



DRAUGHT ANIMAL NEWS

No. 31

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- ☆ Draught Animal News becomes truly international – for the first time we have articles written in Spanish, French and English in the same issue. We are grateful for all those people who found the time to write in.
- ☆ The number of books produced for Draught Animal users continues to increase. We have news in this issue of two books written mainly for people in USA and UK who keep working oxen and horses. However, much of the content of each of the books is relevant to owners in other parts of the world.
- ☆ Please continue to send in your news and articles, preferably on a 3½" disk (using Microsoft Word, Word Perfect or Rich Text Format) or via email. If you wish to include photographs, we need the best possible definition because of losses in the reproduction process. Therefore high resolution photos saved in .tif format are preferable (using Winzip to compress the file if necessary), or the original photograph. The editor: *Dr R.A. Pearson, Editor, Draught Animal News, Centre for Tropical Veterinary Medicine, Easter Bush, Roslin, Midlothian EH25 9RG, Scotland, UK. (Fax: 44 131 445 5099; e-mail: anne.pearson@ed.ac.uk).*
- ☆ Jon Verhaeren assisted in the preparation of this issue.
- ☆ The drawing on the front cover of a buffalo in Vietnam is by Archie Hunter.

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RESEARCH AND DEVELOPMENT PROJECTS

1. LATIN AMERICA

(a) Colombia

Soil preparation alternatives for the sugarcane production system in the region of Gualiva (Cundinamarca)

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Summary

To establish the effect of the soil preparation on the production of the sugarcane crop, an experiment was carried out where three farming systems were proven. Bullocks were used as the power source and the animal draught implements used were a traditional reversible type mouldboard plough and a ridger designed by the Colombian Agricultural Institute (ICA).

It was concluded that the use of the animal traction as a tillage power source constitutes a viable alternative, when properly used in combination with appropriate implements for tillage. It is an effective option. The employment of the ridger ICA represented a better crop development than the other treatments, besides being the cheapest.

Introduction

The region of Gualivá is an area located in the department of Cundinamarca that represents a high contribution to the Agricultural Internal Product, with crops like vegetables and citrus and with much capital generated by the sugarcane crop. Particularly in smallholding zones, where hillside lands are characteristic, the sugarcane crop has developed as an agricultural product of outstanding importance in the rural economy. One of the most demanding tasks in terms of effort on the part of the producer, is the tillage. Therefore, the development of new technologies that make the work conditions more affable, and that are synonymous of productive and conservationist soil preparation is of invaluable importance. The use of the producer's resources represent a source of basic investment for the incorporation of techniques intended to improve the production.

A comparison of improved and traditional techniques encourages the owner and the producer of the area to adopt the techniques that magnify his work and production. These people then become diffusers of such alternatives of soil tilling.

In sugarcane crops a combination of the following soil tillage systems with a previous cut and burning of weeds is commonly used:

- Manual preparation with hoe, pike or both.
- Ploughing up new ground with draught-oxen mouldboard plough and by hand.
- Ploughing, traversed plough pass and ridging using animal traction.

Materials and methods

The experiment was located in a place called El Hato belonging to the municipality of Guaduas, Cundinamarca. The field had a 23.5% slope and a soil texture middle clayey-sandy (FArA); area: 4863 m², pH: 5.7; mean temperature: 23°C; average rainfall: 1628 mm. The field was divided into three plots, each one of which having one of the treatments implanted. Prior to the tillage experiments, a Glifosato dose of 4l/ha was applied on the three plots. The characteristics of the animals used in the experiment were: calculated weight (kg): 439.5 and 443.8, health: good, age: 5 and 5.5 years.

Traditional tillage treatment, consisted of a plough pass (Plate 1), a traversed plough pass and a ridging, using the peasant's traditional reversible type of mouldboard plough. The ridge separation in this treatment was 120 cm. The ridges were made following the natural land level paths and with the help of a *cejero* (an operative's helper who leads the yoked team for the ridges path through a rope attached to the animals nose ring).



PLATE 1:

René Rodríguez
with a team of
bullocks and a
plough in Bolivia.

The second treatment (reduced tillage), consisted of a previous pass with the mentioned plough. The ridging was performed using the ICA ridger, under the same technical indications of the traditional tillage.

In the third treatment or holing (*ahoyado*), 30 cm side wells were made, leaving 60 cm among them (Plate 2). In this job workers used a manual implement called a *palín* (a spade-like implement with which holes were made).

To establish the differences between the treatments, they were compared as follows:

- The initial soil conditions, subsequent to the preparation, and then 80 days after the tillage.
- The field capacities and the power requirements.
- The crop development, which was followed along three months. Measurements were made 38 and 80 days after the sowing.



PLATE 2:

Sugarcane beds
made through the
holing system in
Colombia.

(R. Rodriguez)

Results and analysis

Soil tillage work

The data obtained in the soil tillage work are shown in Table 1, for traditional tillage.

Table 1: Traditional tillage: equipment performance.

Work	Ploughing	Traversed plough pass	Ridging
Width (cm)	17.5 (0.5)*	22.4 (2.6)	116** (11)
Depth (cm)	22.0 (2.8)	23.9 (2.3)	20.8 (3.8)
Speed (m/s)	0.49 (0.26)	0.46 (0.27)	0.42 (0.37)
Horizontal draught (kgf)	142	137	130
Power (kW)	0.682	0.618	0.535
Effective field capacity	7.9	7.9	2.8
Total efficiency	68.2	55.6	33.7

*Average of the measurements. Standard deviation in parenthesis

**This width represents the ridge separation

The values obtained from the operation width measurements (Table 1) were expected for ploughing, the advisable values range from 15 to 25 cm. According to the theory, depth values should vary around 20 cm which happened in this case. Therefore the values obtained are quite acceptable and appropriate for the crop development. Regarding the registered speed values, they were a little low in response to the draught increase, but a hard soil was found according to the results of the initial soil condition study. The draught values were higher and almost 18.5% of the animals weight was used as draught force. This value was measured for a short performance period during the 6 hours of daily operation.

The same considerations above are applicable to the work of the traversed plough pass and ridging in Treatment 1. The power developed in all the work was in an acceptable range.

5.

The data obtained for the reduced tillage treatment are shown in Table 2.

Table 2: Reduced tillage: machinery performance.

	Ploughing	Ridging
Width (cm)	21.9 (3.3)	133.4* (0.1)
Depth (cm)	20.7 (2.1)	21.9 (2.7)
Speed (m/s)	0.48 (0.2)	0.35 (0.13)
Horizontal draught (kgf)	150	132
Power (kW)	0.706	0.453
Effective field capacity	52.3	24.1
Total efficiency	51	25

* This width means the ridges centre separation.

According to Table 1, the work of ridging showed the lowest efficiency. It was understandable taking into account the operative's unfamiliarity with the work and the inexperience of the yoked team in the operation. The use of the *cejero* was necessary in the work related to the ridging, even more, when the bullocks yoked were not experienced, because they try to alter the course and the separation between ridges is lost. Such factors as the time spent in cleaning the implement, the time spent in turns and rests in the work day, can account for the reduction in the total efficiencies of the work.

As with the traditional soil tillage, the values found for the ploughing and for the ridging in the second treatment (see Table 2), in respect to the operation width and depth measurements, showed results which were acceptable and similar to the expected ones. In spite of the low speed values in response to the initial soil conditions and the draught rising; the power development was appropriate.

In Table 2, a marked difference between the efficiencies found in the ploughing and ridging works for the second treatment were shown. This was in response to the operative's poor agility at ridger use.

The efficiency and field capacity values between the two treatments in the ploughing work should be approximately the same. In this case there were differences especially in the final efficiency. The reduced tillage efficiency was less than the traditional one, due to factors such as turning efficiency which was determined by the land conditions and the operative's agility. The field capacity values were approximately the same.

The following data were obtained for the third treatment (holing):

Holes separation:	128 cm from centre to centre
Average time per hole:	2.84 min
Average hole dimensions:	Length: 35.6 cm • Depth: 28.7 cm Width: 36.9 cm
Covered area in 6 hours:	114.54 m ² by two workers
Labour:	130 J/ha.

Soil**Table 3: Soil performance in traditional tillage.**

	Measurement times					
	t0		t1		t2	
	0-15	15-30	0-15	15-30	0-15	15-30
Bulk density (Mg/m ³)	1.16	1.40	NA	NA	1.14	1.35
Moisture content (%)	35.8	30.7	25.0	26.9	23.1	28.8
Cone index (MPa)	0.701	1.500	0.072	0.832	1.178	1.683

NA: Not available

Table 4. Soil performance in reduced tillage.

	Measurement times					
	t0		t1		t2	
	0-15	15-30	0-15	15-30	0-15	15-30
Bulk density (Mg/m ³)	1.23	1.35	NA	NA	1.31	1.36
Moisture content (%)	37.5	26.9	26.6	26.4	22	25
Cone index (MPa)	0.960	1.780	0.233	0.687	1.747	2.431

NA: Not available

Table 5: Soil performance in holing.

	Measurement times					
	t0		t1		t2	
	0-15	15-30	0-15	15-30	0-15	15-30
Bulk density (Mg/m ³)	1.37	1.45	1.36	1.46	1.33	1.41
Moisture content (%)	27.3	22.5	26.2	26.1	25.2	24
Cone index (MPa)	1.010	1.853	0.838	1.544	1.572	2.216

As a conclusion from Tables 3, 4 and 5, it can be seen that the soil in Treatment 2, was tightening/hardening faster than in the first treatment because the density values in the Treatment 2, had already passed the initial values; while in Treatment 1, this trend was not yet present. This phenomenon is clear, since in the first treatment the soil was more disturbed as a consequence of the tillage with the purpose of giving better conditions for the roots taking. In response to this tillage the Cone Index diminished by 90 % from its initial value. It is also clear that the practices employed considerably affected the soil condition in the layer between 15 and 30 cm of depth. All the above mentioned reactions should be considered in the knowledge that the moisture values were decreasing with time, and this could influence the hardening or the soil tightening.

Treatment 3 cannot be compared to the other two treatments, because it was not put under soil tillage practices strictly speaking, instead the soil structure was disturbed only in the places where seeds were sown.

Crop measurements

With the purpose of quantifying the effect of the soil preparation practices on the crop, measurements at different development stages of the crop were made, as shown in Table 6.

Table 6: Two development stages crop measurements for the three treatments.

Treatment	Days	Crop density plants/m ²	Plant height (cm)	Number of leaves
1	38	4.82	11.36	3.35
	80	6.32	19.78	6.90
2	38	4.10	11.90	3.50
	80	6.41	26.20	9.85
3	38	1.74	12.75	3.65
	80	2.62	25.73	7.15

Plant densities per m² were small for the treatment three than for the other two. Treatment 3 showed smaller density values than Treatment 1 in the first measurement, but for the second measurement the bulk density had overtaken that of Treatment 1; Treatment 1 increased 131% while Treatment 2 increased 173%.

For the second measurement, treatments which were sown through *chorrillo* showed similar density values. The above can be explained by the fact that the more disturbed the soil is, the easier the plants germinate; therefore Treatment 2 germinated more slowly than Treatment 1 although a faster growth was achieved, maybe in response to the better soil conditions for plant development.

As for the plants' height, the two measurements for Treatments 2 and 3 showed similar values between them, bigger than those presented in Treatment 1.

For the measurement time 2, the reduced tillage treatment showed an increase of 213%, while the holing increased 202% with respect to the initial height.

Similarly, the number of leaves presented the highest increase in Treatment 2 with an increment of 274%, while in Treatment 1, it was of 206% and in Treatment 3 of 196% with respect to the number of leaves recorded in time zero; giving Treatment 2 the best crop development and growth conditions.

Tillage cost

Each treatment preparation cost is shown in Table 7.

Table 7: Preparation cost for the three treatments.

Work	Field capacity (h/ha)	Unified cost(\$)	Total cost(\$/ha)
Traditional tillage			
Ploughing	47.10	22,000	172,700
Trav. Plough Pass	47.20	22,000	172,700
Ridging	16.90	22,000	61,966
Cejero*	16.90	10,000	28,127
<i>Total</i>			<i>435,534</i>
Reduced tillage			
Ploughing	52.30	22,000	191,767
Ridging	24.12	22,000	88,440
Cejero*	24.12	10,000	40,200
<i>Total</i>			<i>320,407</i>
Holing			
Holing	130	10,000	1,309,000
<i>Total</i>			<i>1,309,000</i>

Currency: Col \$ 1984= US\$1.00

Table 7 shows that reduced tillage practices gave the lowest preparation costs, besides the fact that values in Table 7 do not include the worker's meals, which increases the holing cost, is important. It is necessary to perform an additional cleaning of the ridges through the hand-hoe when clods fall inside them because of the slope of the land or of the operative's path. Economic analysis should consider the above extra expenses.

