# Work on animal power harness technology in Kenya

*by*

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## Abstract

*The Draft Animal Power Development Project in the Department of Agricultural Engineering, University of Nairobi, Kenya, has developed many options for harnessing draft animals. First an alternative yoke for oxen was developed; then a collar harness was adapted to the local oxen and donkeys. Because collars can only take horizontal forces lengthwise, a saddle for donkeys was developed to take up the vertical forces a cart imposes on them; it comes with a breeching strap which enables the donkey to brake the cart when it is going too fast.*

*Other work by the project has been on developing panniers for donkeys. The ones presently available are a canvas pannier for transporting general goods or water containers, a canvas slurry pannier for transporting slurry from zero-grazing units to the fields where fodder is grown, and a steel frame saddle with hooks for attaching metal baskets or bundles of fodder grass.*

## Yokes

Since the first introduction of ox cultivation in Kenya early this century, the harnessing system has hardly been changed. Double withers yokes (also known as neck yokes: see Photo 1) are common: they are cheap and easy to construct. Generally farmers use a long wooden pole with sticks through it to separate and link the animals. The centre of the yoke has a ring or U-bolt to which implements can be attached by a chain. This kind of yoke is seldom adapted to the shape of the withers (base of the neck) and the contact area is very small, thus creating a lot of pressure on the animal's skin which in turn leads to discomfort and even injury. Oxen are steered using verbal commands with the help of sticks. If the animals are not properly trained they do not walk in straight lines, which results in poor field operations. If, under these circumstances, plowing is carried out with two or three pairs of oxen, two people are needed to guide the oxen.

*Photo 1: Double yoke built at University of Nairobi*

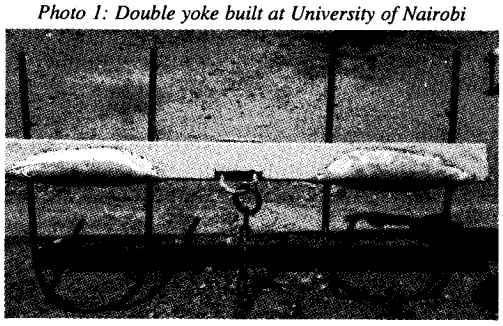

Photo: Luurt Oudman

In the mid-1970s an alternative steering system consisting of nose ropes and reins was introduced, and the wooden sticks were replaced by big U-bolts. This system is now promoted through the Farmers Training Centres.

After studying improvements of harnessing systems for oxen in Africa and Asia, priority was given to improving the present withers yoke. An alternative design was developed, based on the Clarkson Yoke, made in Samaru, Nigeria. This yoke consists of a smoothly finished square piece of timber about 125 cm long, 10 cm wide and 10–15 cm thick.

The areas of the yoke which bear on the animals are 75–90 cm apart and contoured to the shape of the oxen's necks. The yoke is kept in position by two loops made of conduit pipe or round bar which are angled forward to clear the animals' throats and are adjustable by means of spring pins. Not only is the new yoke contoured to the shape of the neck, which provides a much larger contact area, but the shaped areas are also covered with pads made of canvas filled with tail hair. The "improved" yoke does not cost much more than the traditional one in terms of materials, especially when traditional wooden sticks (also known as skegs, skeis or staves) are used instead of round bars, but does take more time to make (Dibbits, 1985).

## Collar harness for oxen

It took a long time before there was any progress in the development of collar harnesses for oxen (and donkeys). Lack of experience with this type of harness, and lack of documentation about existing designs. caused the slow start. The old harness-making tradition in Europe was transferred from father to son and was therefore never recorded.

First, two collar harnesses made in Germany were borrowed from the Department of Agricultural Engineering of Egerton College (now Egerton University). These collars were designed for humpless oxen and were unsuitable for the zebu

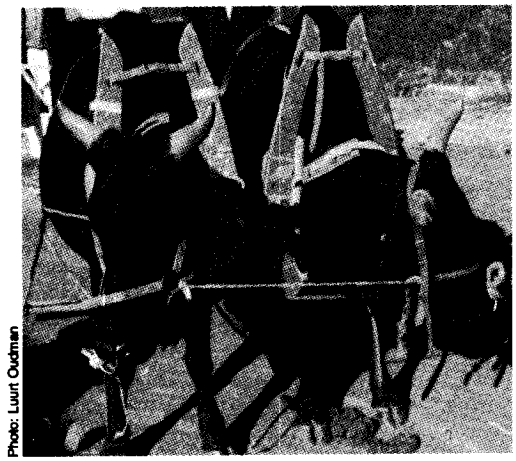
Photo: Luurt Oudman

*Photo 2: Collar harness for oxen (note the use of nose-rings)*

breeds in Kenya. However, a study of them revealed a great deal of information about the unwritten technology. Mr W L Micuta, of the Bellerive Foundation of Geneva, Switzerland, assisted in the construction of the first two collar harnesses: he derived his knowledge from harness makers in that country (Micuta, 1985).

