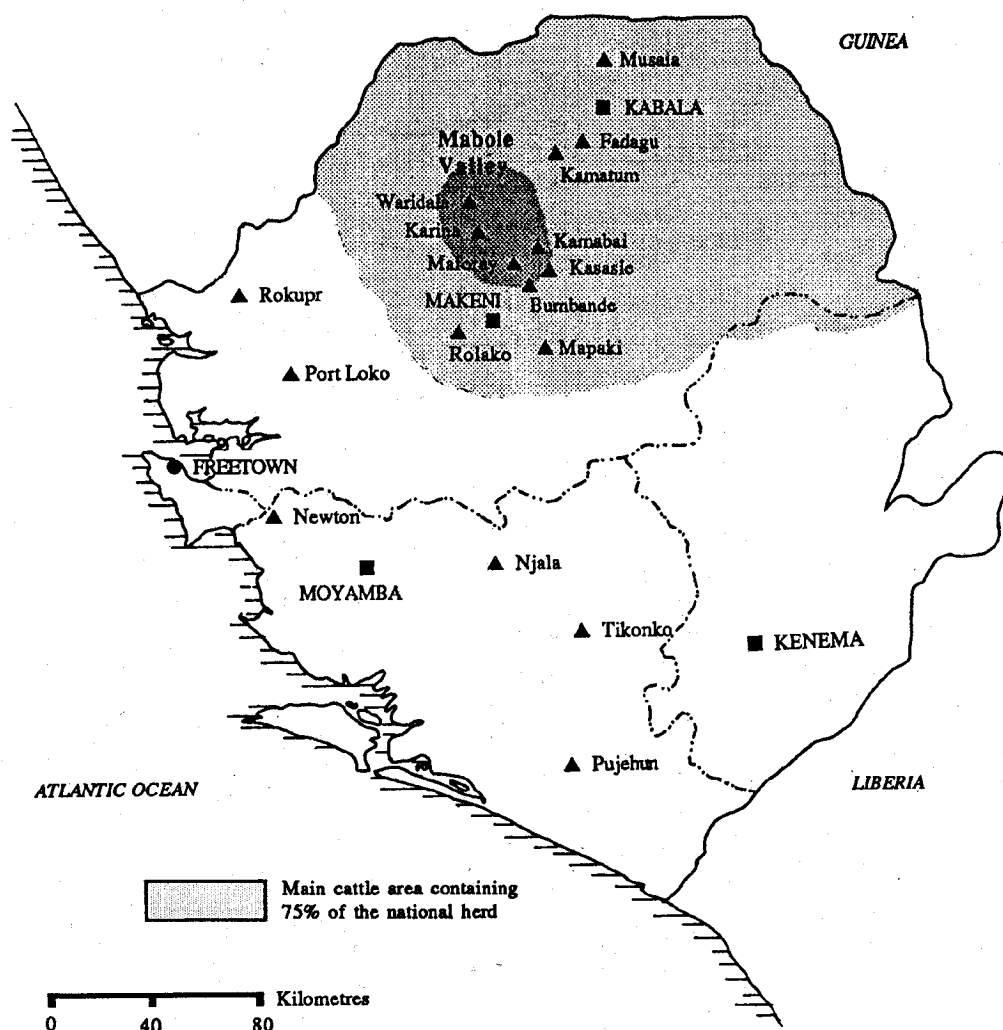


The Field Visits



Map of Sierra Leone



Sierra Leone showing sites of field visits and main animal traction centres

Introduction to the Field Visits

Before leaving Freetown, staff of the Work Oxen Project gave brief descriptions of each of the eight villages that had been selected for the field visits. A summary was given of the history and current status of animal traction in each village and what would be seen in the farmer-managed demonstration plots. The villages differed in their length of animal traction experience, their dominant ethnic group, the systems of ownership (individual or village association) and the gender of the users. Participants were then free to choose the village of their preference. A few adjustments were made to ensure roughly equal groups, the balancing of country representation and to allow just one language (English or French) to be used in the villages (where all questions, answers and discussions would have to be translated into the local vernacular).

Following an overnight stay in Makeni, the different groups, each comprising about seven people, travelled to the villages early on Sunday morning. The coordinating member of the Work Oxen Project introduced the visitors to the chief and farmers, and each group then saw some farmer-managed demonstrations of animal traction use. The groups were also able to visit farmers' fields and see the animal paddocks. The groups returned to their respective villages, and held detailed discussions with the farmers of the village, with the aid of local in-

terpreters. Following traditional village hospitality (lunch) the groups all met up again at the Rolako Ox Plow Centre, where they inspected the workshop and saw demonstrations of recently installed prototype animal-powered gears.

Back in Freetown, the groups re-assembled to discuss the implications of their observations and discussions. Each group was asked to summarize its findings to a plenary session of the Networkshop. It was suggested that each group start by describing briefly what was observed. Good or positive lessons were then highlighted, followed by examples of disappointments or negative lessons. Each group was asked to identify what it considered to be the most critical constraints to animal traction in the village, and then make suggestions on how these constraints might be overcome. Finally groups were asked to present their conclusions and any recommendations, which were briefly discussed.

Thus the following summaries of what was seen on the field visits and what was learned and suggested have been compiled from three sources: the background information supplied by the Work Oxen Project as part of the pre-visit briefing, the notes made by the rapporteur of each group, and the contents of the discussions that followed each report.

BUMBANDAE VILLAGE

Visiting group

A. Samura (Coordinator),
D. Phillip (Rapporteur),
A. Gedeo, S. Leaman, A. Mansaray, D. Sarr,
B. Mansaray, A. Schumacher, M. Sesay.

General information

Ethnic|group: Limba

Location: Mabole Valley,
about 15 km from Kamabai

Population: 300

No. Farmers: 31

Cropping systems

Swamps: 25% of cropped area.
Rice in rainy season.
Cassava and sweet potatoes in
the dry season.

Boliland: 0% of cropped area.

Uplands: 75% of cropped area.
Mixed cropping: rice with
some maize, sorghum, Guinea
corn, pigeon pea, groundnuts
and millet.

Animal traction history

The section chief Morie Brima II bought the first set of oxen in 1983, and the oxen are now five years old. He is using the Pecotool plow manufactured in Sierra Leone. In 1986 the Work Oxen Project agreed to set up a farmer association for the use of oxen. The association has ten members. One new set of oxen (2-3 years old) and a new Pecotool plow have been provided. In the current year (1986) the farmers began plowing in June and finished at the end of August, plowing a total of 12 hectares. In the developed swamps, it is possible to plow two times before broadcasting but other swamps are only plowed once. Other implements that have been supplied for the

farmer-operated, on-farm demonstration plots include: triangular spike tooth harrow, Super Eco seeder, Pecotool weeder and Pecotool groundnut lifter.