Conclusions

1. In spite of the better root taking condition of the crop following the traditional tillage treatment, with low values of both cone index and bulk density, reduced tillage treatment gave the best growth results, quantified by means of both the number of leaves and plant height.
2. It is likely an increase of the cone index values for the three treatments was due to the decrease of the soil moisture content.
3. In comparison to the traversed plough pass and ridging tillage practices, ploughing is the most efficient; in terms of both the operative's implement and job experience. Ploughing requires a power input within the capacity of animal power, which makes animal traction use appropriate for these tillage practices.
4. It is cheaper to prepare a hectare for the sugarcane crop by the use of animal traction, performing work that involves one ploughing and a ridging. The traversed plough pass of the lands is an advisable practice to improve the ploughing practice effect on the soil structure. Holing is the less profitable system in comparison to the reduced and traditional tillage.
5. Animal traction as a power source in soil tillage practices becomes a technical option for the producers to improve both, their lands and their resource management. It is necessary to encourage appropriate management of draught animal technologies, providing guidelines to assist promotion and adoption. This can contribute to the new agricultural projects rising for the rural sector.

References

- Camacho García H. (1981). Preparación de suelos en zonas de ladera. In: *Mecanización en el cultivo de la caña panelera. Industrialización de la caña*. Compendio No. 42. ICA. p.15-23.
- Gajendra Singh *et al.* (1989). Performance of bullocks under different load and climatic conditions. *AMA* **20**(4), 23-26.
- Harbbans, Lal. (1985). Animal wheeled tool carried: an appropriate mechanization for improving farming systems. *AMA* **16**(1), 38-44.
- Kemp, D.C. (1987). Animal traction: some recent and current works. *Revista de Zootecnia* **63**, 7-14.
- Sims B.G. & Jacomé M. (1989). Estimation du poids des bovines et trait au Mexique. *AMA* **20**(4), 23-26.

(b) Bolivia

El impacto de la investigación en mejoramiento de animales de trabajo: El proyecto prometa en Bolivia

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Summary

The DFID funded Draught Animal Improvement project aims to combat rural poverty through improving the productivity of farm working animals. The emphasis is on participation with local farmers in the inter-Andean valleys (high, dry and cold). The Project is working on a wide range of topics affecting animal welfare and output: health, nutrition and implements and harnesses. Some results to date include: ox carts; high lift harnesses and light-weight implements for equines; improved pastures and feeding systems. The impact is already impressive with sales of implements and pasture mixtures through local companies. The future programme includes combining feeding with hillside soil and water conservation; design and manufacture of reduced till implements for single animals. The Project actively disseminates its results and was the host for the III Latin American Congress of the Regional Animal Traction Network in November 1999.

Introducción

La ayuda internacional hacia los países en desarrollo, cuya finalidad es reducir los índices de pobreza, son efectivos en la medida en que transforman actitudes de su población. De ahí que decimos que la lucha por la pobreza empieza por case con una racionalidad en el uso de los recursos disponibles para generar tecnologías que tiendan a un incremento de la capacidad productiva que produzca ingresos mientras preservan el medio ambiente.

Dentro este marco y basado en la observación y diálogo con los agricultores de la región interandina de Bolivia; se implementó el Proyecto "Mejoramiento Tracción Animal" PROMETA-CIFEMA, bajo un convenio entre la Universidad Mayor de San Simón a través de la Facultad de Agronomía y el Ministerio de Desarrollo Internacional (DFID), del Reino Unido. Cuya finalidad es aumentar el rendimiento de los animales de trabajo en los sistemas de producción agropecuarios de ladera.

La investigación un instrumento y un mandato de prometa

Hay diversas maneras de introducir tecnología a los agricultores: unas son desarrolladas fuera del lugar directamente importados y atados a paquetes y entregados bajo diferentes modalidades hasta de donación; otros desarrolladas en estaciones experimentales y luego transferidas mediante equipos de extensión; y otras que tienen la característica de haber sido desarrolladas con los agricultores y como tal, siempre tuvieron una rápida adopción por los beneficiarios.

Con los antecedentes anotados, la metodología de investigación del Proyecto, es realizar trabajos en predios de agricultores con la intervención de los mismos y los investigadores en forma horizontal y consensuada, para la identificación, ejecución y evaluación del problema. Así el enfoque de la investigación es participativa con la

familia campesina (hombres y mujeres), particularmente con las mujeres que laboran dentro de los sistemas agropecuarios, administrando la economía del hogar y el trabajo de alimentación y cuidado del ganado. Además el Proyecto interactúa con ONGs y OGS para la difusión de los resultados de la investigación.

Las zonas de intervención del Proyecto resumen la diversidad de agroecosistemas de la región andina que están caracterizados en seis comunidades de tres provincias (Cuadro 8).

Cuadro 8: Características agroecológicas de las comunidades de influencia del PROMETA

Zonas Agroecológicas: Valle		Montaña	Puno
Comunidades	Sarcobamba Sarcok'uchu	Piusilla San Isidro	Kolque Joya Boquerón Kasa
Altura (msnm)	2,300	3,600	3,580
Topografía	Plana	Con pendientes fuertes	Pendientes moderadas a fuertes
Temperatura (°C)	18	15	14
Cultivos	Hortalizas, papa, maíz	Papa, haba y cereales	Papa, haba y cereales

La detección de problemas y necesidades de investigación en animales para tracción se han caracterizado en tres aspectos fundamentales: nutrición, salud y tecnología. Esta última abarca la diversificación del uso de animales y el desarrollo de equipos e implementos de trabajo.

Resultados obtenidos

El Proyecto ha iniciado muchas líneas de investigación, a continuación se describen algunos resultados salientes.

Carreta para yunta de bueyes

Se desarrolló carreta mono eje con chasis metálico y plataforma de madera de 1.8 m de largo, 1.2 m de ancho y 0.95 m de altura. Tiene una masa de 224 kg, volumen cerrado de 1.1 m³ y capacidad de carga diseñada para 800 kg. Es jalada por timón de madera acoplado al yugo tradicional de nuca de la yunta de bueyes. Una característica novedosa son los frenos de tambor con balatas externas accionadas por palancas manuales, uno en la parte delantera y otro en la parte posterior.

Los resultados de las pruebas técnicas demostraron su efectividad en el uso con animales de peso mediano y en terrenos con pendientes ligeras como son los terrenos de la zona de puna (provincia Tiraque). Además hay un ahorro significativo en los costos de transporte comparado con los métodos tradicionales de cargar sobre el lomo de equinos y humanos.

Arneses de alto levante para equinos sencillos e implementos livianos

Los equinos (caballos y burros) pueden jalar implementos para la cultivación mediante sistemas de transmisión sencillos y cómodos como lo es el arnés de alto levante. Ensayos han demostrado una reducción de la fuerza de tiro horizontal por un elevado ángulo de enganche hasta 40° (Plate 3).

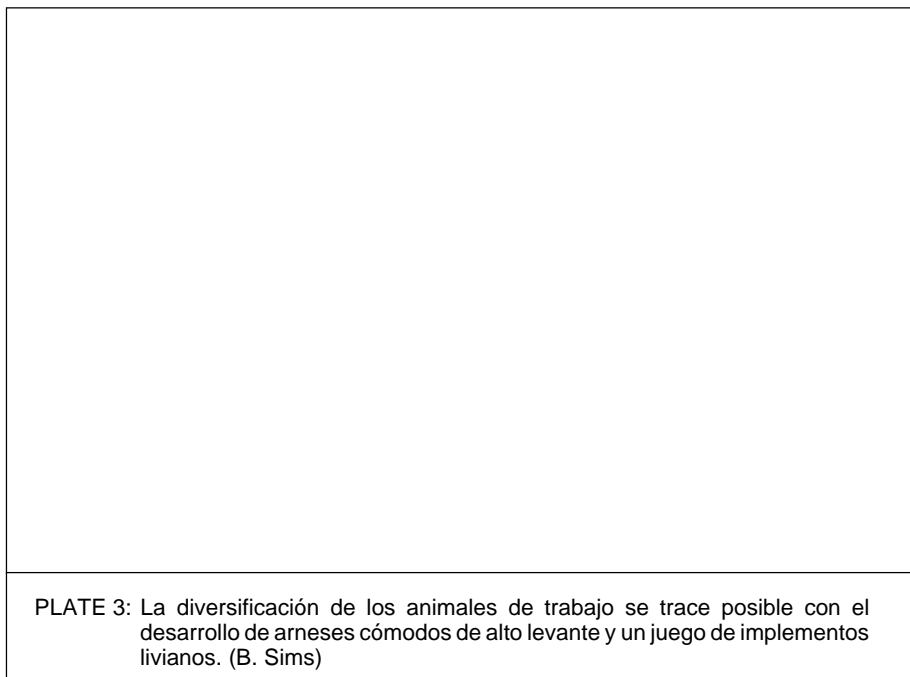


PLATE 3: La diversificación de los animales de trabajo se trace posible con el desarrollo de arneses cómodos de alto levante y un juego de implementos livianos. (B. Sims)

Mejoramiento de praderas y sistemas de alimentación

La producción de forraje para los animales de trabajo es escasa, sobretodo en época seca. Por tanto es una preocupación constante para los agricultores, máxime en un sistema agropecuario “difícil” como lo es la zona interandina; por su escasez de agua y temperaturas bajas. Por lo que se está llevando adelante un estudio a objeto de definir las deficiencias nutricionales según las estaciones del año y elaborar un paquete alimenticio suplementario económicamente y fisiológicamente viable.

Así mismo el déficit alimenticio trae como consecuencia la necesidad de vender las yuntas a precios bajos; por lo que se ha visto la forma de proveer forraje suficiente por medio del establecimiento de praderas mixtas en terrenos en descanso (3 a 6 años sin cultivo), donde se han obtenido resultados positivos con una leguminosa el trébol rojo (*Trifolium repens*), y dos gramíneas, el lolium (*Lolium perenne*) y la festuca (*Festuca arundinaceae*) cuyos rendimientos fueron satisfactorios y aceptados por los agricultores.

Impacto del proyecto

Al haber sido desarrolladas las tecnologías junto a los agricultores y la infraestructura ya establecida en el Centro de Investigación Formación y Extensión en Mecanización Agrícola (CIFEMA), en cuanto a equipamiento y personal han hecho que la difusión de los resultados sea rápida. Por lo que a la fecha de han fabricado y vendido 10 carretas para yunta de bueyes en diferentes comunidades rurales y más que 100 equipos para caballo y burro. La semilla para praderas mejoradas estas siendo suministrada por una

empresa local de semillas (SEFO). Una consecuencia de los resultados de la investigación ha sido también la realización del Primer Seminario Taller Nacional en Tracción Animal; a cuya finalización se ha conformado la Red Nacional de Tracción Animal como nodo regional de la Red Latinoamericana de Tracción Animal, RELATA. El Proyecto será el anfitrión del II Encuentro Latinoamericano de RELATA en noviembre de 1999.

Conclusiones y programa futuro

Todavía no es posible predecir con certidumbre el éxito de cada elemento del Proyecto. Sin embargo el concepto de participación con las comunidades mejora las posibilidades de una adopción de los resultados. Todos los elementos bajo investigación han sido escogidos por las comunidades y ellas manejan los experimentos en sus parcelas en coordinación con los investigadores. Luego la participación de las comunidades en la evaluación de los resultados confirmará su beneficio total dentro de los sistemas de producción de laderas.

El presente Proyecto tiene una vida de solo tres años y quedan temas de investigación en las áreas mencionadas (salud, nutrición, diversificación de uso, desarrollo de implementos y equipos agrícolas). Como es un Proyecto dinámico, tiene que responder a los intereses de los comunarios. Las siguientes actividades se destacan para el futuro inmediato:

- Seguir e intensificar la investigación en producción de forraje en la época seca.
- Combinar la producción de forraje con la conservación de laderas por medio de barreras vivas y cultivos de cobertura.
- Diseño, fabricación y evaluación de implementos de arado cincel con equinos para labranza reducida en laderas en combinación con mini-terrazas.
- Diseño, fabricación y evaluación de sembradora de cero labranza para laderas.
- Desarrollar equipos de transporte para equinos.
- Combinar los elementos de nutrición, salud, arneses, implementos, conservación de suelo y agua, estabulación en estrategias para el mejor manejo de animales de trabajo en los sistemas interandinos.

