Draught Animal Power For Smallholder Wheat Farming

Modification and Development of a Yoking System and Implements to Suit Planting and Weeding Operations in Wheat Production

SUA-NORAD FOCAL PROGRAMME

Draught Animal Power For Smallholder Wheat Farming

Modification and Development of a Yoking System and Implements to Suit Planting and Weeding Operations in Wheat Production

---

SUA-NORAD FOCAL PROGRAMME

Prepared by:
Dr. A.A.O. Aboud
Eng. S.A.Mkomwa

Mr. A.M. Elanga
Mr. R. Mwakimbwala
Dr. S.H.Israel

ISBN: 9987-8949-2-5

Published by:
Future Opportunities and Challenges in Agricultural Learning (FOCAL) Programme
Programme for Continued Norwegian Support to SUA for 2002-2006
Sokoine University of Agriculture
P.O.Box 3151Morogoro

Programme Publication Number: FOCAL 5-2005
MAY 2005

TABLE OF CONTENTS

1.0 Introduction

The Future Opportunities and Challenges in Agricultural Learning (FOCAL) is a NORAD funded project coordinated at Sokoine University of Agriculture. The primary mission of FOCAL is to support farmer's efforts towards poverty alleviation through use of proven technologies. In this regard FOCAL supports scientists in all allied fields of agricultural science with the view to facilitating transfer of technologies to the farmers. It is the FOCAL's working policy that technologies to be transferred should be those sought by farmers. At Kisilo farmers have a long tradition of growing wheat. However, wheat has remained a marginal crop coming third after potatoes and maize. The main reason for this is low yield and back breaking labour intensive husbandry practices associated with wheat farming. Having noted the advantages of draught animal powered technologies introduced at the village by the TARPII-SUA project, farmers noted opportunities that could be applied on wheat production. Thus, a request was made to scientists from Sokoine University of Agriculture (SUA) and Agricultural Research Institute- Uyole (ARI-Uyole) to help in adapting for wheat farming animal powered technologies that were originally designed for maize and potatoes. FOCAL supported the request via an intervention grant titled: ***Modification of yoking system and animal drawn implements for planting and weeding operations in wheat production at Kisilo village.***

2.0 Small holder wheat farming in Tanzania

It is estimated that Tanzanians consume approximately 4 kg of wheat per capita per year. Local wheat production is estimated at between 85,000 to 110,500 metric tonnes per year, most of which comes from large-scale mechanized farms in northern Tanzania. Annual domestic demand for

wheat exceeds local supplies. Wheat imported to supplement local production for the past six years (1998-2004) stood at an average of 12,000 metric tonnes per year.

Smallholders on plots rarely exceeding 0.6 hectare grow nearly all the wheat from the southern highlands zone. In 1997/98-season Iringa region produced nearly 36% of the total local wheat production (39,700 of 110,000) from about 36,100 hectares. In the southern highlands wheat is generally regarded as a "lady's" crop and little investment is directed to it at family level. The average yield is estimated at 1 ton/ha. Scientists at ARI-Uyole have identified several factors contributing to the low production in southern highlands, poor husbandry being the uppermost reason for the low yields. Broadcasting and late or no weeding in wheat fields are common husbandry practices in the southern highlands
Despite the low yields, wheat is still regarded by farmers as an important food and cash crop.

Opportunities
Inputs for wheat production cost just about a half the value of inputs needed for maize (i.e. 50kg N/ha vs 100kg N/ ha.; only one weeding session for wheat). The current yield levels for wheat produced at Kisilo without any use of fertilizer is approximately 1 ton/ha. The corresponding yield for maize planted without fertilizer is also 1ton/ha. At current prices (2004) the value of wheat exceeds that of maize by Tsh 75/kg.

The soil and climatic conditions in the southern highlands are generally suitable for rain fed wheat production.

Researchers at ARI-Uyole have produced high yielding disease resistant wheat varieties. Farmers in the southern highlands already have a good working knowledge in the use

of draught animals in maize production. With some innovations it is possible to extend the use of draught animals into wheat farming.