The collar harness (Photo 2) consists of the collar itself and accessories such as a hump strap, a back strap, a tail strap, draft traces, a swingle tree, a double tree and a bridle or halter. The collar consists of a left and a right hame, upper and lower hame straps to keep the two hames together, shoulder pads to protect the animal's shoulders from rubbing by the hames and a neck pad to keep the collar at the right height. The straps are all adjustable to fit the most common sizes of draft animals. The draft traces conduct the draft force from the hames to the implement through a swingle tree. The swingle tree allows the collar to move slightly with the shoulders of the animal when it is walking. These movements are important to prevent the collar rubbing on the animal's skin. If a pair of animals is employed, a double tree or evener is also used to balance the forces of the two animals.

The lumber strap, back strap, tail strap and side strap combination suspends the draft ropes, mainly to prevent the ropes from becoming entangled with the legs of the animal while it is working (Ogweno and Oudman, 1990). The halter consists of a number of straps and rings; reins are connected to these rings to enable the ox to be steered from behind. Oxen which do not respond to a halter with a tight nose strap should be ringed. The reins are then extended to the nose-ring. Gentle pulling of the nose-ring is usually enough to steer the oxen.

The departmental oxen, which were trained using the traditional yoke, accepted the collar harness immediately. The harnesses have been used at the university for several years, but they have not yet been widely adopted by farmers in Kenya.

## Collar harness for donkeys

The first development in the attempt to improve the harnessing system for donkeys was the construction of a few breast bands. However, the breast of a donkey slants and a breast band does not fit properly, as it does on horses. Although not ideal, a breast band could be used for light work, such as pulling a light cart; it is not considered suitable for heavy work. Therefore, further attention was given to the development of a collar harness which would enable farmers to use donkeys for cultivation in light and medium-heavy soils.

The first collars for donkeys were constructed in 1983. Thereafter, the departmental donkeys were trained and the collars were modified based on the experiences with our own donkeys and those of farmers.

The donkey collar (Photo 3) has the same parts as the ox collar: the differences are only in size and shape. The bridle looks like the ox halter extended with a bit and two mouth plates. Donkeys, like horses, have an open space in the mouth where a bit can fit. A bridle with such a bit is a very useful part of the harness when it comes to training donkeys and for easy control after training. The collar and the bridle are sufficient for pulling agricultural implements, but for pulling a cart a back-saddle and a breeching strap are needed. The back-saddle with its girth and shaft-holding straps takes up the downward, and sometimes upward, loads of the shafts. The breeching strap allows the donkey to apply a braking force comfortably and efficiently whenever the cart tends to run into the donkey.

*Photo 3: Collar harnessing system for donkeys*

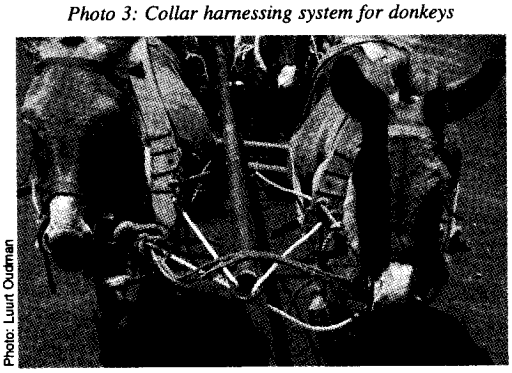
Photo: Luurt Oudman


*Photo 4: Two donkeys with collar harnesses pulling a wagon. The wagon has drum brakes on the rear wheels while the donkeys can brake with their breeching straps*


*Photo 5: Four donkeys pulling a cart. The rear ones have a collar and a saddle. The front ones have only a collar*

Such a complete harness which satisfies the principles of efficiency and comfort is not cheap to make, in terms of materials or labour. A harness for carting (collar, saddle and accessories) presently costs 950 Kenyan Shillings (Ksh). This includes the cost of materials with an additional 30% of the material cost attributed to labour. By comparison, a pair of plowing collars for two donkeys costs KSh 850 and a pair of collars for oxen KSh 1250. (At time of writing in January 1992, the value of the Kenyan Shilling was about KSh 33 = US$ 1.)

If two donkeys are needed for a cart, because of steep terrain, the cost of harnessing doubles. The second donkey can only work effectively if it is harnessed in the same way as the first. This means that the cart should be provided with three shafts and that both donkeys should wear a collar and a saddle, at a cost of KSh 1900.

The same donkeys in front of a wagon require a harnessing system costing KSh 1000, as a plowing set is needed plus two breeching straps. These breeching straps are attached to the collars and the collars are attached in turn to a ring at the front end of the pole which steers the wagon. If the wagon tends to overrun the donkeys, the pole will pull at the collars (by means of nylon ropes which are slackened when the animals pull) and the donkeys are thus able to resist that pull with their breeching straps (Photo 4). The same applies to oxen, at a harnessing cost of KSh 1400.