(c) Mexico

Economics of draught animal ownership in smallholder *campesino* (peasant) Hillslope Agricultural Production Systems in the State of Mexico

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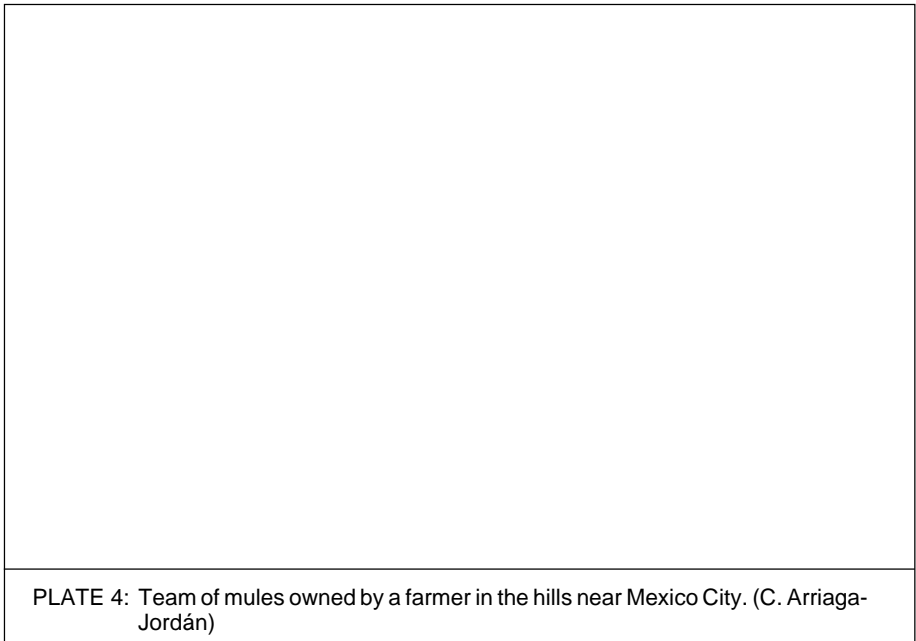
Despite the fact that draught animal power is fundamental for agriculture and rural livelihoods in Mexico, there is very little research undertaken to know and improve the performance of work animals. The Research Centre in Agricultural Science (*Centro de Investigación en Ciencias Agropecuarias* – CICA) of the Autonomous University of the State of Mexico is concerned with research and development for smallholder *campesino* agriculture which comprises over 87% of agricultural producers in the state and the

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country, with the objective of contributing to sustainable rural livelihoods.

Several of CICA's projects have been undertaken within a participatory approach working with *campesino* villages in the municipality of San Felipe del Progreso, located at 19° 28' to 19° 47' 07" N and between 99° 52' 02" and 100° 16' 26" W, and an altitude of 2,500–3,000 m. The municipality has a mixed topography, with highland valleys surrounded by hills and mountains; with a sub-humid temperate climate.

Both in the valleys, but especially in the hills, the livestock element is of vital importance to the livelihoods of *campesino* families, with a very strong interaction between the crop and livestock components of *campesino* systems. The goal of *campesinos* is to own their ploughing team (Plate 4), which enables them to undertake the ploughing and cultivation tasks at the times when it is most convenient, allowing better performance of the crops. This is most important due to the unreliability of rains (González et al., 1994).



Within this framework, a team from CICA undertakes a project with the objective of improving the management and performance of working equids following a participatory rural research approach in hillside *campesino* farming systems in *San Pablo Tlalchichilpa*, a *campesino* farming village belonging to the *Mazahua* ethnic group in the municipality of San Felipe del Progreso.

This paper reports on the economics of draught animal ownership. Calculations were made through activity budgets for production and opportunity costs for agricultural and other activities performed with the use of equids, who have greatly replaced the traditional use of bulls for ploughing and cultivation purposes. Large equids are

multifunctional, in that besides ploughing tasks they can be ridden and used to carry loads.

Mean farm size is 2.5 ha, and the ownership of draught equids represents a number of benefits.

Ownership of equids

1. Represents savings since families do not have to rent in ploughing teams to do the tilling and cultivation of the fields.
2. Enables the undertaking of agricultural activities on time, which is crucial given the small window of time that the climatic conditions impose on agriculture.
3. Enables the transport of the harvest (around 1,500 to 2,000 kg of maize cobs/ha). These three aspects may be accounted for by ascribing opportunity costs and represent 897.50 Mexican Pesos/ha, or 2,018.75 Mex.cy./year/farm, equivalent to US\$211.00 /farm/year (US\$1.00 = 9.55 Mex Pesos).
4. The carrying of loads undertaken by equids may also be accounted for, mainly in the form of carrying manure and other soil amendments needed in the maize fields, which represent an extra 318.75 Mex cy/farm/year (US\$ 33.80).
5. Those farmers who own ploughing teams may rent them out to others, which represents an additional income both for agricultural activities as well as for carrying loads of around 2,624.38 Mex cy/farm/year (US\$ 275.00).

Taking these figures, the ownership of working equids represents direct opportunity costs of around 935.00 Mex cy/ha (US\$ 98.00/ha) or 2,337.50 Mex cy/farm with 2.5 ha, plus the possible income of from renting out the equids, giving a total margin of 4,961.88 Mex cy/farm/year (US\$ 519.60/farm/year).

Deducting the depreciation and keep of a pair of large equids (mules are preferred, but also horses are used) calculated at 1,592.00 Mex cy/year, the direct economic impact of owning a pair of equids is around 3,369.88 Mex cy/farm/year (US\$ 352.90).

This has enormous significance when it is considered that the urban minimum wage in the State of Mexico is 30.00 Mex cy/day (US\$ 3.14/day).

Besides, there are a number of other important economic benefits which cannot be accounted for in money terms:

6. The renting out of equids for other load carrying activities (fertilisers, building materials, etc.) which do not take place regularly, so that they are difficult to account for.
7. Equids, particularly donkeys, play a most important role in domestic chores such as carrying water, firewood, clothes, food and other goods. It is not common for families to rent in animals for these activities, and they usually are the responsibility of women and children (von Keyserlingk, 1996) so that equids here play a most important role in improving the quality of life of these vulnerable groups which otherwise have to carry heavy burdens on their backs.
8. It is also necessary to account for the fertilising contribution of manure, which farmers acknowledge as vital for good crops.

This study concludes that the ownership of draught equids has a considerable economic benefit for *campesino* farming systems, and they also play a very important role in contributing to improve the quality of life of campesino families.

References

- González Díaz, J., Velázquez Beltrán, L., Espinoza Ortega, A. y Arriaga Jordán, C. (1994). Draught animals in small-holder (campesino) farming systems in the Highlands of Central México. *Draught Animal News*, Centre for Tropical Veterinary Medicine, University of Edinburgh, **21** (November, 1994), 7-10.
- von Keyserlingk, A. (1996). The study of the use of the donkey in the Central Highlands of Mexico from a gender perspective. MSc Thesis. Centre for Tropical Veterinary Medicine, University of Edinburgh.

2. ASIA

(a) Indonesia

The relevance of animal power for land cultivation in upland areas: A case study in East Java, Indonesia¹

Ir. A. M. g. Cornelissen & Dr. Ir. H. M. J. Udo

Dept of Animal Sciences, Animal Production Systems Group, Wageningen Agricultural University, The Netherlands

This work is based around animal power within a farming system. It investigated the hypothesis that the main factors determining the role of animal power for land cultivation in upland areas are the characteristics of the soil and terrain. To determine the reliability of this hypothesis two villages were compared in a case study.

The first village (*Putukrejo*) is on land with deep soils on the flat areas that are dominated by annual crops. Of this higher quality land 35% is cultivated by cattle, whereas only 14% of the poorer land is cultivated this way.

At the second village of (*Kedungsalam*) agroforestry is increasingly important due to the steep slopes and shallow, stony soils. Only 11% of the better land at Kedungsalam was cultivated by cattle and an even smaller number of 6% on the poorer land. As expected this meant that the better land at Putukrejo had the highest levels of land cultivation efficiency. However at village level it was found that not all available energy is spent on land cultivation, this was especially true in the second of the two villages.

At village level the data followed the previously mentioned hypothesis. However, at farm level this is not always the case because land use seemed to determine the use of animal power rather than soil and terrain characteristics.

Animal Production Systems Section at Wageningen

The primary tasks of the of the Department of Animal Husbandry of Wageningen Agricultural University are research and education related to the study of animal production systems, with special emphasis on sustainability. Its mandate covers a wide range of production systems, from those characterised by high external inputs and high

¹A paper on this work has been published in *Agricultural Systems*, 1997, **54**, 271-289.

levels of production per animal to low external input production environments where animals perform a variety of functions.

The research findings, just as with any university department, are laid down in papers for scientific journals or proceedings of conferences, or in PhD-theses. Part of the research work covers issues relevant to livestock systems in developing countries. To discuss implications of this work for livestock systems development they sometimes combine research findings with general impressions on (tropical) livestock for e.g. public lectures or papers for professional journals. They would like to make this spin-off of their research efforts more easily available for livestock development purposes. Added to this, they encourage direct exchange of views and experiences.

Electronic means of communication are becoming increasingly more important in information exchange. So, they have combined on a diskette eight papers that represent some of their views on current issues in livestock production. The papers are stored in WordPerfect 5.2 files:

A View On Current Issues In Livestock Production

Editors: Ruba Mohamed, Fokje Steenstra and Henk Udo

Wageningen, February 1997

- INTRODUCTION - (1_Readme)
- LIVESTOCK PRODUCTION FROM A SYSTEMS PERSPECTIVE - Ton Cornelissen (2_System)
- RESEARCH AND EXTENSION IN LIVESTOCK DEVELOPMENT - Hans Schiere (3_Resext)
- ALLOCATION AND UTILIZATION OF RESOURCES AT THE FARM LEVEL - Gerrit Zemmeling (4_Feed)
- ASSESSMENT OF BIOTECHNOLOGY IN ANIMAL NUTRITION - Hans Schiere and Seerp Tamminga (5_Biotech)
- USE OF TROPICAL RUMINANT LIVESTOCK RESOURCES; BACK TO THE FUTURE Henk Udo (6_Genres)
- RELEVANCE OF FARMYARD ANIMALS - Henk Udo (7_Anrelv)
- EXPERIENCES OF NETHERLANDS DEVELOPMENT COOPERATION IN DAIRY DEVELOPMENT IN AFRICA AND ASIA - Rijk de Jong and Dick Zwart (8_Dairy)
- MYTHS IN LIVESTOCK DEVELOPMENT - Henk Udo (9_Myths)

They hope that these papers will be of interest to you, and welcome your comments and suggestions. For more information on this diskette please contact:

Ir. A. M. G. Cornelissen and Dr. Ir. H. M. J. Udo, Department of Animal Sciences, Animal Production Systems Group, Wageningen Agriculture University, PO Box 338, 6700 AH Wageningen, The Netherlands

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or

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(b) India**The use of the Bhadawari buffalo in augmenting the dry land economy in India****Ran Vir Singh***Animal Genetics Division, Indian Veterinary Research Institute, Izatnagar (U.P.)*

The Bhadawari is a very useful breed of buffalo. It can easily adapt to high temperatures and thrives on very coarse vegetation. It is a triple purpose animal mainly used for milk, draught and meat. Both the males and females are used for transport, ploughing and lifting water from wells. The Bhadawari has a medium body size for a buffalo and is famous for its high milk fat content (10–12%) and heat tolerance. The Bhadawari buffalo needs less feed and fodder as compared to other buffalo breeds. This buffalo has a very wide range of diet. They prefer eating in the pastures which comprise shrubs, trees and natural grasses. The farmers feed 'Bajard' as concentrate to lactating and working animals. The Bhadawari buffalo and Jamunapari goat are the prevailing mixed livestock production systems in the buffalo's native habitat. The average daily milk yield of the buffalo is 3 kg. The population size of this buffalo has been declining over the years due to upgrading with Murrah. Immediate attention should be given to conserve this valuable endangered buffalo genetic resource.

Encouraging livestock based dry-land animal husbandry system through distribution of Bhadawari and other improved livestock, which are able to thrive on coarse vegetation and adapt to harsh climatic conditions, will be beneficial to the dry-land farmers.

