# The role of work oxen in swamp development in Sierra Leone

*by*

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## Abstract

*Sierra Leone is a net importer of its staple food, rice. Many programmes to increase rice production have been implemented with limited success. Present policies emphasize the development of inland valley swamps. Most farming in Sierra Leone is based on upland soils, with some cultivation of small portions of rain-fed swamps. The traditional methods of swamp rice farming have evolved over centuries, using no fertilizers, low management, long-duration rice varieties and minimal soil preparation. Some systems are based on transplanting, others on broadcasting.*

*Development agencies in Sierra Leone have tried to raise yields using an "Asian model" of swamp development designed to allow 2-3 crops per year. This system requires constructing a main drain, peripheral canals, regular plots, the complete levelling of the soil, very good water control, a steady supply of mineral fertilizers, high labour inputs, and a high level of management. The anticipated increases in yields in "developed" swamps have seldom been obtained by farmers, and reports are cited of local systems out-yielding improved swamps. "Asian model"-developed swamps are highly labour-intensive and labour shortages restrict efficient levelling and water management. Development agencies now consider that where swamp land is plentiful, increasing rice production by extending and improving traditional methods may be preferable to higher levels of development.*

*Traditional systems are not dependent on fertilizer and use local seeds, and as swamp land is readily available, labour is the main limiting resource. The use of work oxen could relieve the labour constraint. This would allow an increase in the area planted and also enable earlier planting, which has been shown to increase yields. Ox-carts could be used for transporting produce. Work oxen are appropriate for achieving improvements in traditional swamp cultivation because they are not dependent on fossil fuels, they appreciate over their working life, provide dung as a fertilizer, plows can be maintained by village blacksmiths and oxen can be successfully hired out within villages. In "Asian model" swamps work oxen can be also be utilized for plowing, levelling and puddling.*

*The utilization of work oxen in swamp farming exemplifies a technology that may be realistic, challenging, technically sound and appropriate. Techniques should be designed around the traditional farming system with the participation of farmers.*

## Introduction

The staple diet in Sierra Leone is rice. The country, once an exporter, now has an annual shortfall of 150 000 tonnes of clean rice. An increase of 270 000 tonnes of paddy rice would be required to meet this domestic demand.

Many rice farming programmes designed to increase rice production have been implemented in the past: the mangrove development (1930s - 1950s) and mechanical cultivation of the bolis and riverain grasslands (1950s - 1960s) are two examples. Since the 1960s, the Ministry of Agriculture, Natural Resources and Forestry has emphasized the development of inland valley swamps for rice production. Many aid agencies have participated in schemes designed to increase swamp rice production. These have included some large-scale initiatives funded by the Taiwanese and Chinese, and the small-scale inland valley

swamp development schemes of the 1970s, sponsored by the Integrated Agricultural Development Projects, the Peace Corps/Small Farmers Project and the World Food Programme.

At the request of the Ministry of Agriculture, Natural Resources and Forestry, the United Nations Development Programme (UNDP) and the Food and Agricultural Organization (FAO) of the United Nations initiated the "Inland Valley Swamp Rice Development Project" in September 1982. FAO is the implementing agency in conjunction with the Ministry of Agriculture, Natural Resources and Forestry. The project is now based at Moyamba town, in the Moyamba District of Sierra Leone and is operational in swamp development throughout the Moyamba District. Current activities include swamp development, agronomic rice trials, irrigation and soils analyses, vegetable production, World Food Programme, work oxen and power tiller programmes, and extension services.

## Traditional rice farming and the introduction of the "Asian model"

Although conditions vary, traditionally the mixed upland farm is central to the local farming systems. A mixed approach is used to minimize the potential disaster of a crop loss. In addition to their upland farms, 20-30% of the farmers work a portion of a rain-fed swamp for rice production (Knickel, 1984). The swamp farm is secondary to the upland farm, and is usually planted after the upland is completed.

The traditional method of swamp rice farming by hand involves brushing and clearing of the swamp in May or June. From this point, one of three methods of soil preparation and planting can be used:

- In the dry season the farmer may use a swamp hoe to make large mounds that incorporate weeds as green manure. These are planted with cassava or sweet potato during the dry season. After the first heavy rains, the mounds are dispersed and the soil is puddled for rice transplanting.
- The farmer may simply turn the soil with a swamp hoe, puddle roughly, and then transplant the swamp rice.
- The farmers may use little soil preparation, and simply broadcast their dry or pregerminated rice seeds.

Soil preparation and planting are usually completed by August, with all operations being done manually. Weeding takes place in September or October, with bird scaring in November and December. Manual harvesting, by the stem or panicle method, takes place in December or January. This traditional method of swamp farming uses little or no fertilizer, low management, long-duration, photo-sensitive rice varieties and minimal soil preparation. These farming systems with their particular methods of using swamps have evolved over centuries, and are based on the experiences of the farmers at their village level.

In the past, development agencies in Sierra Leone have attempted to raise yields through the exclusive use of the "Asian model" of swamp development. This model is based on maintaining strict water control. It involves a great deal of planned work in constructing a main drain, peripheral canals to redirect water flow, the formation of regular plots divided by bunds, and the complete levelling of the soil inside these plots. With good water control, short-stalked varieties can be used with mineral fertilizers, with the goal of two and possibly three crops of rice per year. This system requires very good water management, a steady supply of mineral fertilizers, high labour inputs, and a high level of management.