General observations

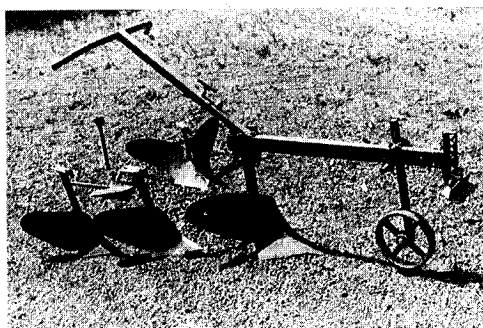
The farmers demonstrated the use of their oxen for plowing, weeding and groundnut lifting. There were two sets of oxen, one for the farmers' association and one for the village chief. Both sets were trained in the village with the help of the Work Oxen Project. When oxen were used for cultivation, there was a tendency to opt for monocropping of swamp rice, upland rice and groundnuts. According to the chief, land availability was not a limiting factor, but labour and capital (cash) limited the area that could be farmed. The owners of the oxen claimed they made regular visits to the veterinary services to check the health of their oxen and treat any illnesses. Women were not involved in animal traction.

Successes or positive lessons

- Farmers were enthusiastic about the potential for using work oxen.
- Oxen had been shown to decrease the manual labour requirement.
- Demonstrations showed that most farm operations were possible with work oxen.
- The animals were well trained and responded to signs and vocal orders rather than being beaten.

Failures or negative lessons

- The farmers were dependent on the Work Oxen Project and showed no tendency for self-reliance.
- The large number of stumps made upland demonstrations difficult, so that the demonstration sites had been located near swamps.



Pecotool showing three plow size options, ridger and groundnut lifter

- The weeder and groundnut lifter demonstrated did not seem effective under the prevailing conditions, and much manual labour was still required after the ox-weeder and groundnut lifter had passed.
- School age children were being used to supervise the oxen. This might restrict their education and be a long-term social problem.
- The animals in each pair did not fit well together.

Primary constraints

- There are at present too few oxen for the number of households, and yet there are severe financial constraints that restrict the potential for purchasing further oxen and equipment.
- The land needs preparation before being suitable for use with animals. The uplands are still full of roots and stumps, and most

swamps either have many stumps or have very deep flooding.

- There is a serious lack of infrastructural facilities, with poor road access and great difficulty in marketing farm products.

Possible solutions

- The provision of credit is essential if animal traction is to develop.
- A more integrated approach towards assisting farmers to overcome rural poverty is required. Animal traction should be seen as just one component of the farmers' many requirements to improve their production and their marketing.
- The farmers' self-reliance needs to be encouraged and developed.

Conclusions

- Water control needs to be developed in deep swamps before oxen can be used effectively.
- The use of animal traction for groundnut harvesting and weeding under such conditions seems premature.
- The weeder and groundnut lifter being used need to be redesigned.
- There is a need to investigate in more detail how animal traction can be integrated into upland farming systems. Until such systems are developed, the use of oxen should only be encouraged for swamp preparation.

FADUGU VILLAGE

Visiting group

P. Allagnat (Coordinator)
A. Westneat (Rapporteur),
S. Harouna, C. Ladrette, D. Zerbo.

General information

Ethnic group: Mandingo and Limba
Location: 80 km north of Makeni,
on road to Kabala
Population: 1500
No. Farmers: 150

Cropping systems

Swamps: 20% of cropped area.
Rice in rainy season.
Groundnuts, cassava, sweet
potatoes, rice in dry season.
Boliland: 45% of cropped area.
Rice in rainy season.
Uplands: 35% of cropped area.
Mixed cropping rice with
sorghum, maize, Guinea corn,
benniseed, cassava, groundnuts
and millet.

Animal traction history

In 1964 two cattle-owning farmers bought plows from traders from Guinea and started to use ox traction (without any assistance from extension agents). In 1967 a subsidized tractor hire scheme was started and the farmers lost interest in animal traction. Since 1982 tractors have been unavailable for hire. Farmers took a renewed interest in animal traction and they themselves contacted the Work Oxen Project. In 1985 the Work Oxen Project began to work with the farmers of Fadugu and in the current year (1986), five sets of oxen are in use, all owned by Mandingo farmers. All farmers own Pecotool plows and use them for plowing (twice) in swamps prior to planting in the rainy

season, and again for dry-season swamp cultivation. On-farm demonstrations, operated by the farmers, have included the use of triangular spike tooth harrows, a Super Eco seeder and Pecotool weeders and groundnut lifters.

General observations

The history of animal traction in Fadugu is particularly interesting. Farmers began using animal traction themselves in 1962, stopped when tractors were available for hire, and became interested again when the tractor programme finally collapsed. Farmers claimed that when tractors were available, farm families in Fadugu were producing about 300 sacks of rice per farm. When they returned to using the hoe and manual labour, they cultivated much smaller areas so that production fell to about 30 sacks of rice per farm. In 1985 some Mandingo farmers restarted the use of animal traction, and already, by 1986, five pairs of oxen were in use.

The group visiting Fadugu were treated to demonstrations of the yoking of a single ox and pairs of oxen, harrowing with a triangular spike tooth harrow, seeding with a Super Eco seeder, plowing in a swamp with a 6" Pecotool and weeding with an adjustable, two-blade Pecotool weeder.

The young N'Dama cattle were in good health and in their first year of traction work. Pairs of this sort were reported to cost about Le 6000 (about US\$200 at the rates current in September 1986). Head yokes were attached to the back of the animals' horns and nose rings were fitted to allow good control. The animals were handled by two people; one person controlled the animals from behind by using reins, while the other operated the equipment. The oxen had been trained by the farmers themselves with technical assistance from the Work Oxen Project staff. Each pair farmed about 6 ha.

Men worked with the animals. Women transplanted rice seedlings.

Successes or positive lessons

The farmers had a very positive attitude to the use of work oxen. They were very skilled at clearly diagnosing their problems and were closely analysing their initial efforts in the use of oxen. This high interest in animal traction technology, together with a clear aspiration for increased output, were considered positive points. Also important was the close collaboration between the farmers and the Work Oxen Project personnel. The farmers are already experienced in animal husbandry and their oxen were drawn from their own herds and this strongly favours the eventual success of animal traction in this area.