(c) India**Physical characters and load hauling capacity of Kangayam bullocks of South India****S. Panneerselvam & N. Kandasamy***Department of Animal Genetics, Veterinary College & Research Institute, Namakkal-637 001, Tamil Nadu, India*

The Kangayam cattle breed is an excellent draught breed of South India suitable for all agricultural operations and hauling loaded carts. It is hardy and well-adapted to drought-prone areas. Earlier Kangayam bullocks were mostly used for drawing water from deep wells and ploughing. Now the bullocks are mainly used for transport of agricultural produce.

Kangayam bullocks are very strong and active and grey in colour, with black markings just in front of the fetlocks on all four legs and on the knees. The most striking characteristic of this breed is the appearance of the head and horns with thick neck, short and strong limbs and well-sprung barrel. The horns are thick, long and black in colour. They curve outwards and backwards then inwards, and almost complete a circle at the point where they approach the tips (Plate 5). Young bulls are castrated around two years. At the age of three years bullocks are trained for ploughing, and after the age of four years they are put to carting.

With financial assistance from the Indian Council of Agricultural Research, New Delhi, a study was conducted to provide quantitative information on the physical characteristics of Kangayam bullocks and to estimate their load hauling capacity. Data

were collected from 100 pairs of Kangayam bullocks which were used to transport sugarcane (carting) from the fields to a sugar mill located in the Kangayam breeding area in Tamil Nadu, India. On average, 300 double-bullock carts are used daily for transporting sugarcane from fields situated as much as 20 km away from the mill.

Physical characteristics

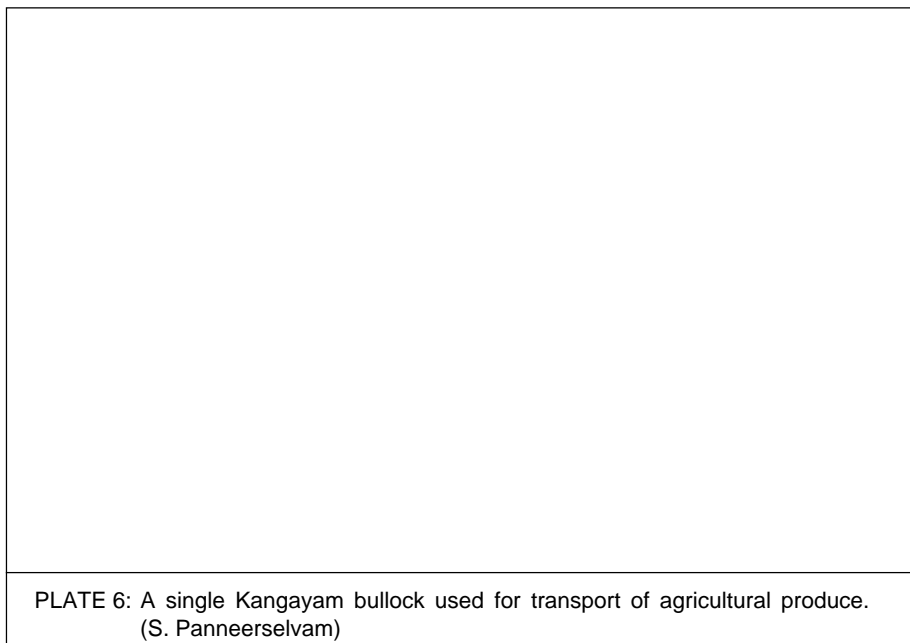
The physical characteristics of adult bullocks (6–11 years) are given in Table 9.

Table 9: Means, standard errors and coefficients of variation of body measurements (cm) of Kangayam adult bullocks.

Character	n	Mean \pm SE	CV%
Height at withers	102	146.7 \pm 0.46	3.15
Body length	102	154.8 \pm 1.03	6.73
Chest girth	102	184.8 \pm 1.00	5.46
Face length	101	54.3 \pm 0.27	5.04
Face width	101	23.5 \pm 0.16	6.77
Horn length	102	61.0 \pm 0.80	13.26
Horn circumference at base	102	33.5 \pm 0.41	12.33
Tail length	79	97.6 \pm 1.02	9.23
Single-fold skin thickness (mm)	73	5.5 \pm 0.05	8.26

Loan hauling capacity

Kangayam bullocks were capable of carting with a load even on a sunny, cloudless summer day with an ambient temperature of 30–35°C. Usually the farmers started around 6.00 am after loading the carts with sugarcane. Double animal, two-wheeled



carts of a specified design made with strong wood and steel and pneumatic tyres (Plate 5), similar to that used for heavy vehicles, were employed. A pair of bullocks were able to pull a total load (including cart weight) of $3,787 \pm 51$ kg, i.e. nearly four times their body weight over a distance of 10 to 20 km without rest. The mean (\pm SE) sugarcane weight per load and empty cart weight were found to be $3,206 \pm 50$ and 581 ± 6 kg, respectively (Table 10). The bullocks usually took four to six hours to cover 18 to 20 km distance with load. The average travelling time for a single trip, i.e. with load to the mill and back with empty cart, varied from 7–11 hours to cover the above distance.

Table 10: Mean (\pm SE) adult body weights (kg) of Kangayam bullocks and their load hauling capacity.

Body weight: Left animal of the pair	Right animal of the pair	Overall mean	Sugarcane weight/ load	Empty cart weight	Total load/ cart
475.0 ± 5 (100)	470.8 ± 4 (100)	472.9 ± 3 (200)	$3,206 \pm 50$ (100)	581 ± 6 (100)	$3,787 \pm 51$ (100)

Figures in parentheses are the number of observations.

Bullocks reached the maximum potential for this type of work around five years and maintained it effectively until 11 years of age. Bullocks of similar age and body size were paired for carting. Single animal, two-wheeled carts (Plate 6) were also used for transport of agricultural produce, manure, drinking water and house construction materials, such as sand.

Kangayam bullocks alone are used for sugarcane load hauling, though different draught type Mysore breeds, viz. Hallikar and Alambadi, are available in this area. It is likely that the performance of the Kangayam bullocks in this type of work is not exceeded by the other Mysore type breeds in India. This quality of Kangayam bullocks facilitates the cart owners to earn their livelihood solely on transport of sugarcane in and around the sugar mill.

3. AFRICA

(a) South Africa

Assisting small-scale farmers to produce healthy animals

Jenny Turton

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The problem

Livestock health problems can prevent small-scale farmers from achieving optimal agricultural production, and many communities have little or no access to veterinary services. This can result in reduced productivity, disease and death of livestock, including livestock used for animal traction.

The solution

Small-scale farmers need to be empowered to better recognise, prevent and treat diseases in their livestock so that they are less dependent on outside assistance and can have healthy and productive livestock. This empowerment can be achieved through information modules on animal health.

The programme

The Animal Health for Developing Farmers programme at the Onderstepoort Veterinary Institute commenced in April 1998 with the specific aim of developing appropriate and relevant information modules on animal health at a suitable level for small-scale farmers. The information modules consist of posters, slide presentations, written and cartoon type pamphlets (translated into all relevant languages; example on p. 20), videos and electronic information modules. They are designed to be delivered by those doing extension work with small-scale farmers (government, NGOs, educational and research institutes, private sector, commodity organisations, farmer unions).

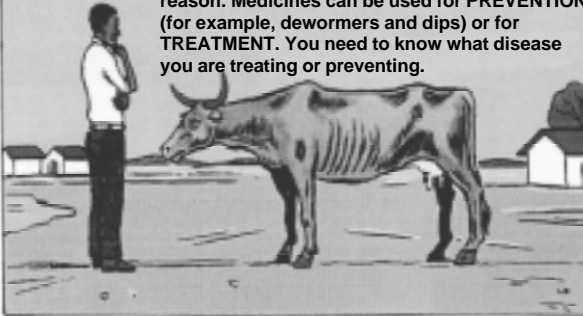
Topics of relevance to draught animals developed to date include:

- Is my animal healthy?
- Common diseases of cattle
- Why did my animal die?
- Zoonotic diseases
- Internal parasites of sheep, goats and cattle
- Tick-borne diseases
- What is the difference between vaccination and treatment?
- Brucellosis and Tuberculosis
- How to estimate the age of cattle
- How should medicines be used?

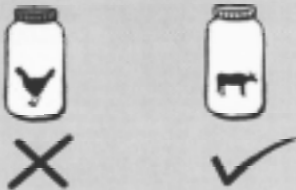
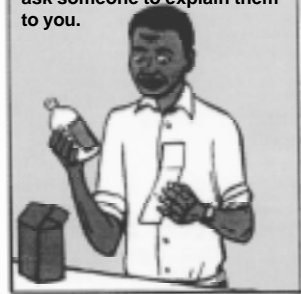
As it is important that these information modules are appropriate and relevant, they are initially being tested by programme staff in target communities throughout the country

HOW SHOULD MEDICINES BE USED?

Make sure that you are using the right medicine for the right reason. Medicines can be used for **PREVENTION** (for example, dewormers and dips) or for **TREATMENT**. You need to know what disease you are treating or preventing.



Always read the instructions that go with the medicine, or ask someone to explain them to you.



Make sure that the medicine can be used on this type of animal. For example chicken medicine cannot be used for cattle.



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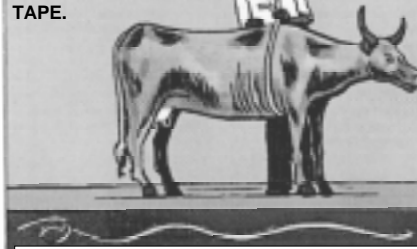


Check the expiry date. If the medicine is past the expiry date it will not work properly.

Make sure that the medicine has been stored properly in the store and at home before you use it. Some medicine needs to be kept cool and in the shade.



It is important to give the right dose. Too little may not work, and too much may be harmful. To estimate the weight of your animal you can use a **GIRTH MEASUREMENT TAPE**.



You can get a girth measurement tape from your farmer co-operative store.



Bigger animals take bigger doses.

which have been identified by linkages with government and non-governmental organisations. Feedback from the farmers following the presentations will determine whether the modules are understandable and relevant, how they can be improved, in what language and format the farmers want the modules, what the animal health concerns of the farmers are and which topics farmers most need to have information on.

The programme is also involved in training of trainers (particularly animal health technicians), and identifying research priorities in animal health for small-scale farmers.

The outcome

Informed livestock owners will have healthy, productive livestock, and these livestock can effectively be used for animal traction.

For further information, contact Dr Jenny Turton (Tel: (012) 5299154; Fax: (012) 5299427; Email: jenny@moon.ovi.ac.za).

(b) Mozambique

Draught animal power in Mozambique

Andrew Mattick

VETAID-Tete Project, PO Box 215, Tete

VETAID is currently carrying out an EU funded draught animal power (DAP) pilot project in one district of Tete province as part of a wider Livestock Support Project to the Provincial Livestock Services. The district, Mutarara, once had many cattle but these were virtually wiped out in the 16-year civil war when the population fled to refugee camps in Malawi. Mutarara does not have a strong tradition of DAP but some farmers used draught animals before the war and most were exposed to DAP while in Malawi. The project was requested by farmers to relieve a chronic rural transport constraint and to overcome the shortage of labour for ploughing arable land.

It is planned to train and distribute 50 pairs of oxen and distribute them to selected farmers with ploughs and scotch carts under a (subsidised) credit system. VETAID was requested by the provincial livestock services to work in coordination with World Vision (WV) which has experience in the area of training draught animals.

The first step was to build a small training Centre in the bush central to the villages that the project hoped to reach. This was done by WV. The next step was to train trainers to later train farmers. WV conducted a training of trainers course over two weeks. All the participants had extensive previous draught animal experience and almost half were farmers. This training included staff from the district agricultural office who will be responsible for follow-up of the project when VETAID leaves in the year 2000. The training programme followed for farmers and animal was based on that used at Palabana in Lusaka, Zambia. This is the programme that the VETAID project uses in the training Centre (Plate 7).

The VETAID/WV DAP project began in August 1998. So far 30 pairs of animals have been trained and distributed to farmers. Additionally, five farmers have sent their own animals for training in the Centre and have bought ploughs and carts.

To be eligible to enter the scheme a person has to:

- be resident in Mutarara and have his/her farm there
- have year round access to grazing resources and water

- not have benefited from earlier VETAID restocking activities
- raise the initial (one third) cash deposit to pay for the animals and equipment
- present a business plan showing how the oxen will be used to increase farm income

The type of animals used are young bulls or steers (Tete shorthorned zebu, similar to Malawi zebu), all locally acquired and with a minimum weight of 180 kgs. Most are two or four tooth, some are six tooth because animals grow slowly and do not attain the necessary minimum weight below this age. Most animals are horned and have small humps. Farmers prefer horned animals as these are used to catch the animals. Strict attention is paid to conformation when selecting animals for training as most animals are entire bulls and will double as breeding bulls.



