

Design and manufacture of a withers yoke for zebu oxen and cows

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Abstract

Poorly designed yokes are commonly used in Malawi, often resulting in injuries to, and poor performance of, draft animals. This paper discusses the design criteria for effective yokes and concludes that the most important criteria are that: the design and materials should be simple, permitting artisanal manufacture; the cost be within the financial means of the intended users and the yoke should be comfortable for the animal. The different lengths of yoke required for plowing, ridging and transport are discussed. The paper details the design of a wooden yoke for zebu cattle that fulfills these design criteria.

Introduction

The word yoke means a wooden cross-piece fastened over necks of two oxen or other draft animals and attached to the implement or cart that they are to draw. A yoke links two draft animals to each other more rigidly than single (collar) harnesses. There are many types of yoke depending on the animals for which they are designed and the materials available for making them. The wide range of yoke types can be divided into two main categories, those tied to the horns of the animal (head yokes) and those taking power mainly from the withers (withers yokes). The withers of an animal refers to the part of the back that is over the shoulders directly above the first thoracic vertebra. The zebu cattle (*Bos indicus*) used in Malawi have their withers immediately in front of the hump (Starkey, 1989). Both types of yokes are used in Malawi. The most common yoke is the withers yoke but in forestry operations the head yoke is used extensively. Head yokes that are securely fastened can facilitate braking when going down a slope and when reversing. However, head yokes restrict the freedom of movement of the neck and head so that the animal has difficulty in warding off flies (Vieberg, 1982) and the string

used for tying the yokes may create sores around the horns. It has been argued that yokes which definitely restrict side-to-side movement of the animals are undesirable.

In Malawi there are many examples of poorly designed yokes. Common problems include:

- yokes that are too short, making the animals bellies touch when hitched
- too narrow a space between the skeis so the animals' necks are squeezed
- skeis too short so the animals are almost strangled
- clamp holes drilled wrongly so the yoke rolls backward making the skeis point forward or the yoke rolls forward making the skeis point backward.

This paper describes the manufacture of a good withers yoke for two animals.

Design criteria for yokes

The common yoke used at present in Malawi consists of a round pole, four skeis and strings (also known as strops). According to Vieberg (1982), a good harnessing system should:

- not hinder the animals' natural movements, breathing and blood circulation, this being of particular importance for efficient power transmission
- permit reliable control and directing of the animals
- not injure animals or cause pain
- be as simple as possible to fit and remove
- be easily adjustable to fit the animals
- permit braking
- be of simple design and permit local manufacture.

be inexpensive to enable farmers to obtain several yokes suitable for various types of work.

The most critical parameters for a good yoke include:

- the design of the yoke should be simple enough to enable farmers and rural artisans to make them in rural areas from materials available locally
- the cost of the yoke should be within the financial means of the users
- the yoke should be comfortable to the animals but at the same time durable to withstand the forces and the weather
- the yoke should have a large and smooth contact area with the animals because a small or uneven area concentrates the force, often resulting in sores at the contact point.

The withers yoke is better for zebu cattle because they are not sufficiently strong necked to use head yokes. Vieberg (1982) recommended that if a withers yoke is used each animal should always be harnessed on the same side so they become adjusted to work on their side through training and corresponding muscular development. When plowing, the right hand animal will become used to moving in the furrow and the left hand animal will become used to walking on the hard ground. The stronger animal should be harnessed on the right for plowing because it has to walk on freshly plowed ground with soft soil and thus has to work harder to provide the same amount of traction as the animal moving on the hard ground.

Neilson (1970) tried to develop several improved yoke types for oxen at Bunda College, University of Malawi. Unfortunately he used metal pipes and chains which are expensive and not readily available in rural areas. The same author later concluded that steel materials should be replaced by wood to reduce the cost and enable manufacture by rural artisans.

Methods of yoking

There are various types of yokes and individual harnesses and their regional distribution in Africa is probably based on several factors including:

- influence of colonial settlers

- availability of animals for example where there are many animals more tend to be yoked at once (eg Botswana)

- soil type

- type of equipment used

- the traditions that have been passed from generation to generation.

Yokes have major control on the output of draft animals. In Malawi three types of yoke are common: the plowing yoke, the ridging yoke and the transport yoke.

Plowing yoke

To reach the optimum depth and width of cut when plowing high draft power is required so the animals should be yoked close together. On a plowing yoke the animals should be placed 90 cm apart (centre–centre) on the yoke shaft. The traction chain should be at least 2.9 m long. If the yoke is too long (animals >90cm apart) a strip of unplowed land will be left at the centre during plowing, and if the yoke is too short (animals <90cm apart) the share cuts a narrow slice of unplowed land. This means that it will take more time to plow a given area of land.

