now, and assure food security for all in the future, then we have to implement a multi-pronged strategy with a focus on rural development. Raising the productivity of the rural poor attacks rural poverty, and also reduces urban poverty by reducing the price of food in cities” (World Bank, 1996).*

Their approach has been focussed on broad economic growth rather than specifically targeting sustainable livelihoods and has not been particularly effective in reducing poverty directly.

The World Development Report of 1990 proposed a strategy for sustainable poverty reduction based on economic growth and improved access to basic services. Since then poverty has been high on the development agenda; for example, a connection was made between poverty and sustainable development in Agenda 21.

*“The major objective of sustainable agriculture and rural development is to increase food production in a sustainable way and enhance food security. This will involve education initiatives, utilization of economic incentives and the development of appropriate and new technologies, thus ensuring stable supplies of nutritionally adequate food, access to those supplies by vulnerable groups, and production for markets; employment and income generation to alleviate poverty; and natural resource management and environmental protection” (UNCED, 1992).”*

The OECD proposed a vision of progress for development cooperation that set a target to reduce by one half the proportion of people living in extreme poverty by 2015 (OECD, 1996). This has also become the key focus of many bilateral development programmes, such as those of the UK Department for International Development, the Swedish International Development Assistance (SIDA) and the European Commission.

Poverty reduction and sustaining livelihoods have thus become the explicit goals of development in general and agricultural development in particular. IFPRI in their 2020 Vision Paper (1995a), placed poverty alleviation at the top of a list of reasons why agricultural growth and development should be vigorously pursued in low-income developing countries.

There are different frameworks for studying poverty and its reduction.

- The poverty line that estimates the income needed to provide basic needs. This framework helps in the analysis of incomes gained from irrigated production.



- Examination of the assets that poor people have, such as land, water, labour, tools, capital and social networks. Assets determine how people can gain livelihoods and fight impoverishment. Assets also lessen the vulnerability of poor people to natural disasters and economic shocks. Irrigation development increases income, provides access to water and reduces vulnerability.
- An assessment of inequality and injustice. The poor are often excluded from equal opportunities and equal rights. This in turn gives the poor unequal access to land and water, and often inequitable water deliveries.

## How irrigated agriculture can reduce poverty

Irrigated agriculture can be defined as agriculture where the supply of water is increased by artificial means, involving the use of water control technology and including drainage to dispose of excess water.

Analysis of information from Asia shows that yields per area, for most crops have increased by between 100–400% as a result of irrigation, (FAO,1996a). This has contributed to a reduction in food prices. For example the area under irrigation in India increased 30% between 1970–1985, from 31.1 million hectares to 41.8 million hectares, whilst food grain prices fell by 20% relative to the price index for all commodities. These reductions have had a positive impact on the real incomes of the urban and rural poor, who spend a large proportion of their income on basic foodstuffs. Hazell & Haggblade (1990) show that an increase of Indian Rs100 in irrigated agricultural output stimulates Rs105 worth of additional manufacturing output and Rs114 of additional tertiary output, a total non-farm multiplier of 2.19.

### Recognition of small-scale efforts

A cooperative of landholders and migrant squatters interested in urban irrigated agriculture emerged in Addis Ababa, Ethiopia. This co-operative claimed unused land on which both communal and private plots were developed for cultivation. Membership was open to men and women, and their respective households. They acquired assets for irrigation and marketing equivalent to some \$600/member. In addition to vegetables from their private plots, members received an average annual dividend of \$22 in the period 1985–1990. The irrigation cooperative made a significant contribution to vegetable supply in the city, being highly rated for both freshness and variety. The most critical outcome was to create a cooperative that could negotiate with other urban agencies, to gain legal recognition for their existence and by-laws. Previously, the urban government had no mandate to deal with agricultural organizations, which until then had been classed as “rural”.

### Benefits to people in irrigated areas

Irrigation brings a range of benefits to individuals and households that economists sometimes distinguish between *primary* and *spill-over* effects (Shah, 1993).

Primary effects

- Increased and more stable flow of income from farming made possible by increased intensity of cropping, improved yields and new farm enterprise / technology mixes.
- Appreciation of the value of land with access to water for irrigation.