PLATE 7:
VETAID's DAP
training activities
in Mutarara,
Tete Province,
Mozambique.
(A. Mattick)

Up to five pairs of animals are trained in each training cycle. The cycle lasts approximately a month. The training is done by three trainers and three assistant trainers with the new owners present receiving training with their animals. After distribution of the animals, monitoring is carried out periodically by the project to make sure the farmers are using the animals correctly (Plate 8).

Scotch carts come from three sources: Zimplow, Bulawayo, Zimbabwe; locally made in small welding shop in Tete; and locally made in workshop of another NGO. Mouldboard ploughs are from Agro Alfa in Maputo and from Zimplow.

Observations to date

The introduction of scotch carts has had a positive impact on rural transport and all farmers with scotch carts are using them and hiring them regularly.

Regarding land cultivation, most farmers who received ploughs, did so since the last agricultural season and have not yet used the animals to plough. The few people who received animals in time to plough last year did use them for this purpose but due to the small size of the animals the ploughed areas were small.



PLATE 8:
Scotch cart at
VETAID's draught
animal power
training centre in
Mozambique.
(A. Mattick)

The monitoring programme revealed initial problems with overworking of the animals, in many cases resulting in weight loss, lameness, and in a few cases death of one of the animals. This occurred at the time of harvest and marketing of maize when oxen owners had so much transport work offered them that they overlooked their animal's welfare interests in order to make more money. It appears that the lesson was learned in most cases because those who did overwork their animals were eventually forced to rest them for periods of up to three months while they recuperated.

Another observation is that the cash deposit required in order to acquire animals under the credit scheme limits the entry into the scheme to those who can raise the money, i.e. the better off. However, this was anticipated and the project is not designed to have a poverty focus.

Challenges in the next year

1. Include women in the DAP programme (in an area where, traditionally, women do not own cattle)
2. Introduce small cultivators for inter-row weeding
3. Improve management of the animals through training and extension.

4. NORTH AMERICA

USA

Ox competitions in the USA

Drew Conroy

Oxwood Farm, 22 Little River Road, Berwick, Maine, 038 24, USA

Throughout the Northeastern United States there are numerous competitions that today are held in conjunction with agricultural fairs. These competitions offer ox teamsters a chance to compare their animals, training techniques, and equipment. Such exhibitions offer a great way to share information. They have been popular for centuries. There are two types of pulling competitions. One is called an elimination pull. The animals have

to pull as much as they can two meters in one continuous motion. The animals must typically move three or more times their bodyweight on a sled two meters in order to win. The other competition is more like a race. The oxen and teamster have a pre-set 3 or 5 minutes to go as far as they can with a load equal to about 150% of the animal's bodyweight. The best teamsters will travel 0.8 m/s with these loads on dry gravel.

The yokes these ox teamsters use include both head yokes and neck yokes (we don't call them "withers yokes" because we use a wooden bow and dropped hitch point that is essential to maximizing the surface area that the yoke has in contact with the neck and shoulders). A close examination of the yoke displays the difference between our yokes and those used in other countries. The yokes must fit the animals for competition. Head yokes and neck yokes yield similar results year after year. There is no magic in the animal's training. The key is a comfortable yoke and animals that are accustomed to regular heavy work. Cattle are cattle the world over. The claim that our cattle are stronger because they are given special care is nonsense. Most oxen I have seen in Africa have far more stamina and strength than their North American counterparts. The greatest difference I see is in the yokes they wear. Animal comfort is the shortfall in many yoking systems.

Plate 9 shows Nathan Hines driving a pair of Charolais oxen weighing 1,272 kg pulling 3,090 kg in a competition at Sandwich, USA. The head yoke works well in keeping the animals under control and making them work together. It seems to have no advantage in pulling competitions over neck yokes. Plate 10 shows Alan Pearson's cattle weighing as a team 1,090 kg pulling 1,818 kg with a neck yoke. Smaller cattle often do well in the distance pulls where the competition is more like a race – lighter weights and a set time limit to go as far as they can in three or five minutes. The young cattle, if not overloaded, can really move fast.

Historically the competitions provided an outlet for fun and entertainment where teamsters could gather and compete with animals that were normally used for work around the farm or in the forest. The events set standards for local teamsters. Animal training levels, equipment and techniques have all benefited from the challenge of trying to beat your neighbour in friendly competition. Well matched and beautifully trained teams became the norm and competitions ultimately raised the level of teamster skills and animal abilities. Teams were often put to work in pulling competitions to see who had the strongest team. Classes were also put together to see how well behaved and trained the teams were. The animals often had to hitch to a cart or wagon and maneuver through a variety of obstacles. The ox teams were and are today still judged on their ability to handle the demands placed upon them, as well as, the teamster's ability to control the animals in challenging situations. Ploughing was an important job for oxen on the farm and many agricultural events include and have included plowing competitions.

Early events based solely on strength, were both praised and scorned by ox teamsters. In early Massachusetts competitions that raised the level of teamster skills were praised by agricultural societies, while pulling competitions were often looked down upon by the same groups. In areas where logging was more common, like the northern forests of New Hampshire and Maine, pulling competitions were more popular. Apparently the oxen used in the forest were used to pulling heavier loads and their



PLATE 9: Nathan Hines driving a Charolais team in a head yoke at Sandwich, USA.
(D. Conroy)

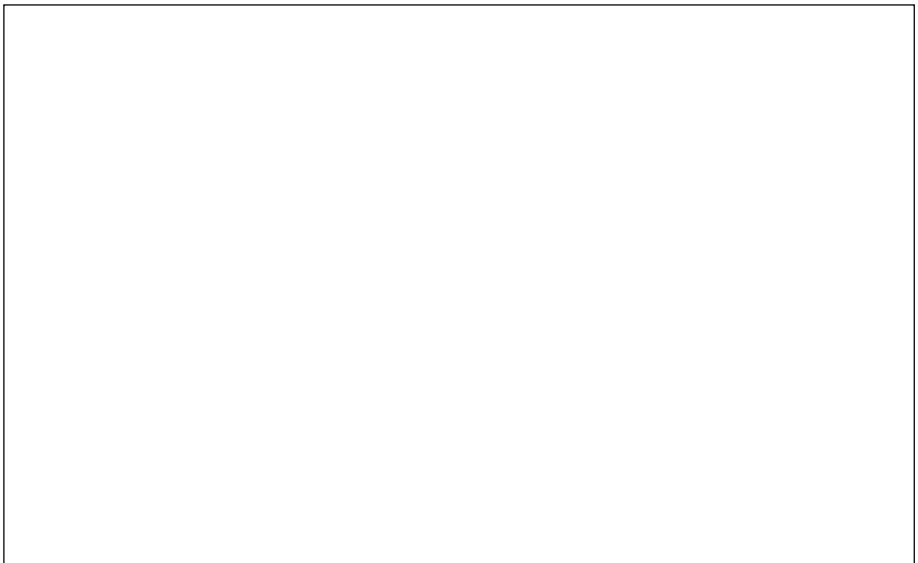


PLATE 10: Adam Pearson's team pulling in an elimination pull using a neck yoke.
(D. Conroy)

teamsters were more at ease with asking their animals to push themselves to their physical limits. Many early New England documents display the differences in philosophy and even outright challenges to teamsters of other regions.

Jochen Welsch, a historian from Massachusetts in the USA, has written extensively on the subject of oxen in Colonial America. Quoting from his thesis we can see how competitions drew both scorn and awe. In 1842, *The New England Farmer*, an agricultural journal, which continues to be published today, documented regional rivalry in an article entitled, 'Worcester teamsters just look at this'. The article began by reprinting an account of the Worcester Cattle Show, published in the *Boston Cultivator*:

"At the drawing (pulling) match, 22 teams entered for the prizes. The loads drawn consisted of 2 tons of stones, and the way they were handled by these young teams, did great credit to the enterprising farmers of Worcester, (Massachusetts), while this conclusively proved how much the value and the usefulness of the ox may be improved by proper care and training."

The editor of *The Maine Farmer*, another early publication replied,

"Two tons why that isn't a load for Kennebec calves. We saw Peleg Raines, of Readville (Maine), at the drawing (pulling) match at The Kennebec Cattle Show hitch his single yoke (pair) of oxen on to a load that weighed six tons five hundred and ninety (pounds), and walked them up a hill just as easy as you would a wheelbarrow. When he got to the steepest part of the way, he stopped them a moment, just to show spectators how easy they could start again. At the word, they started forward as readily as they did at the bottom—no wringing or twisting, or any fuss about it. None of the oxen drew (pulled) less than 8500 lbs."

"If the Worcester boys want to see cattle haul," challenged the editor of *The Maine Farmer*, "they must come to Kennebec."

Today in North America similar competitions continue. The competitions are keen and the ox teamsters continue to regularly challenge each other. Very few teams today are used for farm work. Most teams are used either for pulling, obstacle courses, ploughing contests or showing. The teams used for pulling are well trained, and used to heavy work (primarily short bursts of energy). The greatest difference between the oxen seen today and those in the past is that most animals and teamsters have become specialists. However, the loads that were hauled differ little from those described in the historic document above. Most cattle cannot pull three times their bodyweight on a sled dragged across bare dry soil. It is truly an exceptional pair that can move that percentage of their bodyweight or more under these conditions.

While such competitions have recently drawn the scorn of some international development audiences, there is a great lesson in the way oxen are used and have been used in North America. The yokes have remained virtually unchanged for centuries. Early ox teamsters, like teamsters today recognized the importance of well fitted and comfortable yokes. Yokes that maximize the surface area contact on the animal, while at the same time emphasizing the importance comfort and their anatomy is the most important key to success. Ox training methods and yokes have changed little in 200 years. Like a man wearing a shoe that does not fit, an ox working in a poorly fitted or poorly designed yoke cannot function to the best of their ability. Animal comfort is not

a luxury that can be ignored. My recent work with the Maasai of Tanzania has shown me that even the poorest farmers are concerned with yokes that cause sores on the animal which limit their effectiveness on the farm.

Internationally, competitions can raise the skill level of both man and beast. Like ox teamsters in the present day United States, skills built over centuries tend to be well perfected and tested. Competitions of any type usually raise the level of competence. Working and training oxen is no exception. United State's Peace Corps volunteers and Mission workers often tell stories of exceptional teamsters in Third World countries that have become the standard by which local teamsters strive. Such examples ought to be good lessons for development projects or extension workers attempting to introduce oxen and related technologies. Well trained animals, well designed yokes and good teamsters will always inspire others to adopt the technology or do better, whether this in the pulling ring in North America or the farmer's field in Sub-Saharan Africa.

Bibliography

- Anon (1843). *New England Farmer*. Letter to the editor. 21.35:277
- Brown, Murray A. (1985). *Oxen Traction*. Department of Agriculture and Natural Resources, Sam Houston State University, Huntsville, Texas, USA. 81 pp.
- Conroy, D. (1995). Ox pulling. *Rural Heritage* **20**(2), Spring Issue, 30-33.
- Conroy, D. (1996). New England oxen events. *Rural Heritage* **21**(3), The Evener, 72-74.
- Conroy, D. (1998). Head yokes vs. neck yokes. *Rural Heritage* **23**(6), Holiday, 66-69
- Conroy, D. (1999). *Oxen, a Teamster's Guide*. Rural Heritage, Gainesboro, Tennessee, USA. 360 pp.
- Conroy, D. and Dwight, B. (1986). *The Oxen Handbook*. Butler Publishing, LaPorte, CO, USA. 66pp.
- Copland, J.W. (1985). Draught animal power for production. Proceedings of an International Workshop held at James Cook University, Townsville, Queensland, Australia. 10-16 July 1985. *ACIAR Proceedings Series No. 10*, 170 pages.
- FAO (1993). *Human and Draught Animal Power in Crop Production*. Proceedings of the Harare Workshop, Zimbabwe, 18-22 January 1993. Sponsored by the Silsoe Research Institute (Agricultural and Food Research Council), Commission of the European Communities, Agricultural Engineering Service (FAO). Rome, Italy. 154 pp.
- Kibalama, J.S. (1993). The assessment of agricultural mechanization in Uganda: Perspective engineering options and strategies. PhD Dissertation, Department of Agricultural Engineering, The Ohio State University. 195 pp.
- Klinckenborg, V. (1993). If it wasn't for the ox, we wouldn't be where we are today. *Smithsonian Magazine* (Sept), 82-93.
- Langdon, J. (1986). *Horses, Oxen and Technological Innovation*. Cambridge University Press, Cambridge, England and New York, New York. 331 pp.
- Pike, R. (1967). *Tall Trees, Tough Men*. W.W. Norton & Company, New York, NY, USA. 288 pp.
- Russell, H.S. (1982). *A Long Deep Furrow: Three Centuries of Farming in New England*. University Press of New England, Hanover, NH, USA. 380 pp.
- Sheldon, A. (1862). *Yankee Drover*. Reprint 1988. University Press of New England, Hanover NH, USA. 192 pp.
- Skinner, J.S. (1848). An essay on the use of oxen. In: *Every Man His Own Cattle Doctor* (ed. William Youatt). Philadelphia: Lea and Blanchard, Philadelphia, PA, USA. pp 143-167.
- Sloane, E. (1962). *The Diary of An Early American Boy, Noah Blake, 1805*. W. Funk, New York, NY, USA.

