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Micro-scale irrigation in Africa

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INTRODUCTION

Food security is one of the highest priorities of rural development in sub-Saharan Africa. Variations in rainfall from year to year lead to conditions of food surplus being followed quickly by conditions of shortage or even famine. In some cases surplus and shortage may exist at the same time in one country due to the difficulty of transferring the surplus production to the areas where it is needed.

The development of irrigation has been seen as the means to reduce vulnerability to climatic variations. However, with the exception of Sudan, Madagascar and Nigeria, irrigated agriculture has a minor place in the economies of sub-Saharan African countries (ref 1). It has been estimated that in 1982 only some 20% of potentially irrigable land was actually being irrigated, whether under modern or traditional methods (ref 1).

Much of this irrigation is devoted to the production of cash crops, so reducing the impact on food security. The performance of many of the irrigation schemes has not come up to expectations (refs 2 & 3). This is in spite of considerable investment.

One reason for this failure of irrigation to live up to the expectations has been the reluctance of planners to acknowledge forms of irrigation not conforming to their definitions. A large area of irrigation, that of garden cultivation on dambos and similar wetlands, goes unrecorded in the statistics.

In Zimbabwe it has been estimated that this area may be in the order of 30,000 hectares (ref 4), and contributes significantly both to rural cash incomes and to food security. In Nigeria, it is reported (refs 5 & 6) that fadama (wetland) irrigation has increased almost seven-fold between 1958 and 1978. This is a far greater increase than that achieved in the formal sector, despite massive investment.

An analogy may be drawn with the field of environmental health through the provision of clean water and sanitation. It is now being accepted that conventional schemes,

with piped water, flush toilets and centralised sewerage systems, cannot serve the needs of most of the rural population in the foreseeable future. Hand-dug wells, simple pumps and, especially in Zimbabwe, Blair improved pit latrines are the accepted, appropriate and very effective means to achieving the end of improved environmental health.

While this type of informal small-scale irrigation, which we refer to as micro-scale irrigation, does not receive the recognition it deserves, policy formulation on food security and irrigation development will remain far from optimal.

BACKGROUND /CONVENTIONAL IRRIGATION

While formal irrigation schemes will remain important in sub-Saharan Africa it is useful to appreciate some of the factors which limit their widespread success.

Large scale conventional irrigation schemes often require a massive upgrading of the existing infrastructure. Roads may need to be built, housing provided and facilities such as health and education provided from scratch.

The cost of conventional irrigation development can be immense. An investment cost of US\$10,000/ha is considered standard with some schemes such as the Bura scheme in Kenya costing many times more, up to US\$50,000/ha (ref 3). While a large proportion of this cost takes the form of non-productive infrastructure, this infrastructure is necessary for the success of the schemes. It has recently been estimated that when investment costs exceed US\$6,000/ha none of the cereal crops can make a profit (ref 1), and high value crops must be grown. This leaves the problem of food security unsolved.

The demands of the market are notoriously hard to predict in advance. Where a demand exists the sudden entry of a new large scale scheme can have undesirable effects on those already supplying that demand.

In many cases, large numbers of people must be relocated to the new scheme. These

people need to be given the skills to participate in the schemes, skills that take a long time to acquire. Of particular importance is the fact that in Africa, women do most of the agricultural work and it is the men who are targeted in many of the large new schemes. Conventional irrigation is a high cost, high risk and very lumpy investment.

One solution to the problems encountered by the large scale schemes has been to promote small-scale schemes. However, in many cases the only small-scale element in these schemes is the size of the individual plots. While a scheme extending over only 80 hectares is indeed small compared to some of the large schemes the problems of co-ordination among a large number of users will still remain. The area under irrigation is not the only factor to be considered.

WHAT IS MICRO-SCALE IRRIGATION ?

Micro-scale irrigation has been around for a long time. A system of rice cultivation on dambos was described by Leask in 1867 as he travelled through southern Zimbabwe (ref 7). It has continued in Southern and Central Africa despite official lack of recognition and even prohibition (ref 8). Similar types of cultivation are widespread throughout Africa with the lack of recognition being emphasised by the dearth of statistics.

An example

As one travels through certain parts of rural Zimbabwe in the dry season, one frequently sees small gardens situated on dambos. Cultivation is by ox-plough or hoe and the plants receive water either through residual soil moisture in the early dry season or from a shallow well using watering cans and occasionally pumps.

A wide variety of crops is grown on these gardens, with staples such as rice and maize being grown in the wet season and vegetables for home consumption and for sale in the dry season.

Generally the plots are worked by individual families although there is often a lot of co-operation with their neighbours through the tradition of 'nyimbe'. This may take the form of shared labour at peak periods of the year or a collectively erected fence to protect the gardens from animals.

Recent research (refs 8 and 9) has

illustrated the potential for developing this resource. Until recently dambo gardens have been given little recognition and have often been prohibited by the authorities.

Objectives

The two main objectives of micro-scale irrigation as it is currently practised are:

(i) Food security for the individual or group involved and;

(ii) Income from the sale of produce. This income is often the only means by which the rural poor, particularly women can obtain cash for such things as clothing and school fees.

Main features

The main features of micro-scale irrigation are:

Control: is the single most important feature of micro-scale irrigation. Control is exercised as far as possible by the individual, family or group that does the work. This control covers cropping patterns, choice of technology, labour timing, marketing and use of income generated.