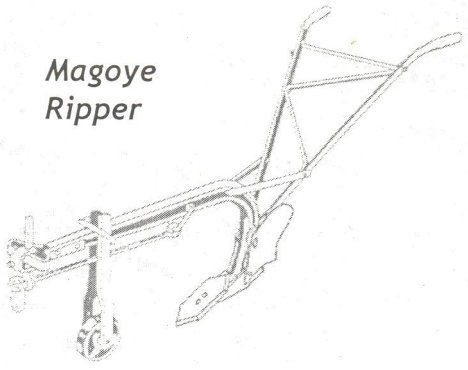
3.0 Constraints in wheat production

- The traditional methods used by farmers limit wheat production. Planting by broadcasting is wasteful, promotes un-even plant spacing.
- The local varieties used are low yielding and prone to foliar diseases.
- Broadcasted fields necessitate labour intensive hand weeding, offers no opportunity for mechanical weed control.
- Hand pulling of weeds is ineffective, enhances weed competition and reduces yield.
- Harvesting is difficult on broadcasted fields.
- The traditional plough can be used only for the tillage operation, not for weeding.
- Farmers are not informed on alternative animal powered technologies for planting and weeding.

4.0 Improving yield and labour productivity in wheat production

Two most limiting factors in smallholder wheat production are low yields and high labour requirement. The former is largely due to the use of poor varieties and improper husbandry practices. The later arises from the farmers' lack of knowledge on alternative power sources that can greatly enhance labour productivity. In sections 4.1- 4.4 two types of labour saving implements are described.

4.1 The Magoye Ripper



Magoye Ripper

Magoye Ripper is a single tine implement used for opening planting furrows on either ploughed or unploughed fields. The implement may be drawn by a pair of oxen, donkeys or even a single ox depending on the soil type. It has the advantage of being able to penetrate dry soils making it possible to complete primary operations well in advance of the rains. The furrows so made are of the right depth and at correct spacing for seed and fertilizer placement. This gives the advantage of completing three operations at once where the operator is helped by assistants following behind to drop seed and fertilizer as the furrows is opened. The ripper also improves effective water infiltration and helps *in-situ* water harvesting.

4.2 Benefits of Magoye Ripper

The use of Magoye ripper on wheat has the following benefits:

- ♣ Enables the farmer to complete field preparation in just a third of the time needed to do the same operation using the traditional mouldboard plough.
- ♣ Ripper furrows allow easy seed placement and effective fertilizer utilization promoting vigorous growth and higher yield.
- ♣ Planting in rows avoids seed wastage common with broadcasting.

- Planting in rows allows weeding using ox drawn implements.
- Wheat planted in rows is easy to harvest.
- Ripper furrows help in moisture penetration and *in-situ* water harvesting.
- Rippers can be used in minimum tillage thereby helping in soil conservation.
- Opportunities with other crops:

Magoye ripper can be adjusted to suite row planting of maize, sorghum, beans, finger millet, and bulrush millet, sunflower and upland rice.

4.3 How to use the Magoye Ripper

4.3.1 Choosing the crop spacing

Having decided on the type of crop the farmer wishes to grow, the farmer then defines the right spacing for the crop. The recommended wheat spacing for smallholders to facilitate hand hoe weeding is 40 cm between rows. Spacing within the row is not important here. For elaboration, the 40 cm spacing is adopted throughout this booklet. Experience has shown that with this spacing, wheat grows more vigorously, yields well and ox weeding can be done more effectively. The next step is to get a yoke that would suite the required spacing.

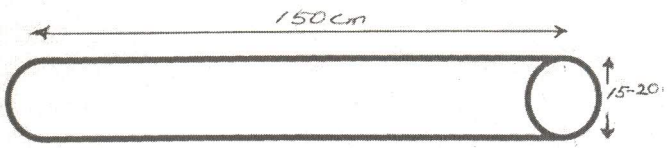
4.3.2 Making the yoke

For a 40 cm spacing the right yoke shall be 80 cm between the oxen (Figures 1- 3).