- Starkey, P. (1989). *Harnessing and Implements for Animal Traction: An Animal Traction Resource Book for Africa*. A publication of Dt. Zentrum fur Entwicklungstechnologien – GATE and Div. 421 – Agricultural Production Systems in Dt. Ges fur Techn. Zusammenarbeit (GTZ) GmbH. – Braunschweig; Wiesbaden. 245 pp.
- Starkey, P.H. & Faye, A. (eds) (1990). *Animal Traction for Agricultural Development*. Proceedings of the third workshop of the West Africa Animal Traction Network, held 7-12 July 1988, Saly, Senegal. Published on behalf of the West Africa Animal Traction Network by the Technical Centre for Agricultural and Rural Cooperation (CTA), Ede-Wageningen, The Netherlands. 479 pp.
- Starkey, P., Mwenya, E. & Stares, J. (1994). *Improving Animal Traction Technology*. Proceedings of the first workshop of the Animal Traction Network for Eastern and Southern Africa (ATNESA) held 18-23 January 1992, Lusaka, Zambia. Technical Centre for Agricultural and Rural Cooperation (CTA), Wageningen, The Netherlands. 490 pp.
- Starkey, P. & Wilson, M. (1992). *Animal traction in Tanzania: Experience, trends, and priorities*. Natural Resources Institute, Chatham Marine, UK. and The Ministry of Agriculture, Planning Division, Pamba House, Dar es Salaam, Tanzania.
- Strickland, W. (1971). *Journal of A Tour In The United States of America 1794-1795*. New York, New York Historical Society.
- Watson, P. (1983). *Animal Traction*. Artisan Edition. Artisan Publications, Summit, NJ, USA. 151 pp.
- Welsch, J. (1993). If the Worcester boys want to see cattle haul, they must come to Kennebec: The trial of working oxen as an expression of regional agricultural values, 1818-1860." *Annual Proceedings Dublin Seminar for New England Folklife 1993*, Boston University Publications, Boston, MA, USA. pp. 85-94.
- Welsch, J. (1994). A real Yankee always likes to see a good pair of oxen pull: The development and reemergence of a regional agricultural tradition. MA Thesis, University of North Carolina, Chapel Hill, North Carolina, U.S.A. 82 pp.

SHORT NOTES AND NEWS

Useful Web Sites

The Editor will be pleased to receive more contributions to this section:

<http://www.uni-kassel.de/hrz/anwendungen/rosebrock/wiz/db>
<http://www.gcw.nl/kiosk/njas/issues/njas591/njas591.html>
<http://www.dissertation.com/library/112015xa.htm>
<http://www.uky.edu/Agriculture/Forestry/AppalFor/dejr.htm>
<http://www.hoofcare.com>

DFID funded projects on Draught Animal Power:

<http://www.nrinternational.co.uk/~n/nri/plive/r5198.htm>
<http://www.nrinternational.co.uk/~n/nri/plive/r6166.htm>
<http://www.nrinternational.co.uk/~n/nri/plive/r6605.htm>
<http://www.nrinternational.co.uk/~n/nri/plive/r6609.htm>
<http://www.nrinternational.co.uk/~n/nri/plive/r6970.htm>



Good Samaritan Donkey Sanctuary

This sanctuary inaugurated in December 1990 provides 'special care, refuge and protection for orphaned, abandoned, neglected, mistreated and rescued donkeys' in Australia. They produce a small newsletter called *Sanctuary Serenade*. Their latest book 'Donkey Business III' was reviewed in Draught Animal News, 30, page 24. Any one wishing to know further information about this organisation is asked to contact Jo-Anne Kokas, P.O. Box 5, Crescent Head, NSW 2320, Australia. Telephone/fax: +61(0)2 6567 4626.

ATNESA elects a new steering committee to take it into the next millennium

A new steering committee was elected by ATNESA at its Third General Assembly meeting held during the ATNESA International Workshop in Mpumalanga, South Africa in September 1999. The committee members are:

Dr Pascal Kaumbutho, Kenya – Chairman
• KENDAT, PO Box 61441, Nairobi •
Tel: + 254-2-766939 • Fax: +254-2-766939 • kendat@africaonline.co.ke

Dr Edward Nengomasha, Zimbabwe – Treasurer • Matopos Research Station, P/Bag K 5137, Bulawayo •
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Mr Bruce Joubert, South Africa – Secretary • Faculty of Agriculture, University of Fort Hare, P/Bag X 1314, Alice 5700 • Tel: +27-40-6022125 • Fax: +27-40-6531730 • Sanat@ufhcc.ufh.ac.za

Mr Wells Kumwenda, Malawi – Publicity • Chitedze Res. Station, PO Box 158, Lilongwe • Tel: +265-831-637 • Fax: +265-184/784915 • icrisat-malawi@cgiar.org

Ms Enny Namalambo, Namibia – Publicity • Ministry of Agriculture, PO Box 20781, Windhoek • Tel: +264-61-2087006 • Fax: +264-61-2087768

Dr Alemu Gebre Wold, Ethiopia – Advisor • Institute Agric Research, PO Box 2003, Addis Ababa • Tel: +251-1-511802 • Fax: +251-1-611222

NEW BOOKS

Management and Welfare of Farm Animals

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In keeping with the charitable objectives of UFAW, the handbook is offered at the specially low price of £17.00 to ensure the important information it contains is available



to all who need it. Available from:



UFAW, The Old School, Brewhouse Hill,
Wheathampstead, Hertfordshire AL4 8AN, UK
(Tel: 01582 831818; e-mail: ufaw@ufaw.org.uk),
or contact Stephen Wickens (e-mail: wickens@ufaw.org.uk).

Oxen – a Teamsters Guide

by Drew Conroy

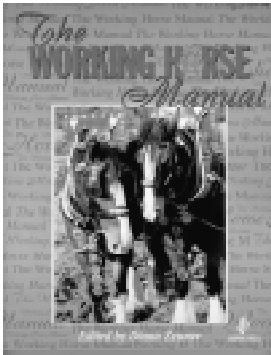
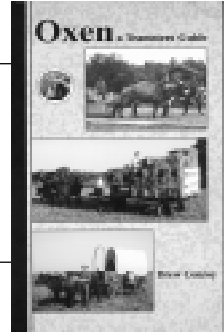
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The book is available from the following Web site:

<http://www.ruralheritage.com/bookstore>, or contact Drew direct

(see Contributors on back page).



The Working Horse Manual

edited by Diana Zeuner

(Publisher/Editor, *Heavy Horse World Magazine*)

246 pp, paperback • Price: £24.95 • ISBN 0–85236–401–6

Published by Farming Press, Miller Freeman UK Ltd,
2 Wharfedale Road, Ipswich IP1 4LG, United Kingdom

Distributed in North America by Diamond Farm Enterprises
Box 537, Bailey Settlement Road

Alexandria Bay, NY 13607, USA

MEETING REPORTS



Report of the Animal Traction Network for Eastern and Southern Africa (ATNESA) International Workshop on Empowering Farmers with Animal Traction into the 21st Century sent in by the reporting committee from the workshop, co-ordinated by Dr Pascal Kaumbutho, The ATNESA Chairman, KENDAT, Kenya.

"The workshop was held at the Loskop Dam Conference Centre, Mpumalanga in South Africa from 21st to 26th September 1999. It was attended by 110 people from 25 different countries. For the first time in ATNESA's history, representatives from North Africa, the Horn of Africa, Central Africa, East, West and South Africa featured at an ATNESA workshop.

This year's workshop theme, 'Empowering farmers with animal traction into the 21st century', led discussions towards recognising the importance of the smallholder farmers in their contribution to global food security. Most smallholder farmers are resource poor and constitute over 80% of domestic food producers in Sub Saharan Africa. That notwithstanding, smallholder farmers have been marginalised in the era of

mechanisation – wrongly perceived as motorisation – hence supporting the minority large-scale farmers. Sadly, this marginalisation has resulted in an exponential increase in numbers below the poverty line particularly in Africa and other third world countries. Fortunately, draught animal power is gaining recognition after close to a decade of lobbying by its promoters. More action on the ground is needed particularly in changing attitudes of stakeholders – especially potential users – as this is indeed one of the greatest constraints.

At the workshop, emphasis was laid on working out ways of impacting positively on end users by increasing food production. Thus, the smallholder farmer remains the prime client. A need for integrating different sectoral approaches at all levels of the project cycle including on and off-farm research is necessary. The aim is to achieve a holistic output with adequate food and improved livelihoods as a measure. It was with this in mind that workshop outputs were synthesised and action plans developed.




PLATE 11: Delegates at the ATNESA Workshop field day in Mpumalanga, South Africa. (A. Pearson)

Workshop objectives

The following were the main objectives of the workshop:

1. To share regional experiences on empowering farmers and entrepreneurs on the use of animal traction.
2. To review the research, development, training and extension messages regarding the use of animal traction that have been tried in recent years.
3. To analyse the existing technologies (harnesses, carts, equipment, etc.), management systems (selection, feeding, animal husbandry, etc.) and the socio-economics of draught animal power use.

4. To make strategic plans as to how to empower farmers with animal traction in the next millennium.
5. To propose future national and joint/collaborative activities.

The above objectives were addressed in the form of thematic paper presentations in plenary sessions, poster presentations, evening sessions, a field visit and group discussions. At the end of the workshop, strategic plans (with action plans) were developed.

Thematic paper presentations

A total of five sub-themes were addressed in plenary sessions within the first two days of the workshop. Experiences of stakeholders in animal traction were presented as follows:

- *Session 1: General review.* After introduction by the ATNESA chairperson, participants were presented with a country synthesis paper on South Africa by the South Africa Network for Animal Traction (SANAT) secretary. SANAT was the official workshop host. Thereafter, papers on worldwide trends, issues and challenges in animal traction, conservation, tillage and environment, and empowering people through donkey power were presented.
- *Session 2: Participatory rural development and technology transfer.* Papers on experiences of farmers, extensionists, manufacturers and researchers in technology transfer in Ethiopia, conservation tillage and watershed management in Kenya and farmers' participation in testing of implements and harnesses in Ethiopia were presented.
- *Session 3: Entrepreneurship, gender and rural transport.* In this session, papers presented included: entrepreneurship in animal traction by empowering local initiatives in Tanzania; issues and challenges in empowering farmers and pastoralists through animal-based rural transport in Kenya; gender issues in animal traction and transport in Zambia, Uganda and South Sudan; and supply and distribution of implements and spares in Southern Africa.
- *Session 4: Animal welfare, nutrition and management.* Three general papers were given on strategies for improving the effectiveness of crop residues as supplementary feeds for working cattle in semi-arid regions, management of draught animals from a welfare and health perspective, and multipurpose use of work animals in smallholder farming systems.
- *Session 5: Case studies and poster presentations.* Participants from different countries gave country reports and updates on the status and trends of animal power use in their countries. In this session, all regions of the continent were represented. Posters were mounted and presented and some implements displayed. Discussions on these went on outside plenary sessions and during tea breaks.
- *Field visits and demonstration.* Farmers in different parts of Mpumalanga province were visited and interviewed informally by small groups of nine to ten people on the third day.

Field visits ended with a farmers' field day organised by government officials and the SANAT secretariat. At the field day, demonstrations were held on implements, tillage practices, harnessing of donkeys, and use of cows for traction. For more effective networking, a joint luncheon was held for farmers, extensionists (and government

officials) and workshop participants. Fruitful discussions were held and lessons learnt from these meetings were applied in the workshop synthesis and discussions as well as in the final action planning.