Investment Cost: is low. In assessing what is low, account should be taken not just of the strict financial viability of the investment but of the reduction in the need for food relief and the advantages of having a healthy food production sector widely dispersed in the rural areas.

Scale: The basic unit of the traditional micro-scale irrigation plot varies from a few hundred square metres to several hectares. In addition to unit size, the concentration of plots within any one area must relate to the ability of the existing infrastructure to sustain it. Traditionally the growth of micro-scale irrigation is limited by constraints such as lack of finance or markets. This means that when growth does occur it is sustainable, as it only occurs when conditions allow it. The scale is small and growth is organic.

Integration: Because micro-scale irrigation is firmly set in the local community, it fits in with local practices and capabilities. New developments must fit in with the existing situation and involve the local community as far as possible. In particular, they should fit in with the existing farming system. In these systems, labour is generally a scarcer resource than land and rain-fed agriculture will retain a dominant role in food production.

Water source: the water source in most micro-scale irrigation is small, localised and directly accessible to the user. This obviates the need for complex water management systems.

Technology The technology that is most likely to succeed is that which relates to those tools that are presently used, such as watering cans, simple hand-pumps, ox-ploughs and hoes. The value of indigenous technical knowledge and the dangers of imposed technology, not firmly rooted in local practices, are now being recognised (ref 10).

Present extent

Few figures are available for the extent of micro-irrigation in Africa. In Nigeria it has been estimated that 800,000 ha of wetland is under cultivation (ref 2). In Mali flooded rice is grown over an area of 80,000 ha in holdings of about 1.5 ha; in Sierra Leone about 30,000 ha of boliland is cultivated, with similar areas being utilised in Guinea, Burkina Faso, Cote d'Ivoire and Ghana (ref 10). In Zimbabwe dambo cultivation may account for between 10,000 and 50,000 ha with a provisional estimate of 30,000 ha (ref 4). In Tanzania, a wide variety of micro-scale irrigation is practised from the traditional furrow irrigation on the slopes of Mount Kilimanjaro to the mbugas (dambos) in the central plateau.

When looking at the total area cultivated it is important to keep in mind the fact that micro-scale irrigation, as with any form of irrigation, allows a more intensive use of the land than it is possible with rain-fed cultivation. On the dambo gardens of Zimbabwe two to three crops are often harvested in one year from the same piece of ground.

It is also important to have some idea of the number of people affected. Micro-scale irrigation plots are generally in the order

of one hectare. When one considers an area of 30,000 ha under micro-scale irrigation in any one African country one can appreciate the large numbers of people affected. In Zimbabwe cash incomes from larger gardens can reach US\$3,000 per annum (ref 8).

Finally, one must consider which people benefit. In Zimbabwe most people living near dambos have access to them. The dambo gardens are particularly important to women, and hence to family nutrition and food security.

Environmental Health

Irrigation projects can be serious health hazards and micro-scale irrigation is not exempt. However, in the case of dambos people are using a resource that is close to where they live and encountering hazards with which they are familiar. They are not be exposed to the type of new health hazards associated with large-scale schemes with large areas of open water, especially those involving extensive population relocation. In Zimbabwe a positive correlation was shown between the health of families and their use of dambos for micro-scale irrigation (ref 11). The important question is whether or not the improved nutritional and income status justifies the risk to health.

MICRO-SCALE IRRIGATION AND RURAL DEVELOPMENT

Fundamental to the promotion of micro-scale irrigation is its recognition not only as a desired end result but also as part of the development process. This process is most likely to succeed if it is a series of small steps where an assessment of success or failure can be made at each stage of the process. Thus sudden cultural or organisational change or quantum leaps in technology must be approached very warily.

Small scale irrigation is often viewed as a useful entry point to rural development (ref 10). However, given the successes of micro-scale irrigation, government encouragement or attempts to link it with other forms of development must be given or made with due recognition to the self-reliance and sustainability that are among its chief characteristics. The creation of dependency must, as far as possible, be avoided.

CONSTRAINTS AND NEEDS

Inattention by government, research and

funding agencies has resulted in a situation where a successful form of irrigation receives negligible consideration. It may appear that this inattention has been beneficial, especially in the light of the attention given to many large schemes and their lack of success. However there is a need for sympathetic attention, respecting the successes and addressing the real perceived problems.

Finance is never sufficient for farmers but there are special requirements for micro-scale irrigation. Large numbers of small farmers needing small amounts of finance can impose difficulties for the traditional financial institutions. This is especially so in the case of vegetable production where markets and prices can fluctuate sharply. Financing institutions such as community revolving funds or credit unions may be necessary.

Technology requirements include the need for improved water lifting devices (ref 8). Micro-scale irrigation deserves the same sort of attention that has rightly and effectively been given to appropriate rural sanitation.

Environmental Issues such as soil degradation and the impact on catchment hydrology must be addressed. This should be done using the knowledge and experience of the local community, who are often the only real experts on the likely effects of changes in land use, in addition to standard techniques.

CONCLUSION

In the context of rural development micro-scale irrigation deserves recognition for the role it plays in providing food security and incomes in sub-Saharan Africa. It should however be considered in conjunction with conventional irrigation and not simply as a replacement.

For governments and aid agencies, the promotion of a dispersed micro-scale irrigation programme involves low cost and an evolutionary growth. The risks involved are far fewer than those associated with large scale schemes, the failure of which can be disastrous to both finances and morale. The potential for micro-scale irrigation is very real and the rewards are already evident.

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