Spill-over effects

- Increased and more evenly spread farm labour opportunities and improved wage rates.
- Reduced out-migration and increased return migration.
- Improved security against impoverishment.
- Lower food prices and better nutrition throughout the year.
- Growth in non-farm employment.
- Greater urban-rural contact and new social networks.
- More water for non-agricultural uses, including domestic uses that improve health.

Improvements in crop yields have been made possible by the development of hybrid and improved seed varieties, used in combination with good water control and fertilizer application. The best-documented effects of this are on wheat and rice, with the technology package known as the ‘Green Revolution’ which has helped transform output in Asia and parts of Latin America. Improved yields, through new varieties and improved water delivery, have also been promoted for a number of other irrigated crops important to smallholder irrigators, notably cotton, groundnut, citrus, maize, sorghum and potatoes.

Much of the initial development of irrigation was promoted with the aim of extending the benefits of irrigated agriculture to all farmers. However, it was recognized that making irrigation technology accessible to the poor is not straightforward. Thus much effort must be put into providing better services to the land-poor, to give them access to new technologies in irrigation water supply, seeds, fertilizers and cultivation tools, through credit and information services. While there have been special initiatives for agricultural research and development relevant to the poor farmer, there is still scope for further work.

### **Targeting the land-poor**

Development of irrigated agriculture benefits land-owning households in the first instance by increasing their incomes from gains in productivity. One challenge in promoting irrigation for poverty reduction is to specifically target the land-poor. The land-poor include those who neither own nor operate land, or whose major source of income is derived from agricultural wage employment, even if they own or rent small amounts of land. These programmes include:

- Employment-intensive construction, operation and maintenance practices.
- Approaches that allow the land-poor to own irrigation systems and sell water for profit.
- Settlement practices that allocate irrigable land to the land-poor when irrigation is introduced, or the water supply is extended.
- Rights of water use and appropriate technology for unregistered water users (such as squatters in urban and rural areas).
- Compensation and justice for dispossessed cultivators.
- Institutional reforms to give security of water supply to the poor in times of scarcity.
- Mobilizing small or marginal quality supplies to help disadvantaged rain-fed farmers.

## **The value of irrigation to small-scale farmers**

In Bangladesh groundwater irrigation set the scene for almost a three-fold increase in agricultural employment, from 138.8 million person-days in the period 1985–1990, to 356.1 million person-days in the period 1995–2000 (Pitman, p55 in Kahnert & Levine, 1993).

Irrigation in Africa is often highly valued by its users. Investigations by Chancellor & Hide (1997) at 12 small schemes in Kenya and Zimbabwe, where the average holding size varied between 0.5ha and 1.0 ha, showed that irrigation generally contributed 25–80% of total family income. The annual net income from irrigation per family farm was generally between \$150 and \$1000. Farmers appeared to have a reasonable standard of living and were able to cover the cost of school expenditures and health needs. On a few schemes they were making a good income from exporting vegetables to Europe via entrepreneurial businessmen. A further indication of the benefits from irrigation was that the extra capital in the area led to the establishment of small businesses in the vicinity, whereas rainfed agriculture did not generate sufficient revenue. Farmers normally have small irrigated plots, on which they grow food and cash crops, and larger dry land holdings further away for low-input food and forage.

Altat (1994) suggested that one of the biggest constraints to increased food output and rural development is limited uptake of new technologies by risk-averse small farmers. Higher productivity is associated with greater inputs and initial capital expenditure. In such circumstances, failure of a single harvest can cause a farmer to lose his land to moneylenders. Poor farmers, especially women, are usually unable to obtain credit from commercial banks for lack of collateral.

## **Targeting the land-poor — examples from Bangladesh**

Bangladesh has good examples of support to target the land-poor through improved opportunities to develop and operate a supply of water for sale. Initiatives by the non-governmental organization (NGO) Proshika and the Grameen Bank are well documented (Kahnert & Levine, 1993; Wood & Palmer-Jones, 1990). An inventory in 1992 showed that an initiative to assist groups of land-poor women has extended opportunities to over 1500 landless groups involving over 67 000 members. Of the groups, 27% were exclusively male, 3% exclusively female, and the rest were mixed sex groups where the aggregate proportion of women was 52%. The poor benefited most from loan repayment conditions allowing small regular instalments, which include an element paid for by crop-share with allowance for fluctuation in crop prices. Research showed that women were able to take up irrigation management effectively. This was best when there was a strong water-selling role and empowerment support from NGOs. Women living in male-headed households did not benefit if the group was weak and water selling was not a key aim. Outside water buyers reported female managers' performance to be similar or better than that of men. Both economic and social benefits accrued to women heads of households from involvement in irrigation enterprises, (van Koppen & Mahmud, 1996).