Discussions

The last two days of the workshop were spent between group discussions and plenary presentations. Thematic groups were formed and requested to develop action plans on the respective themes. Both long and short term plans were developed. Thereafter, the plans were presented in plenary session for discussion, appropriate changes made and specific workshop participants assigned specific tasks. Each task was allocated a realistic time frame.

Action planning

Themes requiring action planning were divided broadly into four categories: (1) Policy and socio-economics; (2) Technology; (3) Work animals; (4) Specific issues. Among the specific issues were: harnessing; feeding strategies; training; image/status of draught animals and their use; field day planning and organisation; participatory processes; and environment.

Issues such as opening a web-site to strengthen networking by ATNESA and using the site for information exchange and dissemination were suggested by almost every group. The summary below does not represent all key issues addressed in the groups, but mentions some important issues unique to the groups.

- Regarding policy and socio-economic issues, ways of involving policy makers (government officials and donors) in activities on the ground, and aggressive sensitisation of everybody on the good of animal traction were suggested.
- On animal issues, capacity building in the form of training at both extensionist and end user level were emphasised. On-farm testing of research recommendations of past animal husbandry projects (e.g. harnessing, feeding regimes and others in relation to work animals) should be carried out while ensuring that existing indigenous practices and knowledge are incorporated whenever they are complimentary.
- Some recommendations from the technical group were: on-farm research on improvement of implement design; quality control of implements; participation in trade fairs and agricultural shows; facilitation of exchange visits of users and manufacturers."

A detailed report of the meeting is being prepared and will be available shortly from ATNESA. The Workshop Proceedings, which will contain copies of all the papers presented at the workshop will be available in 2000. For further information please contact the ATNESA Chairman: Dr Pascal Kaumbutho, Kendat, PO Box 61441, Nairobi

Nairobi Conference brings new promise of affordable transport for the rural poor: World Bank brings world's experts together in anti-poverty initiative

Animal traction is an important, versatile and sustainable contributor to intermediate means of transport (IMTs) and poverty alleviation. In an important new move to bring serious and sustainable help to those rural communities in Africa that do not have access to affordable transport, the World Bank's Rural Travel and Transport Program

(RTTP) invited the world's leading experts in the field to a three-day workshop at the UN Complex, Gigiri, Nairobi from 15–17 June 1999. The meeting was organised by RTTP and the United Nations Habitat.

The problem confronting academics and activists was how to promote the use of low-cost labour-saving transport devices for those communities whose resources will not as yet allow them to buy and maintain expensive vehicles. The point of using these devices, broadly known as IMTs, is to enable rural dwellers to cut down on wasted time and unnecessarily back-breaking work, such as carrying water and firewood. If these factors are reduced, the time and work saved can be turned towards income-generating activity.

Most IMTs are already in use and some of them have been employed from the earliest times – simple wheeled vehicles and the use of animal power, for example. Other IMTs include bicycles, bicycle trailers (some of them specially modified for transporting water), hand-carts and motorcycles. The task of the RTTP meeting was not to design or to re-invent these devices. It was to develop ways of drawing attention to their value, their cost-effectiveness and their availability and their importance in rural development. Their intention is to enable more development funding to be directed towards IMTs as a direct contribution to alleviating rural poverty across the continent.

Said RTTP regional advisor, George Banjo: 'What has made this meeting a success is the contributions of the experts who have come from institutions all over the world and in particular from Africa. These are the people who most understand the problems of rural poverty and how more efficient low-cost transport can contribute to solving those problems. The next step now is to take forward our findings to the government level and beyond so that we can get the understanding and co-operation necessary to bring this urgently-needed help to the rural areas.'

David Nalo, chairman of the Kenyan Forum for Rural Transport and Development, remarked: 'This work is extremely important in complementing the government's initiative on the alleviation of rural poverty. It is very timely from the Kenyan perspective.'

At the meeting animal traction featured as a major and versatile contributor to efficient and sustainable intermediate means of transport. Animal traction's unique features are those of accessibility to farming and transport operators, and especially its complementary roles in tillage.

Animal Traction in the New Millennium: Importance for Latin America

This meeting was held on 8–12 November 1999 at Cochabamba, Bolivia. For further details please contact either:

PROMETA/CIFEMA Av Petrolera, Km 4, La Tamborada Cassila 831, Cochabamba, Bolivia (tel: 591 4 225515; fax 591 4 234 994; email: cifema@pino.cbb.entelnet.bo) or RELATA-FORMENTA. De la Shell Las Palmas 1 cuadra al Norte. Aptado 95, Telcor Douglas Mejia, Managua, Nicaragua (tel: 505 266 4084, 505 268 3126; fax 505 266 8617; email relata@ibw.com.ni; website: <http://www.relata.org.ni>).

IMPLEMENTS

Direct Seeding Equipment for Small Farmers in Southern Brazil

Les Matériels de Semis Direct chez les Petits Agriculteurs dans le Sud du Brésil

Roland Pirot

CIRAD CA (BP 5035 34032 Montpellier Cedex 1, France)

Summary: Direct seeding techniques are actually used on the small farms of Southern Brazil. Farmers, manufacturers, research centres and extension agencies have co-operated to adapt this technique and design animal draught implements. The author presents the different types of equipment which are used in this region.

Résumé : La technique du semis direct est aujourd'hui utilisée dans les petites exploitations du Sud du Brésil. Les agriculteurs, les constructeurs, les centres de recherche et les services de vulgarisation ont coopéré pour mettre au point cette technique et concevoir des matériels à traction animale. L'auteur présente les différents équipements qui sont utilisés dans cette région.

Introduction

Dans les années 70, les cultures industrielles comme le soja et le maïs ont remplacé la culture pérenne du café dans les exploitations commerciales du Nord du Parana¹. Les pratiques alors mises en œuvre étaient directement issues des techniques traditionnelles avec travail du sol profond. Celles-ci sous régime climatique tropical, se sont rapidement montrées catastrophiques dans ces zones vallonnées. Les agriculteurs et les autorités de cette région ont vite réagi en mettant en place des aménagements anti-érosifs et en promouvant des systèmes à base de couvertures végétales et de semis direct.

Plus au Sud du Parana, à l'Ouest du Santa Catarina et du Rio Grande do Sul, quelques petits agriculteurs installés sur des zones souvent très accidentées² et utilisant des matériels de travail du sol, se sont intéressés à cette nouvelle technique et ont cherché à l'adapter à leurs systèmes de production avec les organismes de recherche et de développement.

De nouveaux intérêts sont vite apparus et principalement celui de l'économie de main d'œuvre. En effet, l'absence de travail du sol en début de cycle, associé à l'utilisation d'herbicides induit des diminutions importantes de besoin en main d'œuvre pendant ces deux périodes. Les agriculteurs restés attentifs en ont vite saisi l'intérêt et se sont converti à la technique.

Aujourd'hui, le semis direct est bien développé dans l'Ouest Santa Catarina et du Rio Grande do Sul, et commence à diffuser dans le centre-Sud du Parana.

L'itinéraire technique du "semis direct"

En fait le terme semis direct peut recouper plusieurs situations. S'il est défini normalement par un semis en absence de travail du sol (avec ou sans couverture végétale), il correspond quelquefois à un travail sur la ligne avant le semis.

Dans la région où le semis direct a été mis au point, deux cultures étaient semées tous les ans : il s'agissait généralement du blé en hiver suivi du maïs ou du soja en été. La technique a d'abord consisté à semer en courbes de niveau dans les chaumes de blé ou les résidus du maïs et du soja, en contrôlant les adventices avec des herbicides.

Dans un deuxième temps, la culture du blé devenue économiquement moins rentable, a été remplacée par une culture de couverture (avoine ou légumineuse ou les deux) que l'on détruisait soit par un traitement herbicide soit en passant un rouleau "Faca"³, qui déchiquetait la culture de couverture. On semait ensuite la culture d'été dans cette couverture morte.

Les premiers développements de la technique du semis direct chez les petits agriculteurs⁴, ont consisté à employer les équipements disponibles et n'ont pas fait appel à de nouveaux matériels. Dans ce cas, la jachère naturelle dans laquelle il restait des résidus de la dernière récolte, était utilisée comme plante de couverture. Les risques de bourrage étaient alors limités et les paysans réalisaient, suivant des courbes de niveau, un passage de matériel à dent (Fuçador⁵ modifié par leurs soins) suivi d'un passage avec un semoir traditionnel. La grande innovation de cet itinéraire dans ce type d'agriculture, était l'utilisation d'herbicide qui permettait de contrôler l'herbe non enfouie au labour.

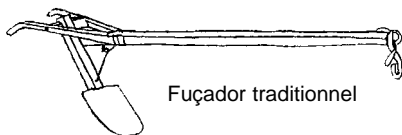
Afin de diminuer le nombre de passages, des constructeurs de matériels agricoles ont proposé des matériels combinés où étaient regroupés, dents et semoirs. Il n'y a pas de coutre circulaire sur ces premières machines.

Parallèlement, les institutions de recherches et de développement travaillaient sur la mise au point d'un itinéraire plus élaboré de semis direct nécessitant l'utilisation de matériels spécifiques. Ont été concernés à l'époque, un épandeur de calcaire⁶ (pour redressement de la fertilité), un semoir de semis direct (avec coutre circulaire) et des appareils de traitement herbicide à traction animale ou tirés par un homme. L'itinéraire proposé était alors identique à celui de l'agriculture commerciale : semis en courbes de niveau, culture de couverture en hivers, destruction au rouleau "Faca" ou à l'herbicide, semis au semoir de semis direct dans le tapis végétal et contrôle des herbes pendant la culture avec des traitements herbicides. Le principal intérêt pour ces agriculteurs est le gain de temps et l'économie de main d'œuvre dus à l'utilisation des herbicides, d'où l'importance de sa bonne maîtrise. L'absence de cette maîtrise entraîne généralement des catastrophes car il n'est possible, alors, d'intervenir qu'à la main (l'utilisation de houes à traction animale est alors devenue impossible compte tenu de la présence des résidus de la culture de couverture).

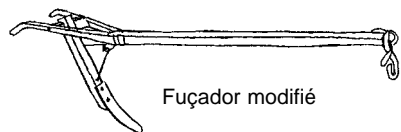
Les équipements de traction animale utilisés dans les itinéraires de semis direct à traction animale

Nous ne présenterons pas tous les matériels proposés par les constructeurs mais les principaux types que nous pouvons trouver dans ces régions.

• **Equipements non spécifiques.** L'ouverture du sillon est réalisée avec un outil à dent (Fuçador modifié) puis le semis avec un semoir traditionnel dans le sillon. Ces équipements ne peuvent pas semer dans des couvertures mortes⁷.



Fuçador traditionnel



Fuçador modifié

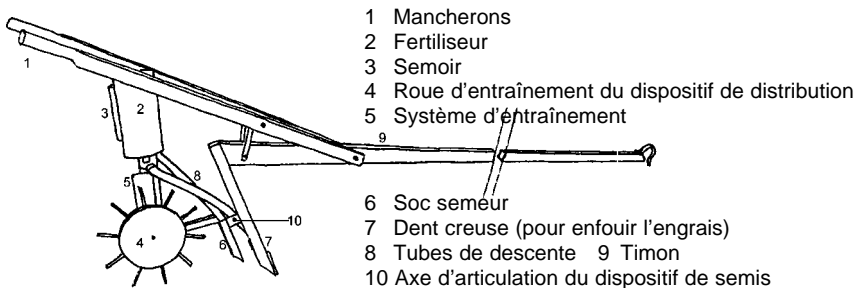
• **Equipements spécifiques issus de la technique précédente.** Le matériel combine les deux outils précédents : c'est un outil à dent sur lequel ont été montés un semoir et

un fertiliseur. A noter la présence d'une roue qui sert exclusivement à entraîner les distributeurs de semences et d'engrais (généralement grande quand elle se situe à l'avant et plus petite quand elle est positionnée à l'arrière).

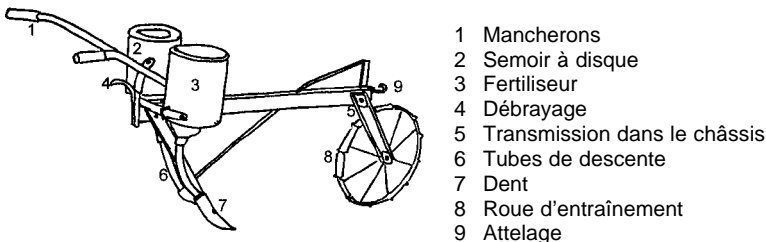
Même remarque que précédemment pour les possibilités de semis.