Positive and negative aspects of equipment being used

The Pecotool has a good, simple design with innovative engineering features including adjustable handles, a supplementary skid for swamp use and a system of implement attachment using movable bolts and fixed nuts. The long chain is good, as is the capacity to change between 6" and 9" plow bodies.

On the negative side, the Pecotool is oversized and its frame is too large. The wheel bearings are not sealed and allow sand and other abrasive material to penetrate into the axle area. No lateral adjustment is provided. There appeared to be a lack of precision in the implement construction.

The harrow featured a simple design and was constructed out of local materials. These positive aspects were offset by the lack of a handle to lift it up when the spikes became clogged with debris. It was judged to be too heavy for young oxen. No measures had been taken to preserve the wood used in its construction.

The weeder was strong, and each spring that held a tine was supported by a helper spring. It

was adjustable side-to-side and front-to-back. Its primary disadvantage was its size, being too heavy and costly for its weeding task. Also it was only supplied with symmetrical ducksfoot shares and not half-blades that would allow weeding nearer to the plant roots.

The harnessing with head yokes and nose rings was considered appropriate for the N'Dama oxen and controlling the animals from behind was good. Insufficient protection of the head was provided which could lead to injury to an animal. The operators placed excessive force on the nose via the nose ring in their efforts to control the pair.

Failures or negative lessons

The farmers complained about the rapid increases in the cost of animal traction equipment. Price rises had been necessitated by currency devaluations and local inflation, but in an attempt to protect the farmers from the effects of rapid inflation, the Work Oxen Project had not yet increased its prices to meet the true cost of production. The Work Oxen Project was thus selling high quality equipment at relatively low prices. Such subsidies would distort the farmers' perception of their true input costs and in the long term this would adversely effect the efforts of the Project.

There was no provision for credit for farmers wishing to adopt animal traction in Fadugu. The farmers who had adopted animal power this year had bought their equipment for cash and already owned cattle. However many of their neighbours who would like to adopt animal traction technology could not afford to buy animals and equipment unless credit was made available.

The animal health services available to the animal traction farmers of Fadugu were very inadequate.

There had been no discussion of soil conservation issues with the farmers.

Primary constraints

The low incomes of the farmers, the high cost of the equipment and the lack of credit will work against the adoption of animal traction.

The national economic situation with high inflation and rapid increases in input costs is adversely affecting the farmers' ability to plan their finances. This will inevitably retard animal traction adoption.

The farmers noted that any investment in crop production, such as the adoption of animal traction, necessitated improved protection from birds and better fencing to avoid crop destruction by cane rats ("cutting grass") and by monkeys. Fences currently built out of palm branches did not last for an entire season and there were insufficient qualified fence builders in the zone to meet the demand. The farmers also considered the grass weed *Imperata cylindrica* to be a major problem, and a means of reducing this needed to be found.

Possible solutions

Fadugu is in an unusual position in that it does not come under the scope of any of the main Integrated Agricultural Development Projects. As a result farmers do not have access to the extension advice and credit facilities available

to most other villages in the country. Including the Fadugu zone within a development project area should assist in the provision of credit and animal health services.

Conclusions

- The animal traction equipment currently in use should be comprehensively studied and appropriate modifications made.
- The extension strategies currently in use need to be studied with the objective of identifying priority training topics and establishing group training programmes which are more efficient than individual contacts.
- A credit system should be established, and this should allow low repayment in the first year of animal traction adoption. This should include some form of insurance for the animals.
- Improvements should be made in the animal health services, and in the fields of animal nutrition and management.
- There is a need to diversify the operations for which animals are used.
- Animals should be brought more permanently onto the farms, through the use of stables and composting technologies.

KARINA VILLAGE

Visiting group

A. Bangura (Coordinator),
F. Ndiame (Rapporteur),
A. Berthé, B. Kouadio, S. Ouedraogo,
M. Sangaré.

General information

Ethnic group: Mandingo
Location: Mabole Valley,
about 10 km from Kamabai
Population: 500
No. Farmers: 25

Cropping systems

Swamps: 40% of cropped area.
Rice in rainy season.
Cassava and sweet potatoes in
dry season.
Boliland: 50% of cropped area.
Rainy season cultivation of
rice only.
Uplands: 10% of cropped area.
Mixed cropping of rice with
some maize, beans, okra,
benniseed and sorghum. Also
groundnuts, millet, cassava and
sweet potatoes.

Animal traction history

Karina was one of the first villages in the country to use animal traction. In 1927 domestic slavery was abolished, creating a major labour shortage for the relatively wealthy Mandingo farmers. Five men from Karina went to Kankan in Guinea for training in the use of draft animals. In 1928 ox traction began with six sets of oxen using Ransome Victory and French plows. In 1950 ten pairs of oxen were in use in Karina, but after that many people

left the village and went to diamond mines. When the Work Oxen Project began its programme in 1980 only seven sets were left in Karina. The enthusiasm of the farmers in Karina for animal traction was such that they readily put on impressive demonstrations of ox-plowing, and this led to the holding of national ox-plowing competitions. The President of Sierra Leone visited the 1985 plowing competition held at Karina and witnessed over 100 N'Dama oxen plowing simultaneously. In the current year, 1986, there are 14 sets of oxen in Karina, one for a farmers' association and 13 for individual farmers. Three farmers each have two sets. In the village there are now 25 plows (Pecotool, Ransome Victory, Guinean, Anglebar and Indian Victory). There are also two harrows (one zig-zag, one triangular), one ridger (for the farmers' association) and one ox cart that has been used for two years. The farmers' association was set up this year with ten farmers. French cooperation has provided them with one set of oxen, one Pecotool plow, one ridger and one harrow.

General observations

The village is located near the Mabole river and most of the population of 500 are Mandingo. Since the 1950s, a high rate of temporary migration to the diamond mining areas has led to a scarcity of male labour. Before the Work Oxen Project started working in the area, oxen were used only for plowing and harrowing. The WOP has tried to promote a more intensive way of using oxen. The group visited farmer-operated demonstration plots where groundnuts, maize and rice were growing. These plots had been plowed twice with a 9" Pecotool plow and then harrowed and levelled with a triangular harrow. A Super Eco seeder had been used for row planting and weeding had been performed with the Pecotool weeder.

Successes or positive lessons

- The farmers and village authorities were closely involved in the implementation of the demonstration trials and also in monitoring their progress.
- The WOP was working effectively through the local leaders in its programme to develop ox traction.

Failures or negative lessons

- The Work Oxen Project was looking at only one aspect of the farming system. Not enough attention was being paid to the diversity of farmers' conditions and constraints. The problems being studied were not necessarily representative or limiting.
- It was uncertain whether the techniques being tested were actually appropriate. There was insufficient monitoring of the technical and socio-economic aspects of the various animal-powered farm operations being tested by the farmers. As a result the Project did not have the means to explain why some plots failed.
- There was no use of manure.