Steps in yoke making:

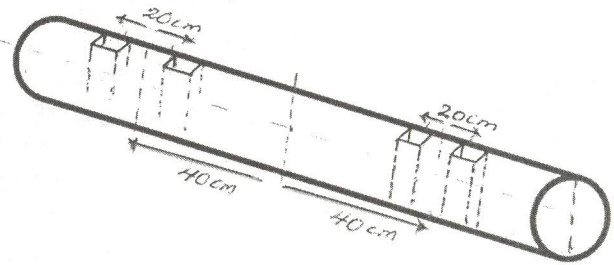
1. *Choose a roughly rounded log, making sure that it comes from a non-splint durable type of timber, and has no cracks. It should be 150 cm long and 15-20 cm thick.*

Figure 1. Choosing the right log



2. *Shape the log to a rounded smooth finish. The final size should be 15 cm thick.*
3. *Mark the central point of the log (75cm). From this central point, measure 40cm on either side and cut a mark.*

Figure 2. Marking the log centre, the distance between animals and drilling *Skei* holes

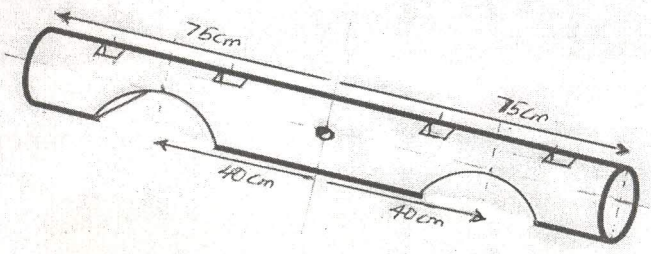


4. *At the 40 cm point, mark off 10 cm on either side and drill square holes at these points, i.e. 20cm apart. These are holes for skeis. The skeis are made from logs measuring 45 cm long and 10cm thick.*

5. *Between the two skei points on either side of the log, notch off the underside of the log to make room for the neck of your oxen*

6. *At the 75cm point drill a diagonal hole pointing upwards from the rear side of the log. Insert the hitching ring. The Magoye ripper will be attached here using a drag chain.*

Figure 3: Completing the yoke by notching between *skeis* and drilling diagonal hole



With the measurements given above, the two oxen when yoked shall be 80cm apart. When one ox walks on the furrow, a second furrow is opened at a constant spacing of 40 cm.

Plate 1: The Magoye Ripper in use for opening furrows for wheat planting.

Plate 2: A field planted with wheat in rows opened using the Magoye ripper

4.3.3 Implement adjustments

In addition to the spacing between rows, it is important to open furrows of the right planting depth for the crop. To achieve this, adjustments can be made in two ways:

(a) Increasing the length of the drag chain - this will allow opening of deeper furrows. The converse is true for shallower furrows.

(b) By shifting the hitching point up or down, depth can be adjusted for deeper or shallower furrows respectively.

Plate 3: Adjusting furrow depth by shifting the hitching point

4.4 The ox-drawn cultivator

An ox-drawn cultivator is an implement used for weeding. There are various types of cultivators. In common use in Tanzania are rigid duck-foot, Earthing-up tines and spring tines (Plate 4). On all cultivators, tines are mounted on either fixed or adjustable tool bars.

Plate 4: Different types of cultivators (a) Earthing-up cultivator (b) duck-foot cultivator

(a)

(b)

The ox cultivator can help the farmer to minimize the labour cost of weeding. It has been shown that weeding takes as much as 70% of total labour requirements among smallholders. It is for this reason that many farmers are unable to increase their farm acreage. With the ox cultivator, a farmer can complete weeding one hectare of wheat field in just 2.5 days instead of 15 days when hand hoe is used.

4.4.1. How to use the ox-drawn cultivator

Row spacing will determine the yoke size. For wheat planting at 40cm row spacing, the yoke size should be one on which the oxen will be 80 cm apart. This means the farmer can use the same yoke as described in section 4.3.2.

Plate 5: Using animal drawn cultivator for weeding a wheat field

4.4.2. When and how often to weed?

Under southern highland conditions, wheat needs only one weeding. This is done four weeks after crop emergence. If necessary, this is also the time for application of blue copper to correct copper deficiency. Three weeks later, fungicides can be applied where necessary.

In order to stop the oxen from eating the crop during weeding, small reed or rope woven basket can be used to cover the muzzle during work (Plate 5). The basket must not be made from materials that can injure the oxen. It should be fitted well over the muzzle allowing sufficient room for breathing freely.

ISBN: 9987 8949 2 5