### **Benefits to the region and nation**

Irrigation development brings a range of potential benefits at regional and national level. It contributes to economic growth by generating export crops, reducing imports and thus saving foreign exchange and increasing home food supplies, which may lead to lower prices. The poor in general can thus benefit through a trickle down effect of lower food prices and more secure supply of food at reasonable prices. In many countries irrigation development has played a major role in eliminating food insecurity nation-wide.

Irrigation schemes often function as a development ‘pole’ in rural areas, where increased output and population concentrations attract additional services and infrastructure. Irrigated agriculture contributes to increased incomes from production and employment, so that families can gain access to schooling, health and welfare services, which are more likely to be present.

Irrigation also satisfies important political objectives in nation building. It opens remote or under-populated areas through new settlement schemes and thus facilitates closer political links with the rural population. It can reduce migration, or discourage unsustainable land use practices, such as pastoralism and shifting cultivation. Irrigation schemes facilitate closer political links between the rural population and local government although large developments may displace people.

### **Local initiatives**

Sengupta (1993) has argued that local forms of water mobilization and management should not be overlooked. In India NGOs are now working to revive use and management of tanks and kurtas. Equally, efforts can be made to produce irrigation components that are cheaper to produce, repair and manage. In Zimbabwe, Bangladesh and India, a number of designers and manufacturers have worked to produce simple pumps and motors for lifting water. According to Polak (1996) more than 600 simple and locally fabricated drip irrigation systems are operational in India and Bangladesh. The system has simple holes instead of expensive button-shaped emitters and a simple but effective cloth filter, to make it practical and affordable to install and maintain. In India, NGOs have developed designs for small storage structures which minimize the use of expensive off-site resources like cement or steel, but which still meet safety standards.

## **How to increase the benefits of irrigation to the poor**

To target poverty successfully it is critical that irrigation developers understand the environment where poor people live, the production preferences and opportunities of poor people and the real economics of irrigation development. The right choice of technology, for example by the design of irrigation systems, is also a critical success factor.

### **Living environment**

Irrigation schemes of any size can benefit the poor, though it is more usual to target poverty by developing small-scale irrigation using the following water sources:

- Lift irrigation to pump water from groundwater, rivers, lakes or dams. This is successful in areas of good recharge potential; however care is needed to avoid aquifers with lower recharge as small farmers are unable to afford deeper wells and more powerful pumps.
- Water storage structures or small dams to distribute water or promote recharge for subsequent use by crops.
- Small systems taking water from rivers or springs by gravity.
- Small wetland developments, where water levels are controlled through a layout of canals and cultivation beds.

Different water sources and hydrological environments give rise to a variety of conditions of water supply and water table control. Local institutions mediating water use will also be highly variable. For future smallholder irrigation development appropriate design-management approaches are needed. There are also prospects for large-scale systems to be managed better for the benefit of poor farmers, for example through participatory irrigation management. Poor farmers living side-by-side with large farmers can collaborate in initiatives to improve local water supply and agricultural production. Help to these farmers could include improving the quantity and timing of water supply, and support to promote better institutional management of water.

The relationship between the irrigation system and its catchment is also of growing importance as water becomes scarce. Understanding this physical interaction will support institutions that help local people plan and maintain the use of their water resources.