Primary constraints

- The farmers received insufficient support for the purchase of seeds, pesticides, chemicals, fertilizers, drugs and spare parts. There was no assistance with marketing of produce.
- Crops were being destroyed by cattle.

Possible solutions

A better understanding of the farmers, their conditions and the diversity of their farms is needed. This should lead to the clear classification of the farms and farmers according to relevant criteria such as labour, type of equipment and type of constraints. This should allow the identification of the farmers' most critical constraints so that future trials could be more adapted to the identified constraints. A more multidisciplinary approach is required. It is likely that diversifying the use of animal power will prove important, but more research is required to identify the key operations and techniques.

Relevance for network

Similar research is being undertaken in several countries in the region, and there is much experience in this field. There is a great scope for exchange and cooperation on methodologies, on-farm experimentation, village associations and the training of extension workers.

Conclusions

Studies should be made within the Network concerning the various experiences and strategies for improving the farmers' use of animal traction through:

- Improved distribution of farm inputs.
- Credit.
- Marketing farm surpluses.
- Improved animal health and husbandry.

KAMATUM VILLAGE

Visiting group

A. Sheriff (Coordinator),
S. Reddy (Rapporteur),
H. Ahmed, R. Bansal, M. Gboku, S. Jarju,
B. Kehr, S. Ravindran.

General information

Ethnic group: Limba, Mandingo and Fula

Location: 65 km north of Makeni
and 15 km from Fadugu

Population: 200

No. Farmers: 15, with 10 coming from other
villages for farming.

Cropping systems

Swamps: 45% of cropped area.
Rice in rainy season.
Sweet potatoes, cassava,
groundnuts, maize and pepper
in the dry season.

Boliland: 35% of cropped area.
Rice in the rainy season.

Uplands: 20% of cropped area.
Mixed cropping of rice with
sorghum, maize and pepper.
Also cassava, groundnuts,
potatoes and millet.

Animal traction history

1986 is the first year of using draft animals. One set of oxen has been trained, and a second has been bought but is not yet trained. Unfortunately the trained set died because of lightning on 9 September 1986, a few days prior to the Networkshop. Two more farmers have decided to get work oxen. This year the pair of oxen plowed 5 hectares. Swamps were plowed once and bolilands had two plowings. The implements in use have been two plows (Pecotool and Ransome Victory) and one triangular wooden harrow.

General observations

This is the first year in which animals have been introduced. The farmer is enthusiastic, but is new to the system. He was happily undertaking trials involving row-planting with a Super Eco seeder, the inter-row weeding of groundnuts, rice and cassava with a Pecotool weeder and groundnut lifting with a Pecotool. The trained pair of animals had recently died and the new pair looked young, and the head yoke and equipment seemed heavy for their size. The rice field was impressive, but the groundnut field had lots of weeds. The demonstration fields were relatively small, and looked more like demonstration plots rather than normal fields. The farmers felt that the fields prepared with manual labour looked better than those prepared using animal traction.

Successes or positive lessons

- The farmers are very enthusiastic, and two more are going to invest in animal traction next year.
- There is plenty of land for expansion, and farmers do not see labour displacement as a problem.

Failures or negative lessons

- The animals seemed young and improperly trained.
- Farmers did not seem to know how to adjust the implements to control working depth.
- The yoke and rein system seemed complicated.
- The groundnut lifter does not seem to be effective and its design needs to be looked into.
- The equipment seems to be too heavy for the job.

The manner of the plowmen to the animals was not friendly or sympathetic.

- There seemed little sign of financial benefits from the adoption of animal traction. Unless there were production improvements, animal traction would not seem economically viable.
- Conceptually there appeared to have been a missing element: that of a farming systems approach. It looked as though animal traction was superimposed on the existing system without attempting to bring about modifications in cropping procedures. For example, the groundnut variety being used was the spreading type, while bunching varieties have to be used in connection with animal traction.
- There seemed to be a lack of effective animal husbandry extension services to advise farmers on cattle rearing and management.
- Linkages between the normal Ministry of Agriculture services and the Work Oxen Project seemed weak.

Primary constraints

- There is a lack of tradition of animal husbandry in general, and animal traction in particular.
- The traditional slash and burn system is not adapted to animal traction.
- Costs of acquiring animals and equipment are high, and there is no credit system to assist in this.
- There is a serious lack of effective animal husbandry and veterinary services.

Possible solutions

- Long-term efforts in farmer training are required.
- The upland farming system must be made more productive if animal traction is to be viable.
- The Work Oxen Project should work through other organizations, such as the Integrated Agricultural Development Projects, to develop credit programmes.

- The Work Oxen Project should work with the veterinary department to improve the animal health services.

Conclusions

Research is required to identify systems for improved nutrition, control of small biting flies (*Stomoxys spp.*) and control of tsetse flies and trypanosomiasis.

The present yoking system is too complicated and cruel. Research is needed to develop a simpler, more effective and comfortable harnessing system.

Animal-drawn equipment, of both traditional and modern designs, that is used in other counties, should be evaluated. A shortlist of designs suitable for promotion should be prepared.

A more integrated approach to agricultural development needs to be adopted. There should be more focus on cropping systems to go with equipment and the use of improved cultural practices to match the animal traction input.

Socio-economic studies should be intensified to assess opportunities for improving the animal traction system and determine its economic profitability. This should also include regular evaluation of the impact of the technology.

The Work Oxen Project might consider establishing training centres to allow farmers to be adequately trained in animal traction technology. It might also strive to establish better links with the other development agencies and agricultural services, notably the veterinary service and the IADPs. It should also try to exchange technology with other programmes within the region and in other areas of the world.

The major lesson learned was that animal traction is not an easy technology to promote and it is still at a testing stage in the area. Thus the approach should be to proceed with caution.

KASASIE VILLAGE

Visiting group

W. McKinlay (Coordinator)
J. Oxley (Rapporteur),
L. Foster, T. Hluchyj, S. Jutzi, D. Kemp,
A. Marong, T. Mbeya, S. Leigh, S. Poats.

tomatoes, maize and sorghum.
Also groundnuts and cassava.