Ridging yoke

To produce evenly spaced ridges the distance between the centres of the animals on the yoke shaft should be twice the desired ridge spacing. The recommended ridge spacing for most crops in Malawi is 90 cm so draft animals should be spaced 180 cm apart (centre–centre) on the yoke shaft. If other ridge spacings are required the yoking position should be adjusted appropriately. For example, if one requires a ridge spacing of 120 cm for tobacco then the draft animals should be 240 cm apart on the yoke shaft.

Transport yoke

The design of a transport yoke is based on the type of carrier to be pulled. The distance between the animals depends on the wheel track of the cart to be used. The wheel track is the distance between the centre of one wheel to the centre of the opposite wheel. This means that animals pulling a cart using a correctly designed yoke will walk in line with the wheels. A person coming from behind should not be able to see the hoof marks of the animals pulling the cart. As an example, a yoke for a standard one tonne oxcart

(1.8 m long and 1.2 m wide) should be 1.7 m long. The draft animals should be placed 110 cm apart (centre–centre) on the yoke shaft.

Manufacture of the yoke

The yoke shaft

The yoke shaft should be strong but not too heavy or too rough. Many farmers in Malawi use bluegum (*Eucalyptus*) poles. Freshly cut trees should be left to dry in the shade before constructing the yoke, otherwise the pole will crack and bend. A smooth finish is desirable to protect the skin of the animal. The diameter of the yoke shaft should be 8–10 cm.

The skeis

Each animal requires a pair of skeis, one on each side of its neck. The skeis in each pair should be 20 cm apart to accommodate the neck of the animal. If the animal is large the space should be increased to 25 cm. Too narrow a space results in the skeis damaging the neck of the animal. However, if the space between the skeis is too big the animal will be able to remove the yoke by pointing its head downwards, especially if it has small or no horns. Skeis with a shallow curve inward are best.

Each skei should be 45 cm long, 7 cm wide and 4 cm thick. The longest side has three notches 1.5 cm deep. The notches are made on the skei to fit three different neck sizes of draft animals. The notches assist in holding the string (also called strops) that goes round the bottom of the animal's neck after adjustment.

To make the notches on the skei, measure from the bottom of one side of the skei upwards and mark at 7 cm, 3 cm, 4 cm, 3 cm, 4 cm and 3 cm. Cut 1.5 cm deep into the skei at the bottom of all the 3 cm gaps then cut again at an angle from the top of the 3 cm to the inside end of the 1.5 cm at an angle. The skei head should be 7 cm x 4 cm x 4 cm, the skei body should be 7 cm x 2 cm and the skei hole should be 7.5 cm x 2.5 cm. The skei

hole will allow the skei body to go through but not the head.

To make the skei holes, first mark the required distance from the centre of the yoke to the centre of the withers of one animal. From this position measure 10 cm towards the middle of the yoke and measure 10 cm towards the outside of the yoke. These measurements will enable you to mark 20 cm on each end of the yoke that will accommodate the withers of the animals. If the animals are large increase these measurements from 10 cm to 12.25 cm on each side so that the distance between skeis for each animal is 25 cm. On the top of the yoke measure a rectangle 7.5 cm long (away from the centre of the animal) and 2.5 cm wide. This should be made into a hole by chiselling.

Clamps

U-shaped clamps at the centre of the yoke are used for hitching to the implement through a chain or boom. Metal clamps are not good because over time they enlarge the size of the holes in the wooden yoke and they are rigid. The best clamps are made of plastic ropes; these are strong and durable but also flexible. It is possible to compensate for animals of different strengths when fixing clamps on the yoke shaft: the stronger animal should be closer to the clamps than the weaker one.

Strings

Strings (strops) go under the neck of animal from one skei to the other. These should be of adequate length, smooth and soft to avoid hurting the animal.

References

- Neilson H, 1970. *Improvement of ox yokes*. FAO Technical Assistance Report No. AGS/TA/MLW/68/3. University of Malawi, Bunda College, Lilongwe, Malawi.
- Starkey PH, 1989. *Harnessing and implements for animal traction: an animal traction resource book for Africa*. GTZ, Eschborn, Germany. 243p. ISBN 3-528-2053-9
- Vieberg U, 1982. Basic aspects of harnessing and the use of implements. pp 135–221 in Munzinger P (editor). *Animal traction in Africa*. GTZ, Eschborn, Germany. 490p.