### **Financial and economic aspects**

Poverty is a major consequence of deteriorating or slow economic growth (Pandya-Lorch, 1994), but the FAO (1996a) points out that economic growth alone is not sufficient to stem poverty. Institutional rigidities and failures of the market may prevent the benefits of growth from reaching the poor. It concludes that the most effective way to achieve better income for the poor is to increase agricultural production. The World Bank (1996) indicates that rural economic growth is more significant than aggregate national growth in reducing overall poverty. Increased agricultural productivity leads to rises in rural income and employment and reduces the flow of labour to the towns, so that the wages of the unskilled and semi-

skilled urban workforce also rise. In consequence, demand for agricultural goods rises, stimulating further increases in production (Brown & Haddad, 1994). However, at some point unit prices may fall, with immediate benefits for the urban poor, but not for the rural poor. The best scenario is therefore an increase in overall income for the rural poor resulting from increased output at lower unit prices. In the right environment irrigated agriculture provides a greater opportunity than rainfed agriculture to achieve significant production increases.

Irrigation involves farmers making capital investments. When access to land and water is insufficient to support the household, the farmers often become involved in off-farm employment to survive, although access to irrigation remains highly appreciated by the family for sustainable livelihoods. Such conditions leave the smallholder vulnerable to bankruptcy if the water supply fails. It is therefore essential that the financial limitations of farmers and the risks and returns that are expected from the additional work involved in irrigated agriculture are clearly understood.

To ensure smallholder interests in irrigation the returns to investment costs need serious investigation. Traditional discounting methods militate against long-term sustainable development and neglect secondary benefits. Sound economic studies of technology choices can help make appropriate decisions about what kinds of technology and production to adopt. New economic approaches can look at different possible benefits from livelihood improvement, economic growth and stimulating local initiative in programmes. They thus help ensure that irrigation programmes are designed consistent with economic strategies that can bring poverty reduction. There are also initiatives in crop diversification, niche marketing and stimulating entrepreneurs that can tackle some of the common problems.

### **Production preferences**

Irrigation brings a range of potential changes in agricultural production. It can give more assured cropping and a more secure food supply for basic needs. This is often the priority of smallholder subsistence producers. Irrigation can change the cropping timetable to take advantage of good weather conditions or avoid periods with hazards like hail or heavy rainfall. Reducing or eliminating water deficits increases crop yields and crops are even possible in drought years, providing the water source is not completely eliminated. Irrigation can also provide a more secure supply of fodder for livestock and the quality of soils can be improved through leaching and drainage. Many of these options need to be given more attention in agricultural research and irrigation planning.

Irrigation can also increase output and value through intensification of cropping and innovation in crop choice. This is often the objective for development programmes. Such programmes increase production and therefore justify the higher production costs. Irrigation can extend the cropping season to allow multiple cropping, improve the quality of produce and permit new commercial crops and varieties to be grown. With irrigation the effects of fertilizers on the yields of new or existing crop varieties are enhanced and multiple farm enterprises with livestock, crops and agro-processing can be developed.

### **Appropriate technology and systems**

Poor farmers first seek to ensure their livelihood needs. Stimulus is needed to convince them to employ their assets in intensive agricultural production. Farmers have valuable information about what is needed in their environment, and what will work. Design processes that involve a participatory approach have brought real benefits to poor irrigators. More remains to be done in the future. Poor farmers are most likely to receive benefits when the technology to supply and convey water is affordable to develop, and easy to operate and maintain at low cost.

It is particularly important to poor farmers that systems are designed in such a way that water arrives reliably in time and volume. For example, protective irrigation systems spread water thinly to provide protection against drought to the largest number of farmers. The systems are fairly simple to operate, but they need strong administrative enforcement. On the other hand, irrigation systems focussed on production deliver the water according to crop water demands. Whilst they can give higher yields, they require more infrastructure for water control and are therefore more expensive to construct and operate. They also require more skilled staff, have higher maintenance costs and are more prone to breakdowns unless there is sound operation and maintenance.

Smallholders need systems that are capable of supplying small plots of land and holdings that may also be fragmented. To accommodate such land holdings some NGOs are now promoting low-cost, locally produced forms of drip irrigation. Small farmers may find it difficult to achieve high standards of land preparation or field layout when working with human labour or animal traction. Thus irrigation scheduling and water application methods that are consistent with their working methods and on-farm technology are more likely to succeed.

Giving access to irrigation equally to men and women can also reduce poverty. In The Gambia, Zimbabwe, Tanzania and Kenya, women's rights to hold irrigated land and control the distribution of produce have been shown to make significant differences in family nutrition and income of female-headed households.