General information

Ethnic group: Limba
Location: 30 km north of Makeni and
2 km from Kamabai
Population: 250
No. Farmers: 25

Cropping systems

Swamps: 30% of cropped area.
Rice in the rainy season.
Cassava, sweet potatoes,
vegetables, peppers and
groundnuts in the dry season.
Boliland: 20% of cropped area.
Rice, potatoes and cassava.
Uplands: 50% of cropped area.
Mixed cropping of rice with
millet, Guinea corn, peppers,

Animal traction history

A village self-help project scheme commenced in 1976 and in 1978 Mrs. Sally Formen Kama-ra founded a women's association, which now has 60 members. In 1983 group farming was started on 0.5 ha, and by 1986 this has expanded to 2 ha. The women's association purchased a pair of oxen and a plow in 1983 with the help of the Canadian Universities Services Overseas (CUSO). The Work Oxen Project provided training for the oxen and the handlers who were girls from the women's association. During 1986 4 ha have been plowed for the association, as well as some private hire work. Projections indicate that the association will soon require three further sets of animals and an ox cart.

General observations

The group experienced a unique visit to an all-women association. About 20-30 women are

Demonstration of weeding upland rice at Kasasie





Girl demonstrates fixing yoke at Kasasie

active in the project, the aims of which are to provide rice seed for other village farms, to furnish food in case of shortages and to generate additional income from sale of surplus crops. The village women also produced handicrafts which were marketed in an outlet in Freetown to earn additional revenue for village needs. The founder of the group had contacted the Work Oxen Project after its symbolic sign had attracted her attention. CUSO paid for the group's first pair of work oxen and a Pecotool plow, with attachments.

Successes or positive lessons

The Kasasie association had successfully involved women in animal traction. Despite some problems, two girls provided an impressive demonstration of plowing, weeding and groundnut lifting using a young and unfamiliar set of animals that had been borrowed for the occasion. Other positive factors observed were easy access to a nearby market; the

strong and dynamic leadership of Mrs. Kamara who seemed to motivate people and inspire a village spirit; the incentive programme for village women who worked on the group farm which involved being given rice seed for use on individual farms, for which a small interest payment was charged; and an interest in training more women to use oxen. These factors have led to such successes as the establishment and operation of a group farm by women and of getting women involved in the use of draft animal power. The group has made effective use of the Work Oxen Project by calling on it for training oxen and operators, and seeking advice on implement use and animal health. The farm with its many crops (seed rice, millet, sorghum, sweet potatoes, peppers, tomatoes, groundnuts and maize) was a good example of the diversification and intensification of cropping and an ideal setting for using animal traction technology.

Failures or negative lessons

One of the major problems identified was animal health. One of the group's oxen had recently died of disease and the other was suffering from apparent parasitism. Consequently a pair of N'Dama were borrowed from neighbours to demonstrate swamp plowing, groundnut lifting and the inter-row weeding of rice. The project was faced with acquiring one or two more oxen and there was an expressed desire to secure an additional three pairs as soon as resources permitted.

There was a need for additional infrastructure in the village to complement the use of draft animals. Cattle from surrounding herds often invaded the group's farms resulting in damage and loss, and so a perimeter fence was one of the expressed needs. Also a partially built bridge just outside the village on the road to Kamabai and Makeni needed covering with wood to allow the possible use of an ox cart, one of the items desired by the village.

As the dominating project founder provided almost single-handed leadership, there was

lack of any clear leader to follow Mrs. Kamara, and the team considered that in the long term this might lead to problems.

There were doubts as to the suitability of the equipment being used. The changing of the attachments on the Pecotool seemed unnecessarily complicated. Moreover the implement was heavy to lift over fences and heavy to work, especially for use by young women in swampy rice fields.

Primary constraints

Primary constraints included:

- The present instability of the ox power system, due to its relatively new status, problems of health care and the uncertainty of obtaining suitable replacement animals.
- Uncertain economic viability of the group farm and its ability to continue to provide credit for the association members.
- The lack of availability of essential inputs such as drugs and fertilizer.

- Inadequate infrastructure including roads, bridges and transportation.
- Inadequate animal health services.
- Limited choice of technological innovations, e.g. few suitable alternatives for equipment, crop varieties and cultivation practices.

Possible solutions

Most of the potential solutions lay with expanded and improved extension and support services. There was also a need to explore viable credit schemes.

In the area of research the team observed that existing agronomic practices were not always compatible with animal draft technology and that studies should be conducted to help farmers fit their practices to animal power interventions. Also there was the need to evaluate alternative implements and field cropping systems related to animal draft technology. The team suggested that studies be undertaken on the suitability of the animal technology for women, including factors such as the appropriateness of implements for use by women.

The villagers of Kasasie provided the workshop participants with a colourful reception and with singing and music they crossed the small bridge en route to the field demonstrations.



MAFORAY VILLAGE

Visiting group

H. Corbel (Coordinator),
P. Serafini (Rapporteur),
L. Afantonou, A. Diallo, R. Imboden,
P. Lekezime.

General information

Ethnic group: Limba
Location: Mabole valley
1 km from Kamabai
Population: 250
No. Farmers: 25

Cropping systems

Swamps: 30% of cropped area.
Rice in rainy season.
Cassava, sweet potatoes,
onions, vegetables in dry
season.
Boliland: 5% of cropped area.
Rice.
Uplands: 65% of cropped area.
Mixed cropping of rice with
maize, sorghum, cassava,
Guinea corn, groundnuts and
millet.

Animal traction history

The use of animal traction in the village started in 1984, when one farmer bought a pair of oxen and a Pecotool plow. In the current year (1986) the farmer plowed 2 ha of swamp with his oxen, with one plowing in March and a second in July. Unfortunately, one of the farmer's oxen was recently stolen. However the village asked for a farmers' association to be established, with financial assistance from French Cooperation, and as the farmer is a member of this association, he can continue to work with oxen. The 1986 demonstration trials operated by the farmer have included row

planting and subsequent weeding of upland rice and groundnuts, and ridging for cassava production.

General observations

The small village was relatively affluent, an indication of which was that half of the houses had roofs with corrugated iron. The people appeared well fed and the children seemed healthy. There were surprisingly few sheep and goats in the village. The villagers themselves did not seem particularly interested in the demonstration of plowing, weeding and groundnut lifting and only people from the neighbouring village came.

Successes or positive lessons

The farmer who was the first and only ox-owner in the village was a blacksmith and carpenter. Thus, from the beginning, he should be capable of maintaining the animal-drawn equipment. It was felt that he could become a very good example.

The animals appeared well nourished and in good health. They were well trained and the operators appeared to have a good attitude towards the animals.

The owner did not operate the oxen himself, rather his children did. The farmer considered that animal power reduced his dependence on hired labour and village work societies.

