# Reduced ridge system to improve productivity and weed control: trials in Nigeria and Tanzania

*by*

**A R Stokes**

*Project Equipment Ltd, 44 Aston Way, Oswestry, Shropshire , SY11 2XY, UK*

## Abstract

*With the power available to the small-scale farmer, the limitation on the amount of land that can be worked is governed by the narrow cut of the mouldboard plow. Ridging offers a solution to this limitation. However, in Nigeria, farmers who practise ridging are at a disadvantage as they cannot split the ridges until the ground is thoroughly wet. This results in late planting and increased weed problems. A reduced ridge system can overcome this constraint. However, this system requires a special multi-purpose implement. Preliminary trials in Nigeria and Tanzania indicate that reduced ridging can be an effective method of weed control that also takes less time than traditional methods.*

## Introduction

The vast majority of subsistence farmers in Africa cultivate and harvest using the hand hoe. However, increasing numbers of small farmers are hoping to enlarge their farms and boost their output by employing draft animals to cope with the heavier work.

There are basically two systems of cultivation available to upland farmers: planting on the flat or planting on the ridge. Both have their advocates, but if productivity is to be increased, a detailed analysis of both methods needs to be carried out and, if necessary, special implements designed to take advantage of any savings possible. These are the lines along which the writer has worked over the past thirty years, both in research and industry.

Implements have been developed to serve the needs of African farmers. However, it is the way in which these implements are used that is the key to their success. This is true especially if the farmer's family is small and insufficient to cope with weeding problems by hand labour alone.

Weeding is the major constraint to a small-scale farmer's efforts to increase productivity through mechanisation: with plowing and planting taking up so much time at the start of the rains, the first weeding of early planted grains is often severely delayed. When it does take place, the weeds are so large that mechanical weeding (which is most effective at the two-leaf stage) fails to kill them and they become re-established if the soil is wet. The problem is eased if the weeds can be carried off the field, but at this time of high workloads the farmer does not have time to do it.

It is logical, therefore, to aim at easing the problem by using methods which delay the growth of weeds for as long as possible. Tractor-using farmers in Europe may do this by pulverising the soil and planting immediately. Most African farmers have only a narrow-cut single-furrow plow to work with. These vary considerably in their efficiency. It is essential to bury the weed seeds remaining on the surface from the previous season as deeply as possible thereby delaying the time taken for these weeds to compete for water and nutrients.

Plowing, however, is a very time consuming operation, especially if small plows, suited to the power of a pair of small oxen (or increasingly donkeys) are used. Traditionally, in eastern and southern Africa, the larger maize farms employed plows with cutting widths of 255 or 305 mm. These were pulled by teams of four to six oxen. Smaller scale farmers cannot afford the cost of such teams. In medium or heavy soils an average pair of oxen cannot pull this size of plow at the depth required for efficient weed coverage. A team of two or four donkeys will also be unable to control weeds with such plows.

## Ridging

With the power available to small-scale farmers, the amount of land worked may be limited by the narrow cut of the mouldboard

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plow. Making ridges can be quicker than plowing, farming on ridges can be an attractive proposition. This technique is used widely in northern Nigeria, where the mouldboard plow is virtually unknown. Soil tillage is done by Emcot-type ridging plows.

In Nigeria, the usual power source is a pair of oxen or bulls. Because of the high power requirement of the wide-share ridger the farmer's animals tend to be large and powerful. In already established fields in Nigeria, farmers tend to split the old ridges used in the previous season and form new ridges on the site of the old furrows. This can only be done when those ridges are thoroughly wetted. Consequently, the ridging plow cannot be brought into use until the rains are well established, by which time the weeds have already taken hold.

The hand-hoe farmers clear old furrows of weeds and then plant their millet and sorghum into these furrows after the first rains; this concentrates the water into the area of the seeds, ensuring survival of the germinated seeds even though no further rain may fall for a week or more. If they had planted on the ridge top at this time the seedlings would have died. In this way the early grains are planted at a time when the surviving plants can grow on through the whole of the rainy season, and so achieve maximum yield. As the young plants grow, the old ridges are gradually moved around the plants until harvest when the ridges are full sized. The animals and the ridging plow cannot be used with this system as the animals have nowhere to walk. The animal-using farmers are therefore at a disadvantage, as they have to wait a further 2–3 weeks until the ridges are wet enough to split. They are then able to plant on top of the new ridge, but too late to ensure maximum yield.

There are other drawbacks to the practice of splitting ridges which come about due to the farmers' reluctance to use more than one yoke on their oxen. The yoke they use is spaced for remoulding ridges, ie, the oxen walk down furrows 1 and 3 whilst the ridger works in furrow 2. When trying to split the old ridge situated between furrow 1 and 2 the draft line is incorrect and the ridging plow has to be leaned over to get it to enter the ridge. The Emcot ridging plow is not fitted with an offset hitch. Even if it were, the degree of misalignment is such that the ridger could still not be used upright, and this leads to poor inversion of the soil forming the new ridge. The end result is that the new ridge is inadequately formed. There is a depression at the centre instead of a peak, out of which appear the germinated weeds from the old furrow. These weeds compete immediately with the crop seeds planted on the ridge top, leading to an early weeding requirement. This cannot be weeded mechanically and therefore has to be tackled by hand hoe.

During the crop growing period, weeds in the furrow are controlled by using the ridger to build up the ridges until such time as the taller grains are too tall to allow the oxen's neck yoke to pass. A narrow yoke, similar to that used for plowing in other countries, as an addition to the wide yoke already used by the farmer, would allow ridges to be split correctly. A wide yoke with alternative holes for the descending pegs could achieve the same result. However, such apparently simple solutions have not been widely adopted by farmers in Nigeria.