Several programmes try to help recognition such as work by Denmark's Development Assistance in Kenya to study and validate farmers' practices to mitigate the effects of salinity on crop yields, and to install a cheap and easily maintained drainage system to control naturally occurring salinity.

Poor farmers also benefit when technology and awareness of environmental hazards and their control can be made available through locally appropriate communication messages. One example of health improvements through effective design and communications is found in schistosomiasis control. Work from Morocco and Zimbabwe has shown that design changes did reduce habitat sites for host snails. Working with health programmes was also important in changing water use practices of poor families dependent on canals for washing and food processing needs.



## **Strategies to reduce poverty through irrigated agriculture**

All or some of the interventions given below can help the smallest producers improve their own livelihoods and contribute to future food production. Successful uptake will depend upon the application of research on how irrigation can reduce poverty and on the awareness of good practices.

### **Invest in irrigation**

Continued investment in irrigation will be central to future food production. Rain-fed agriculture will not be able to keep up with the growing demands to feed increasing populations. The Green Revolution in Asia dramatically improved food production and security. India for example, has not faced a serious famine since the early 1960s. In this case, investment in irrigation was a key element of the strategy to increase food production and maintain stable prices for food crops.

### **Extend participatory irrigation**

By extending irrigation, increased production and employment can be created. Participatory design, sensitive to environmental and societal conditions, will be essential to prevent repetition of past weaknesses in irrigation development. Improved access to water by small farmers at a scale of development suited to the local conditions will be essential.

### **Involve small-scale farmers**

The involvement of farmers in the identification and design process and their investment in the scheme in terms of money and labour are essential to achieve sustainable development. In all cases support is needed to improve management and institutional structures so that poor smallholders benefit from reliable water supplies. An improved awareness of the interventions and initiatives that can sustain irrigation, both physically and institutionally, will be important to prevent impoverishment of small irrigators.

### **Increase opportunities for the poor**

Initiatives that involve the landless gaining access to the benefits of irrigation require greater exposure. New concentrations of the poor in peri-urban areas and regions where water resources are scarce and risk-prone need to be targeted. These areas may still be vital to providing a livelihood to families with few other opportunities. The poor also need to be able to defend their water rights in the face of competition from both larger farmers and from other sectors of water use. Support should be given to irrigation management organizations that promote equitable and efficient use of natural resources, both land and water.

**Promote and adapt affordable technologies**

Irrigation system designs that can bring workable and equitable water distribution in difficult and marginal areas, where the poorest live, are possible, but need much more attention. The challenge will be to make the technology affordable and easy to maintain, and ensure that irrigation systems can operate effectively and equitably under adverse hydrological regimes. Appropriate low-cost irrigation technology, including low-cost pumps, hose and drip systems and simplified drip systems, require further investigation and promotion.

**Irrigation can make a significant contribution to reducing poverty and increasing crop production. As a social good, irrigated agriculture is a vehicle for the provision of basic needs and the reduction of vulnerability to food insecurity. It is, and will remain, a vital activity in the livelihoods of many small producers who value the security it provides.**

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The International Programme for Technology and Research in Irrigation and Drainage (IPTRID) aims to enhance the standard of irrigation and drainage research and development in and by developing countries, giving due regard to the needs of the environment. Its main objectives are to improve technology and management in order to increase the production of food and agricultural commodities, enhance food security and assist in eliminating poverty. The programme focuses attention on four priority themes:

- Synthesising knowledge
- Building national capacity
- Formulating research and development strategies and programmes
- Networking.

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For further information about the IPTRID Programme please contact the IPTRID Secretariat at the following address;

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One of IPTRID's priority activities is to create awareness among the interested public and the professional community on irrigation and drainage issues, particularly on the positive benefits of irrigated agriculture. It is hoped that the reader will be able to better appreciate the role of irrigation and drainage and understand how such developments can be improved with minimal environmental impacts and maximum livelihood benefits.

*Poverty reduction and irrigated agriculture* is the first in a series of Issues Papers to be published by IPTRID. Topics to be covered in later papers include;

- Realising the value of irrigation system maintenance and
- Priorities for drainage

Publication of these papers will be announced in the IPTRID Network Magazine *GRID*, which is published biannually. Requests for *GRID* magazine and for copies of the issues papers should be sent to the IPTRID programme manager at the address above.



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