Failures or negative lessons

The Pecotool equipment seemed much too heavy (perhaps twice as heavy as necessary) for the work it was doing, particularly in the muddy, swampy conditions. This toolbar was designed for upland conditions. The toolbar did not have any lateral adjustment. The animals were too small for use with such equipment.

The weeding tines were not adequately adjustable, front-to-back, to permit weeding in rice. The ducksfoot weeding sweeps were too small.

Farmers did not have access to some of the equipment being demonstrated, notably the weeding tines.

The yoke had not been adequately refined for use with the animals, and had too many square corners.

Crop performance was poor, despite a relatively good environment. Yields were far from their potential due to lack of fertilizer, weed competition and lack of water control.

The agronomic implications of animal power had been largely ignored by the Project and the farmer. The relationship between animal traction and other agronomic technologies and possibilities seemed to have been totally ignored. The Project had provided no inputs other than those directly relating to animal traction.

There was a lack of emphasis on production increases that might give the farmers the means to purchase the equipment they needed. Instead farmers were left almost at subsistence level and provided with equipment at an unrealistic, subsidized cost. If farmers were to use animal traction in the long term they would have to be able to afford the full cost of equipment through increases in crop production.

It was noted that most farm income came from tree crops, including tapping palm trees for palm wine and the sale of palm oil, palm kernels and oranges. Many of the trees had not even been planted so that the farmers were basically gathering what was naturally available in the forest without any significant agricultural efforts. This important economic activity was not linked commercially or psychologically with animal traction.

Farmer training was based on limited operations. As a result the farmers did not exploit

the full multipurpose potential of the equipment and had little appreciation of the possible applications of the toolbar.

Animal husbandry was not an integrated component of the farming system. Even small ruminants were not common, despite vastly under-exploited forage resources. It is possible that serious animal health problems may be implicated in this situation.

Primary constraints

The farmers lack vision of the possibilities of integrating their enterprises; for example the farmers talked of their problems, and not the implications of their problems in terms of the lost opportunities for production. There is therefore a lack of any concept of the improvements in productivity that might be possible with the introduction of animal traction.

There is no coverage of the village by the extension or veterinary services.

Possible solutions

It is recommended that the introduction of animal traction be looked at as a part of an integrated production system and not as an end in itself.

An integrated farming systems research programme is needed. This might include on-farm experiments, one set managed by researchers and the other managed by farmers, designed to establish an appropriate set of agronomic practices for use in an integrated farming system in which animal traction is used for crop production. Simultaneously and in association with this, a basic research and development effort on appropriate animal traction equipment should be undertaken with emphasis on possible participation of local artisans in the fabrication and maintenance of equipment. Furthermore an investigation should be made into appropriate ways of organizing and training the farmers once appropriate extension advice becomes available.

MAPAKI VILLAGE

Visiting group

J. Koroma (Coordinator),
M. Klaij (Rapporteur),
S. Adeoye, E. Busquets, S. Hooke,
M. Jambawai, I. Kabia, T. Turay.

General information

Ethnic group: Limba and Temene
Location: 30 km southeast of Makeni
Population: Over 1000
No. Farmers: 30

Cropping systems

Swamps: 30% of cropped area.
Rice in the rainy season.
Sweet potatoes and vegetables
in the dry season.
Boliland: 5% of cropped area.
Rice in the rainy season.
Uplands: 65% of cropped area.
Cassava, rice, maize, sweet
potatoes, groundnuts, citrus,
vegetables and oil palm trees.

Animal traction history

A farmers' association had been formed in 1983 by school leavers and local farmers. The association's leaders had heard of the Work Oxen Project and in 1985 several members of the association attended the Work Oxen Project's National Plowing Competition at Karina and also visited Rolako. A request was put to the Peace Corps Small Project Scheme who donated a set of work oxen and Pecotool implements. The association's ox handlers were trained at Mapaki by staff of the Work Oxen Project based at Rolako. Since 1985 association members have used work oxen to cultivate 3 ha for the members of the association plus 3.5 ha for other farmers. Members of the association are managing demonstration plots

on which they have undertaken row-planting with a Super Eco seeder, inter-row weeding, groundnut lifting and ridging.

General observations

The group was received by the association's leader who had developed an 8-ha area of fallow land for demonstration purposes. A tractor had been used in initial cultivation to save time. Upland rice (Rok III variety) was inter-cropped with oil palm. An adjacent upland plot had been plowed using oxen and planted with pineapples. There were fields with improved cassava varieties and vegetable gardens with improved varieties of sweet potato.

A plowing demonstration took place in one of the vegetable plots. The oxen were harnessed with a head yoke and pulled a Pecotool 6" plow. The soil was gravelly and there were some stumps which made plowing difficult. A tine-harrow having a wooden frame and iron spikes was also demonstrated. Near the village was the paddock erected for the oxen, complete with a compost pit. In the village a communal building was under construction, which was to be used as a seed store. A young cripple had been trained as a blacksmith, and was making machetes and knives.

Successes or positive lessons

There was dynamic leadership of the association by an extension worker who came from the village. He motivated the association to initiate group action, and caused farmers to adopt new practices by demonstrating, as opposed to *imposing*, the techniques. There had been attempts at soil conservation, with the use of field bunds designed to control erosion. Improved planting techniques (using vine transplantation) had been adopted for sweet potatoes. Farmers appreciated the shorter duration cassava and the increased food production. There was plenty of farmland available.



Plowing with the Pecotool plow at Mapaki

Failures or negative lessons

Several pests were mentioned during group discussions, including monkeys, rodents, birds and human thieves. Small biting flies (*Stomoxys*) were a problem and oxen refused to work in the presence of too many flies. The Pecotool plow and other equipment were too heavy for easy transport to the fields of other farmers. Chemical fertilizers were generally unavailable.

Primary constraints

Labour requirements for weeding and harvesting were the main constraints to using the large land area that was available.

Possible solutions

There was the need to strengthen the external supporting services, notably the veterinary ser-

vices and services supplying inputs such as seeds and fertilizers. Improvements in animal husbandry were required, and farmers were testing the use of mineral oils and certain plants to control the flies. There was a need for improved transport to allow the provision of inputs and the collection and marketing of produce.

Conclusions

Further on-farm adaptive research is required with the active participation of farmers in order to understand the farming system and all its ramifications. This has already been well started and the required basis exists for a good understanding of the local system. The present aim is to generate economically viable low-cost (low-input) cropping techniques and in the circumstances this seems very appropriate.