Apart from the above problems, which are easily soluble, the potential to cover a much greater area of ground using a ridger, (900 mm per pass) instead of a plow (say, 150 mm per pass) are obvious. Providing an effective method of weeding the furrows is available, ridge farming offers much more productivity per worker.

## Reduced ridge system

There is a system that would allow the farmers using animal power to plant millet and sorghum as early as a hoe-using farmer. This also extends the working period of the animals over a greater proportion of the growing season.

I call this the reduced ridge system. Its implementation requires a multipurpose implement which could replace or supplement the existing ridger. The multipurpose implement I have designed is called the Unibar. This implement is more expensive than a ridging plow. However, it has the potential to ensure that crops are planted on time. Also, by extending the cultivation operations into the dry season (when there is less urgency) the system should extend the area which can cultivated by a farmer.

The reduced ridge system calls for the ridges to remain in place for three or four seasons. At harvest time, usually in the early dry season, the tall stalks of millet, sorghum or maize are either pulled up by hand or cut off by machete

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at ground level. They are then carried off by hand or ox cart to the edge of the field, where the heads or cobs are removed when fully mature. Next a flat share-type furrow-weeding tool is drawn down the furrows, removing any existing cross-ties and at the same time scraping off the weeds growing in the bottoms and on the sides of the furrows. As there is no rainfall these cut weeds will quickly die and can be carried off the field at the farmer's convenience. When cleared, the same furrow-weeding share is attached to a groundnut-lifting bracket is drawn down the ridge. The depth of work is controlled by wheels. The narrow yoke recommended for ridge splitting is used. The share will remove half of the ridge (and lift a crop of groundnuts if that was the crop) and dig out any remaining roots of the cereals. After the lifters pass, the ridge will be left with a concave shaped depression. Most lifted roots lie in the furrows, from where they can be retrieved at the farmer's convenience.

The ridges are left in this state over the dry season and until the start of the next rains. Then the farmer plants into the centre of the reduced ridge, either by hand or machine. As the planting area is relatively free of weed seeds the germinating crop seeds can grow on virtually free from competition from weeds. The concave shape of the consolidated ridge will concentrate rainfall into the area of the seeds in the same way as the hand farmer planting into the furrow. The reduced ridge is then rebuilt gradually by use of the same flat share, now refitted to the weeding/cross-tying bracket. The share spills soil from its sides, and, by adjusting the slope of the share, cross-ties can be built at the same time, This helps to ensure that the early rains remain where they can do the most good to the crop.

## Trials in Nigeria and Tanzania

Trials have shown that the sharpened flat share is more effective at scraping weeds from the furrow sides than the normal ridging body. The ridger tends to cover weeds but not uproot them, checking, but not killing them. The writer was able to try out this system in the 1961/62 season at Samaru Research Station, Nigeria. The system proved remarkably effective at preventing weed competition in the early stages of crop growth (millet and groundnuts). However, the author does not have yield data from the Nigerian trials. The multipurpose tools with which to implement such a system are now commercially available. These implements and the reduced ridge system could lead to increased productivity among farmers using animal power. No doubt fertilisers would need to be applied over the four-year cycle, after which time the ridges could be split in the way suggested earlier and the cycle re-established. Productivity data from a test report on performance of the Unibar in Tanzania in 1969 are presented in Table 1.

**Table 1: Work times (person-days/ha) required for land preparation and weeding under different systems of cultivation at Ukirirguru, Tanzania, in 1969**

| *Operation* | *Flat cultivation (days/ha)* | *Hand ridging (days/ha)* | *Ox plow and ridger (days/ha)* | *Unibar First year (days/ha)* | *Unibar Subsequent (days/ha)* |
|---|---|---|---|---|---|
| Ox plowing | 10 | – | 10 | 10 | – |
| Split ridging | – | – | – | – | 2.5 |
| Ridging | – | 50 | 2.5 | 2.5 | 2.5 |
| Tie-ridging | – | – | 10 | 2.5 | 2.5 |
| **Total for land preparation** | **10** | **50** | **22.5** | **15** | **7.5** |
| Unibar weeding | – | – | – | 5 | 5 |
| Hand weeding | 65 | 37 | 37 | 20 | 20 |
| **Total time for two weedings** | **65** | **37** | **37** | **25** | **25** |

*Work-days relating to animal power are based on data for cotton growing at Ukiriguru using two oxen controlled by two people. Estimates for hand weeding based on local farming systems surveys. Data from unpublished report of Alan Scaife, Ukiriguru, 1969.*

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## Conclusions

Farmers in Europe overcome early weed problems by pulverising their soils in a short time and then planting quickly in order to give the crop a head start. They are able to do this by calling on massive power to carry out a multiplicity of operations. As the rewards are good and heavily subsidised, there is money for such mechanisation.

Farmers in Africa are in a completely different situation. Fields are small, often with no access for tractors. The farming systems are designed to achieve basic subsistence, with surpluses that can be sold in local markets. Prices are poor and no subsidies are paid. The single-purpose plows and ridgers available to the animal-using farmers tend to be superimposed onto hoe farming methods instead of having a cultivation system built around them. If tropical soils were treated to the same intensity of cultivation as are European soils they would either wash away or be blown away. Systems have to be devised which take these factors into account. With the planting window for optimum yield relatively short, using equipment at its maximum efficiency is essential. The design of such equipment needs careful thought and each solution may require its own machine. It is the job of agricultural engineers to provide those machines, even though they may cost a little more. Persuading farmers to accept them, however, may take some time!

This paper describes a system which was devised at a time when the equipment to carry it out was not available, except in experimental form. Now that it is, it may be worth a second look. Visits to Nigeria in the 30 years since the system was devised have shown that the number of animal-using farmers has increased dramatically. However farmers have not changed their methods, and there is still scope for increasing their productivity.

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