If four donkeys are needed in front of a cart (Photo 5), the principles for cart and wagon harnessing as outlined above can be combined. The rear donkeys are harnessed in the regular way as for a two-donkey cart. To accommodate the front donkeys properly, the centre shaft should be extended by a pipe which slides into the shaft for about 50 cm and is secured by a pin. This pipe has a ring at the front end to which the collars of the front donkeys are attached by means of nylon ropes. These donkeys are equipped with breeching straps attached to the collars only, but no saddles. While pulling is done with these collars through traces, swingle trees and a double tree attached to a hook under the pipe right in front of the coupling with the centre shaft, braking is also possible with the same collars and the attached breeching straps. This solution is rather expensive on harnessing (KSh 1900 + KSh 1000 = KSh 2900). For oxen the expense would be KSh 3500, comprising KSh 2500 for two plowing sets and KSh 1000 for two ox saddles.

## Panniers

Project work on developing panniers for transporting goods, water and slurry is continuing.

A canvas pannier is undergoing tests at missions in remote areas for transporting goods and water. It is basically a strong, weatherproof canvas cloth spread across the back and sides of a donkey. The cloth has a pocket at each end for carrying assorted goods or water containers. The pockets have been reinforced with leather strips. Underneath the cloth, and stitched to it, are pieces of leather with straps for fastening the pannier to the animal.

The slurry pannier (Photo 6) is made of the same material, but it has a few extras for easy loading and unloading. The slurry is scooped into a square wooden box which has a metal screen for collecting straw and other coarse material which could clog the drain pipe. It then drains into 40 litre closed pockets on either side of the donkey. The pockets taper at the bottom into short canvas hoses which conduct the slurry through PVC elbows into a PVC pipe which has a hole halfway along its length (Photo 7). A second, shorter pipe with a similar hole is put

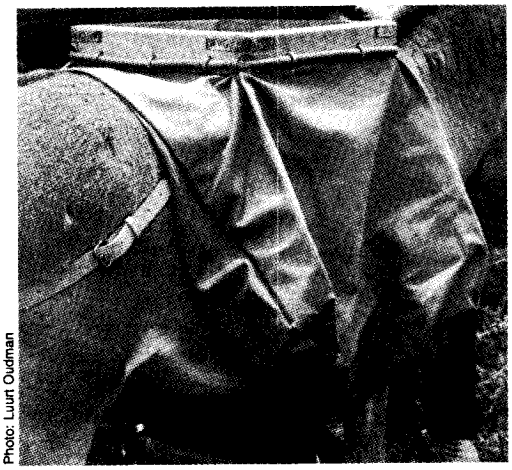

Photo: Luurt Oudman

*Photo 6: Slurry panier to transport slurry from the stable to the field*

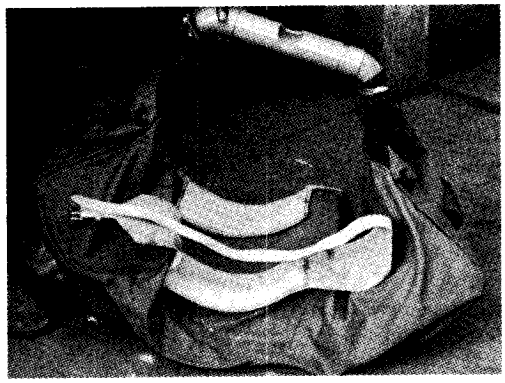

Photo: Luurt Oudman

*Photo 7: The slurry pannier upside down to show the saddle part and the two concentric PVC pipes which regulate the flow*

around the first one. With this arrangement the flow of slurry can be regulated by rotating the outer pipe to change the alignment of the two holes.

The slurry pannier is intended for farmers with a zero-grazing unit. If they own (or can hire) a donkey and a slurry pannier they can conveniently take

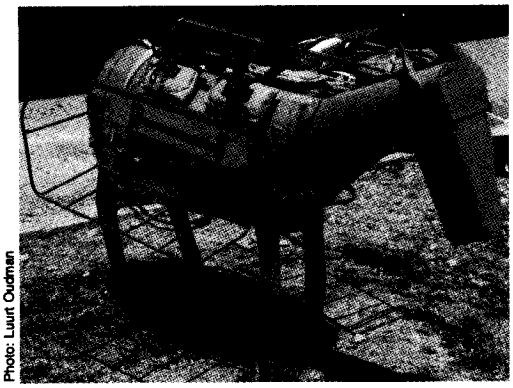

Photo: Luurt Oudman

*Photo 8: Steel frame saddle pannier on a model donkey*

slurry to the field where the fodder is grown. It is recommended to prepare furrows along the rows of Napier grass ahead of time. When the donkey is led through these furrows, the slurry can be dropped in them without spillage. The nutrient losses will be minimal if the furrows are closed within a few hours after application of the slurry.

The third pannier would also be of interest to the zero-grazing farmer. It consists of a steel frame saddle with two hooks on either side (Photo 8) to which metal baskets can be attached for carrying groceries or other goods from the market. Also, bundles of fodder can be attached to the hooks and transported from the field to the zero-grazing unit. The full potential of this pannier is yet to be discovered.

## References

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