WARIDALA VILLAGE

Visiting group

Y. Schwartz (Coordinator),
A. Faye (Rapporteur),
K. Apetofia, R. Mungroop, R. Roosenberg,
G. Le Thiec.

General information

Ethnic group: Mandingo
Location: Mabole Valley,
16 km from Kamabai
Population: 300
No. Farmers: 11

Cropping systems

Swamps: 50% of cropped area.
Rice in rainy season.
Sweet potatoes and cassava in
the dry season in about one
quarter of the swamps.
Boliland: 35% of cropped area.
Rice and millet.
Uplands: 15% of cropped area.
Mixed cropping of rice with
sorghum, millet and
groundnuts. Maize grown
inside the village.

Animal traction history

Ox traction started in Waridala in the 1930s and during the Mabole Valley Ox Ploughing Scheme of the early 1950s several Ransome Victory plows were bought. Use of animal traction persisted without any external support, so that by the time the Work Oxen Project started at Njala University College in 1980, there were still seven sets of oxen in regular use. These oxen were only used for plowing for rice production in a system that involved two plowings between May and August prior to broadcasting or transplanting. Early cooperation with the Work Oxen Project in-

cluded the testing and evaluation of several plow designs, including a light plow made in Guinea and the Pecotool. In 1983 the Work Oxen Project set up a village association of 23 members and provided one set of oxen, a Pecotool toolbar (complete with 6" and 9" plows, weeder, ridger and groundnut lifter), a harrow, ox-cart and a Super Eco seeder. In 1986, French cooperation provided the association with a second set of oxen and a new Pecotool and triangular harrow. There are currently 11 sets of oxen in Waridala, two pairs belonging to the association and eight belonging to individual farmers, including the chief. In the current year there have been farmer-operated demonstration plots evaluating techniques for row planting and inter-row weeding of upland rice, groundnuts and cowpeas.

General observations

Demonstrations were seen of swamp and boliland plowing with a 9" Pecotool, planting millet in boliland with a Super Eco seeder, harrowing with a zig-zag metal harrow, groundnut lifting, and ridging for cassava and sweet potatoes.

Successes or positive lessons

- Waridala appears a well-structured village with good social cohesion and a stable and coherent village hierarchy. The village association for using draft animals is well organized.
- Farmers are very interested in animal traction and ready to learn new ideas or techniques from the Work Oxen Project.
- Plowing depth and land inversion are satisfactory.
- The ox handlers performed well and the animals were well trained.
- Efforts had been made to improve animal husbandry, with clean compounds, daily



Plowing swamp using old Victory plow at Waridala

health checks, and attempts at the systematic use of traditional health practices and medicines.

- Manure is made into compost and used for crop production.

Failures or negative lessons

- The village is highly structured in terms of traditional gender roles and women do not use work oxen. As a result it appeared that development of animal traction might further marginalize the women, and possibly also the children, who often have to look after the animals.
- Yokes are not well designed or manufactured. They are not tightly attached to the horns, and this movement reduces the tractive power of the animals.
- Pairs of oxen were used for seeding, whereas only a single animal is needed.
- The plow has no provision for horizontal/lateral adjustment. The landside is not adjustable. The wheel is not of suitable design since the use of ball bearings should be avoided. The Anglebar plow (superseded by the Pecotool, but still in use) clogged easily due mainly to its low clearance and the rectangular shape of the plow support. The Pecotool weeding and groundnut lifting attachments are underutilized.
- The Super Eco seeder is not adapted to the prevailing humid soil conditions as it is easily clogged.
- The metal zig-zag harrow is too light and does not allow good harrowing.
- The farmers complained that the cost of spare parts is high.
- The Work Oxen Project is only supporting the animal traction aspect of farming, and farmers require other inputs as well.
- The commercial development of farming seems poor, since there is no cash crop. There is little demand for produce within the

village and no easy access to external markets.

- External services, such as animal health or credit provision are lacking.
- Farmers cited that they had difficulty in obtaining oxen.

Primary constraints

The Work Oxen Project is working in "technological isolation". There are many agronomic and economic problems for which it cannot offer any solution.

There is no marketing structure to encourage the commercial development of farming.

Possible solutions

- There is a need to adopt a more interdisciplinary and integrated approach to agricultural development. The Work Oxen Project should be less isolated and should coordinate its activities with other projects to ensure the farmers have access to a much wider range of services.
- Marketing structures should be established as an incentive for crop production.
- There should be further testing and adaption of the animal traction equipment. New designs, such as the UPRIMA seeder from Togo, should be tested.
- It might be useful to undertake trials using draft cows, in case this could be a solution to the problem of obtaining replacement animals.

Weeding upland rice with Pecotool at Waridala



Demonstration of animal power gear systems at Rolako Ox Plow Centre

by

Jonas Koroma¹ and Wulf Boie²

Background

Two animal power gears were set up at the Rolako Ox Plow Centre during the months of August and September 1986, with financial and technical support of the German Appropriate Technology Exchange (GATE), a division of GTZ. These gears will serve the Work Oxen Project as equipment for demonstrations and tests. The current programme is also intended to determine the extent to which animal power gears can be introduced at village level. The Work Oxen Project (WOP) will carry out a research programme on it during the next few months.

The gears have been built in the workshop of the Ox Plow Centre, although some parts, such as the chain drive and the machines driven by the gears (the rice huller, cereal mill and water pump), have been imported from Europe.

Single purpose gear

This system is used to drive a maize mill with a single ox. It is also planned to carry out trials using this gear system to drive a cassava grater, but this installation could not be finished before the demonstration for the Networkshop.

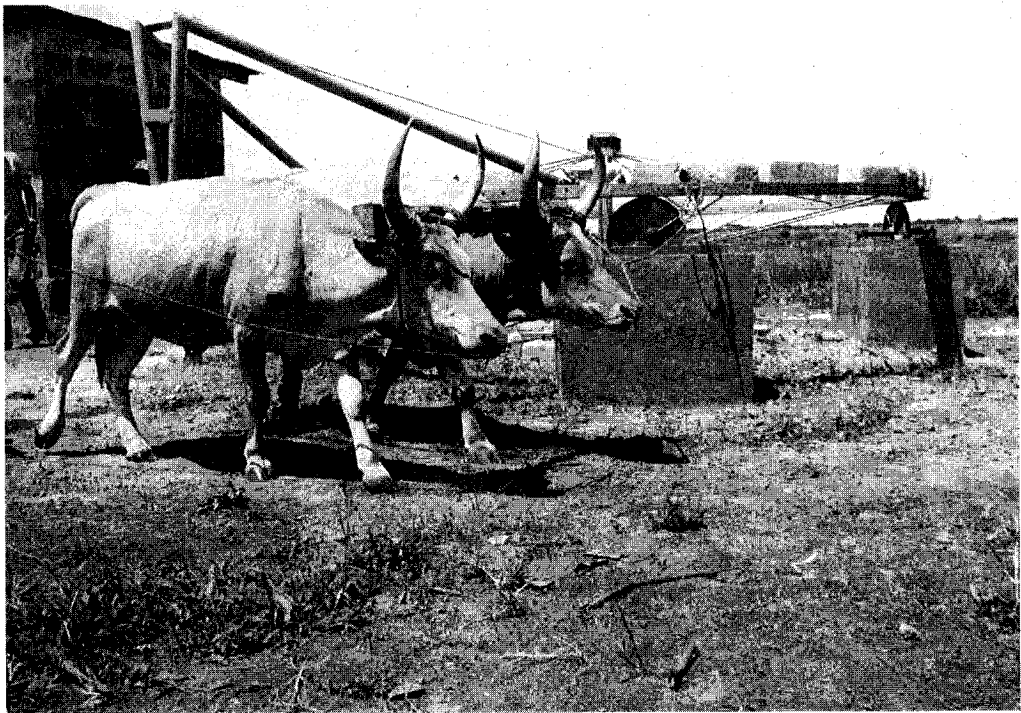
Several gears of this type have already been installed at village level in Senegal and Burkina