In theory, increased rice production would offset the high initial cost of the "Asian model", so that over a period of years the higher yields would make it economically attractive. The problem with the past use of the "Asian model" in Sierra Leone is that the anticipated increases in yields have not always been ob-

tained by farmers, because the development has often not been well carried out. Knickel (1984) reported that in the Moyamba area, slightly *higher* yields were found in traditional swamps (1.49 t $ha^{-1}$) than in "developed swamps" (1.37 t $ha^{-1}$). A variety of reasons can be given for this happening:

- The most significant difficulty faced by water-controlled farming methods is labour shortage. Sierra Leone is not densely populated, compared to many parts of South and South-East Asia. There is no large pool of landless or unemployed peasants willing to work as hired labourers (Richards, 1984).
- The design, layout and construction of "developed" swamps have often been carried out to inadequate standards (Richards, 1985).
- The improved technology of swamp rice cultivation requires timely and adequate supply of essential inputs to the farmers. Unfortunately, these inputs are frequently lacking or supplied late (Dingle, 1984).
- Farmers are not introduced to water management when swamps are developed (Knickel, 1984).
- Levelling is not sufficient in most developed swamps; it is highly labour-intensive, particularly where top soil is removed temporarily (Knickel, 1984).
- Emphasis in the past has been placed on rapid development rather than consolidation and maintenance. Practical or financial assistance has been provided for initial development, but no credit has been available to assist with the problems of maintenance.
- Sandy soil regimes are not conducive to intensive rice production. Their lack of water-holding capacity and their low clay content make fertilizer retention poor.
- One type of design (the "Asian model") has been used for all swamp types, whether they be perennial or seasonal.

Clearly the Asian model is not suitable for all conditions. In sandy soil regimes or seasonal types of swamps, the model has not performed as had been planned. For this reason, development agencies are now looking at different levels of development matched to the characteristics of each swamp.

## Extending improved traditional practices

An FAO workshop on small-scale swamp development held in 1984 gave the following as one of its recommendations:

- Clearly where plenty of swamp land is available (and only 80 000 ha out of the potential 3 000 000 ha in Sierra Leone is cultivated) there are strong arguments in favour of increasing rice production by extending and improving indigenous, traditional methods rather than proposing higher levels of development (FAO, 1985).

To increase production in this manner, more swamp land should be planted instead of increasing input and management levels. Reasons for this are as follows:

- Farmers will not be dependent on acquiring fertilizer and newer high-yielding seed rice.
- Farmers already have much knowledge of the traditional type of swamp rice farming.
- The traditional systems are less labour-intensive than those of the "developed" Asian model.
- With the traditional swamp systems, no permanent structures such as drains and bunds are developed, so that the traditional lack of secure land tenure is less of a problem.

Swamp land is not yet in short supply, and to extend the area planted in the traditional manner little or no fertilizer is used and seed rice is usually available. Thus labour is the only limiting resource, and so the use of work oxen may be encouraged to assist in the labour requirements.

Studies carried out at Njala University College demonstrated that human labour for plowing, harrowing and levelling was reduced from 567 hours per hectare for hand cultivation to 147 hr $ha^{-1}$ using oxen (Starkey, 1981). This is a substantial saving in labour and would assist in increasing the area planted, thus increasing production. In addition, the oxen would assist in the following areas:

- By helping to relieve labour constraints during the planting season, the use of oxen should allow more timely planting of swamp rice (in June and July) after the upland rice has been planted (in May and June). Early planting of traditional rice varieties in June and July yielded an average 1.47 t $ha^{-1}$ compared to 1.18 t $ha^{-1}$ for rice planted in August or September (Knickel, 1984).
- Possible assistance could also be provided to the traditional mixed upland farm for plowing, harrowing, weeding and seeding.
- Transportation of products using an ox-cart.
- Regular plowing aids water retention, by creating a "pan" in the sandy swamp soils.

Production can be increased by planting more swamp land in an improved traditional manner, rather than increasing management inputs. Constraints to production at all levels are more often due to labour that land (FAO, 1985). Labour, the biggest obstacle, is reduced by the use of work oxen.

## The merits of work oxen

In September 1985, an FAO seminar was held at Njala University College to explore the issues surrounding the use of work oxen and power tillers. It was considered that work oxen were more appropriate because:

- The oxen are not dependent on fossil fuels for operation. Availability of fuel, together with its cost, presents a problem for operation of power tillers.
- Spare parts for ox plows are manufactured in the country and are available, while power tiller spares must be ordered from overseas using foreign exchange.
- Many village blacksmiths can repair plows, while the power tillers need special attention by trained mechanics.
- Work oxen have a much lower running cost ratio than power tillers (Kanu, 1984).
- Work oxen appreciate over their working life while power tillers depreciate.
- With the high price and unsteady supply of mineral fertilizer, the use of oxen dung as a fertilizer can be of great assistance.
- Additional income can be earned by the hiring out of oxen at the village level.

Certainly the debate concerning animal traction and mechanization will continue, but the point must be made that they are not mutually exclusive. In some areas power tillers may be appropriate. However in the current economic situation and considering long-term national development goals, work oxen seem more appropriate for achieving the desired improvements in traditional swamp cultivation at the village level.

## Conclusion

Swamp development is continually evolving in Sierra Leone. We have learned from the past, and as a result, we are now targeting levels of development to each unique swamp. The "Asian model" can be implemented in appropriate swamps through the techniques of contour bunding, and additional knowledge of the soil regime. In the "Asian model" work oxen can be utilized for plowing, levelling and puddling. However, in areas where the swamp does not lend itself to full development, an improved traditional method of swamp farming can be used.

A recent FAO report stated that an improved technology has to be realistic and challenging. It has to be technically sound and appropriate under the given conditions. It should be designed around the farmers and their traditional farming systems, ideally with the participation of the farmers themselves (Knickel, 1984). The

utilization of work oxen in swamp farming exemplifies such a technology.

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