¹ Sierra Leone Work Oxen Project

² Projekt-Consult GmbH, on behalf of GATE/GTZ

Demonstration of the single purpose gear used as a maize mill





Oxen turning the multipurpose gear at Rolako

Faso. In these countries the system is used to grind millet, and donkeys are used as draft animals. The women who utilize the mill usually use their private donkeys and operate the mills themselves.

The working principle is as follows. A draft animal moves the frame around a circular wall built of bricks. This brings into motion the car wheel that is supported by the wall. This wheel, in turn, drives the mill by means of a chain drive.

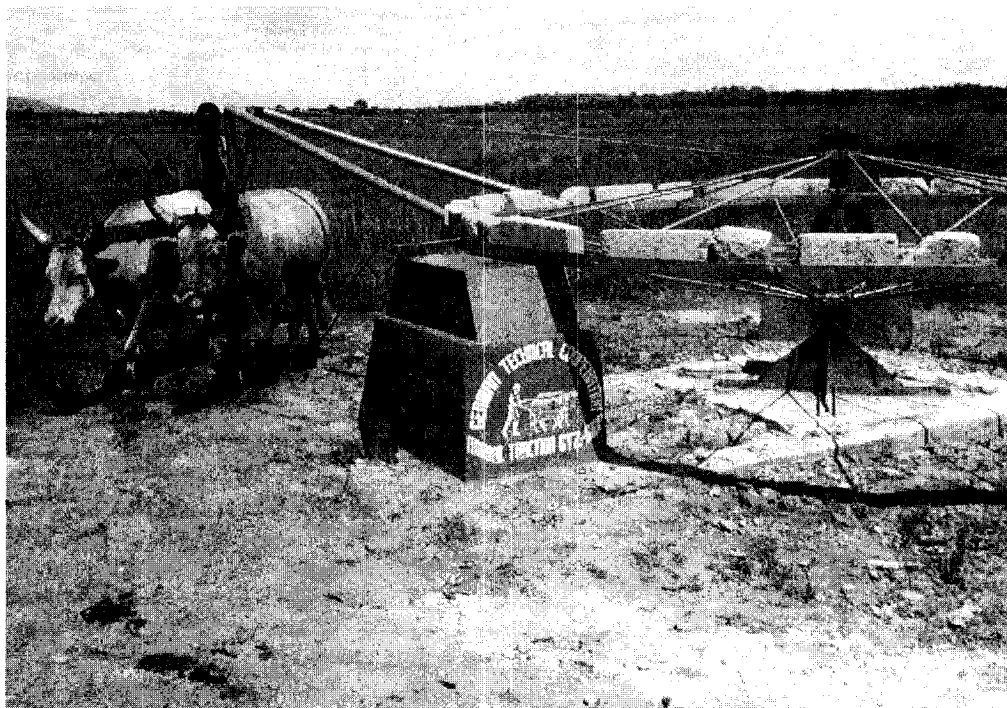
The main advantages of this gear are its comparatively low cost and its simple design. On the basis of current prices, the locally purchased materials to construct the unit cost about US\$ 450, and the mill, imported from Europe, costs about US\$ 250.

The output of the mill has been calculated at about 14 kg maize per hour when two grinding operations are carried out (the first grinding

produces a rough milling while the second is more fine). As the machine is still undergoing tests and research, the final output rates are not yet known. The output of the mills installed in Senegal and Burkina Faso range between 10 and 15 kg h⁻¹.

Multipurpose animal power gear

The installed multipurpose animal-powered gear system is a prototype being tested for the first time in an African country. The system is designed as a multipurpose drive for different machines that require a relatively high rotational speed, and it provides an output of up to 500-600 revolutions per minute (rpm). The gear is intended to drive various crop processing machines, including a rice huller, cereal mill, cassava grater and oil press. The system is currently driving both a rice huller and a water pump. The present price is relatively high (US\$1500) and the main tasks for further de-



Multipurpose animal-powered gear being demonstrated at Rolako

velopment are to decrease the overall cost and to increase the output of the rice huller.

This system works upon the principle of friction. A large wheel made from U-channel steel is turned by a pair of yoked animals. This drives a small friction wheel with a rubber surface from a car tyre. The friction wheel, in turn, drives a shaft leading to the machines. The shaft drives the machine by means of a simple flat belt drive. The change from one machine to another can be done by changing the flat belt.

The water pump that is driven by the gear system is designed to provide Rolako station with water for domestic purposes. The pump is able to lift the water at the rate of about $2 \text{ m}^3 \text{ h}^{-1}$, through a 120-m pipe, to a total height of about 16 m.

The output of the rice huller depends on several parameters including the adjustment of the huller blade and its outlet, the number of revolutions per minute, the variety of the rice being milled, the moisture content of the rice, whether the rice is parboiled or not and the temperament of the animals. During the first tests with parboiled rice, the output was about 15 kg h^{-1} . There were hardly any broken rice grains among the milled rice, and the recovery rate was good at about 80%. During the demonstration, non-parboiled rice was milled, which gave a higher output rate but a lower recovery rate. During the coming year the Work Oxen Project will carry out a research programme to establish the influence of various parameters on the quantity and quality of rice milled and to evaluate the acceptability of the product to consumers.

Title photograph (opposite)

*Workshop group discussing animal traction research and evaluation methodologies
(Photo: Ministry of Agriculture, Natural Resources and Forestry, Freetown)*