La régularité de profondeur de semis est aléatoire et dépend de facteurs tels que, la compaction du sol, l'effort exercé sur les mancherons, etc.... Ce "défaut" ne semble pas influencer de façon importante sur la qualité du semis (aux dires des agriculteurs).

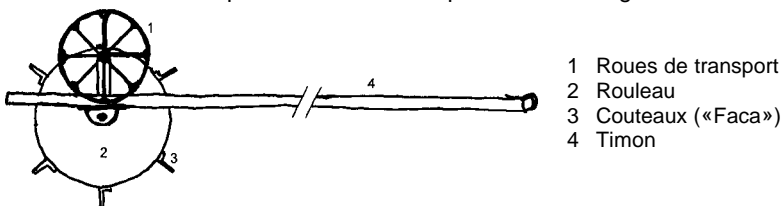
—*Modèle avec roue d'entraînement à l'arrière.* Cet outil est constitué d'une dent, sur laquelle est fixé un dispositif de semis articulé (en 10 sur le schéma). L'entraînement des distributeurs se fait par l'intermédiaire de la roue (en 4) qui repose au sol par son poids.



—*Modèle avec roue d'entraînement à l'avant.* Sur ce type, la transmission du mouvement (de l'avant vers l'arrière) aux distributeurs s'effectue par l'intermédiaire de chaînes et pignons placés à l'intérieur du châssis.

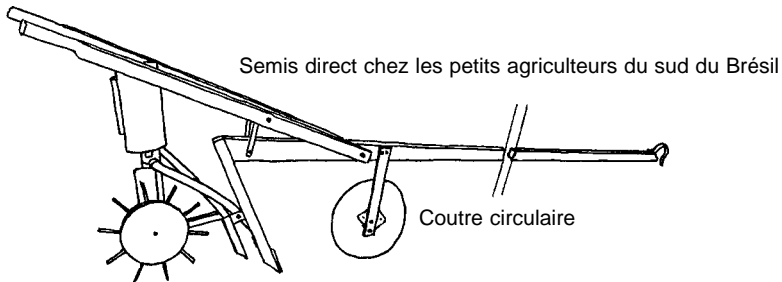


• **Le rouleau "Faca".** Le rouleau "Faca" est utilisé dans les itinéraires mettant en œuvre des plantes de couvertures. Il est composé d'un rouleau en bois ou en fer que l'on remplit avec de l'eau ou du sable et sur lequel sont fixées 6 ou 8 lames métalliques affûtées du côté extérieur. On le passe sur la végétation pour l'écraser plus que pour la couper. La période du passage est importante car il y a risques de repousses. Dans ce dernier cas il faudra épandre un herbicide pour "tuer" la végétation.



• **Equipements de semis disposant d'un disque à l'avant pour trancher le mulch résultant de la destruction des couvertures végétales**

—*Adaptation sur les équipements précédents.* Ces équipements sont directement dérivés des premiers outils où étaient regroupés dent et semoirs (modèle avec timon). En accord avec les paysans, le constructeur a monté un disque sur le timon. L'effort nécessaire au tranchage de la végétation est obtenu par le couple provoqué par la résultante verticale de l'effort de pénétration de la dent, et ayant son point de pivotement au niveau de l'attelage au joug.

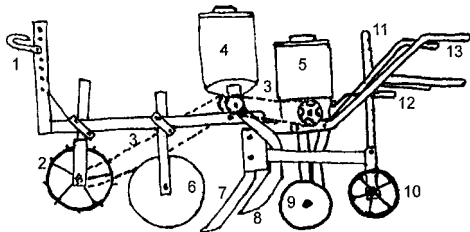


—*Semoir traditionnel adapté pour le semis direct*

Le prototype du semoir a été conçu par le IAPAR⁸. Il s'agissait d'imaginer un système capable d'exercer un effort vertical vers le bas qui puisse permettre au coutre circulaire de trancher la couverture végétale. Le positionnement d'une dent (en 7 sur le dessin) presque en dessous du coutre permet de transformer la force horizontale de traction en une force verticale nécessaire au bon travail du coutre. Tous les semoirs actuels de ce type sont équipés de cette dent en arrière du coutre circulaire.

Sur le modèle présenté, le dispositif d'ouverture du sillon où déposer la graine consiste en un petit disque. Son choix est dû au fait que dans ces régions du Brésil, les terrains sont souvent pierreux. Actuellement, les modèles sont aussi proposés avec un soc semeur, plus rustique et moins cher.

- 1 Crochet d'attelage
- 2 Roue d'entraînement
- 3 Chaînes de transmission
- 4 Distributeur d'engrais
- 5 Semoir à plateau
- 6 Coutre circulaire
- 7 Dent
- 8 Soc de placement de l'engrais
- 9 Disque semeur
- 10 Roue plumbeuse
- 11 Réglage de la profondeur de semis
- 12 Système d'embrayage
- 13 Manchillons



• **Les pulvérisateurs.** Les pulvérisateurs sont des outils indispensables dans ce type d'itinéraire technique qui demandent généralement plusieurs traitements herbicides. Les matériels sont très diversifiés. Les traitements peuvent être réalisés par :

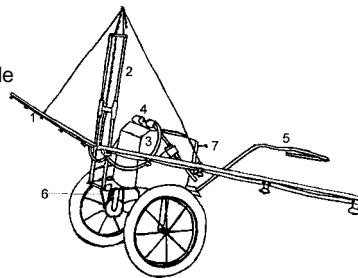
- des pulvérisateurs à dos classiques sur lesquels on peut monter une rampe permettant une plus grande largeur de travail. Largeur traitée entre 1 et 2 mètres.

- des matériels tractés par l'agriculteur. Dans ce cas la pompe est actionnée par l'intermédiaire des roues et d'un système bielle-manivelle, Largeur traitée entre 2 et 4 mètres.
- des équipements traînés par des animaux, la mise en mouvement de la pompe se fait aussi par les roues. Largeur de traitement supérieure à 3 mètres.

La plupart de ces équipements traînés sont réalisés avec des composants issus des matériels à dos. Certains même utilisent un pulvérisateur à dos complet pour la mise sous pression.

Un point important auquel il convient d'être attentif est le problème sanitaire. En effet, de part sa position proche du système de pulvérisation, l'opérateur est exposé à des embruns de produits pesticides donc aux risques qui en découlent. Des campagnes importantes pour le port d'une combinaison et d'un masque pour se protéger ont bien été menées mais, vu l'inconfort de la situation dans ces conditions climatiques, elles ont été d'efficacité limitées.

- 1 Rampe à buses
- 2 Potence permettant de régler la hauteur de traitement
- 3 Réservoir
- 4 Système de régulation
- 5 Mancheron
- 6 Système d'entraînement de la pompe
- 7 Vanne de commande



Conclusion

Quinze années d'expériences ont permis aux petits agriculteurs du sud du Brésil de disposer de matériels variés et aujourd'hui performants pour pratiquer le semis sans travail du sol en traction animale. Ces matériels ont très souvent été mis au point par un travail conjoint entre institutions de recherche, constructeurs et paysans.

Les efforts actuels des constructeurs se font surtout dans le sens de la diminution du poids et du prix. Ce dernier reste cependant assez élevé puisque compris entre 2500 et 3500 FF. De ce fait, l'acquisition de ces matériels par les agriculteurs reste directement liée à leur capacité d'investissement. Celle-ci dépend de leur ressources financières (donc de leur intégration au marché) et des possibilités de prêt auxquelles ils peuvent accéder. Ce dernier point est l'argument toujours avancé par les constructeurs pour expliquer la diffusion lente de la technique. Pour pallier cet handicap, certaines coopératives pré-financent les équipements, certains états mobilisent des capitaux affectés à ce type de prêt, mais ces opérations sont souvent limitées dans le temps ou à certains types d'agriculteurs.

¹ Utilisant généralement des équipements motorisés; ² Utilisant généralement des équipements à traction animale; ³ Veut dire "couteau" en Brésilien; ⁴ Utilisant la traction animale; ⁵ Outil d'origine Nord européenne, ayant la forme d'une pelle; ⁶ Aujourd'hui, les épandages de calcaire sont surtout réalisés à façon par les épandeurs centrifuges sur tracteur; ⁷ Tout au plus dans des résidus de récolte; ⁸ Institut Agronomique du Parana.

LETTERS TO THE EDITOR

Richard Walusimbi who is an implement designer and manufacturer in Uganda has written about his plans to introduce a new weeder design into the market:

"I was taken by the idea of mobile training units as a tool of disseminating and promoting DAP technology. It is a good idea even for Uganda. I have decided to plan for a mobile DAP equipment demonstration and sales unit. It is a very expensive undertaking but I will start in a small way by using facilities existing at district level. I intend to conduct a demonstration of the weeder in Soroti, in conjunction with Soroti District Farmers Association in order to boost my sales. I have also been active fabricating some weeder attachments and I am currently wrestling with the market.

I have heard of a new South African ox plough, which meets the requirements of minimum tillage, or conservation tillage. If there is anyone who is aware of such implements I would appreciate any information available. I am also keen to receive any additional information on a reversible mouldboard plough that I read about in a FAO manual on Animal Traction."

If you have any information that you feel would aid Richard in any way please contact him at P.O.Box 22963, Kampala, Uganda.

Alan Chadborn, also from Uganda, has written in with thoughts on the adoption and non-adoption of animal-drawn weeding technology. Alan, of Youth With a Mission (YWAM), works with small scale farmers in the Teso area of Uganda. Farmers in this area use DAP for primary tillage, such as ploughing and harrowing, and rarely for weeding. He has compiled a list of reasons why weeding may not be adopted in a community using draught animals, despite people spending time training farmers.

"In Teso education, training and extension has been done since 1965 in: ox/bull control by nose-cord or halter, with reins, weeding, seeding, yoke-making and cart use but it is rare to find any farmers actually using these, not even Agricultural Extension workers, not even those trained at Tororo DFI by ATRADO/Tillers in 1995 and not even those trained at Kumi by UNFA in 1998.

Has anybody actually proved the practicalities and economic advantage of DAP weeding. Is it not a viable system? Is training in DAP a waste of time?

Possible reasons for non-adoption of DAP weeding

1. Land is not stumped, therefore tree-roots bend rows, and stumping would promote erosion, and be environmentally bad.
2. Cattle are sold after only 2 or 3 year's work so are not worth the time and effort training in row weeding.
3. Cattle handlers assume they know the work and so are not willing to try new techniques.
4. Seedbeds are needed for seeder units, which take time and expense to create.
5. At this period oxen are needed to plough other lands - few oxen.
6. The window of time, while land is damp enough to plough is small so the priority is to plough other land

7. More passes of implements makes land dry out, risking low germination.
8. Heavy investment is required in all of the following implements before there is any pay-off. It cannot be done piece meal
 - Secondary tillage implement - cultivator or heavy harrow.
 - Seeder - to cope with a variety of seed, millet, groundnut.
 - Weeder.
9. Implements offered to date have been too expensive to afford.
10. Weeding is traditionally women's work, to reduce which men are not prepared to invest their capital.
11. Family money is administered by the men. Priority is given to school fees, bride-price etc.
12. Traditional ploughing quality leaves so much long grass protruding that it cannot be easily pulled down by harrow. It may need a second ploughing then cultivator then harrow before the seeder unit can do a good job.
13. Thus the method requires too large an expenditure of both time, effort and capital.

Has anybody proved that it will pay? Does the plant population improve, therefore better yield per hectare? Is weeding less expensive, than by hand after broadcasting? Is weeding more timely, less weed competition, therefore better yield? Is there a proven range of implements available. Cost? Which crops pay off best with DAP weeding? Is the answer demonstrations by a dedicated farmer, observed frequently sufficient by other farmers?"

PLATE 12: Well padded pack saddle with broad webbing straps and balanced load.
(P. Jones)

Alan is keen to hear any feed back on this subject and can be contacted c/o YWAM, PO Box 792, Soroti, Uganda. Or if you prefer a wider audience please send your views in to *Draught Animal News* and we will print them in the next issue.

Peta Jones has sent in two photographs which show some simple familiar materials as alternatives for equipment and packing used for backloading donkeys Plates 12 and 13. Peta is based in South Africa and can be contacted under: P.O.Box 414, Louis Trichardt 0920, South Africa.

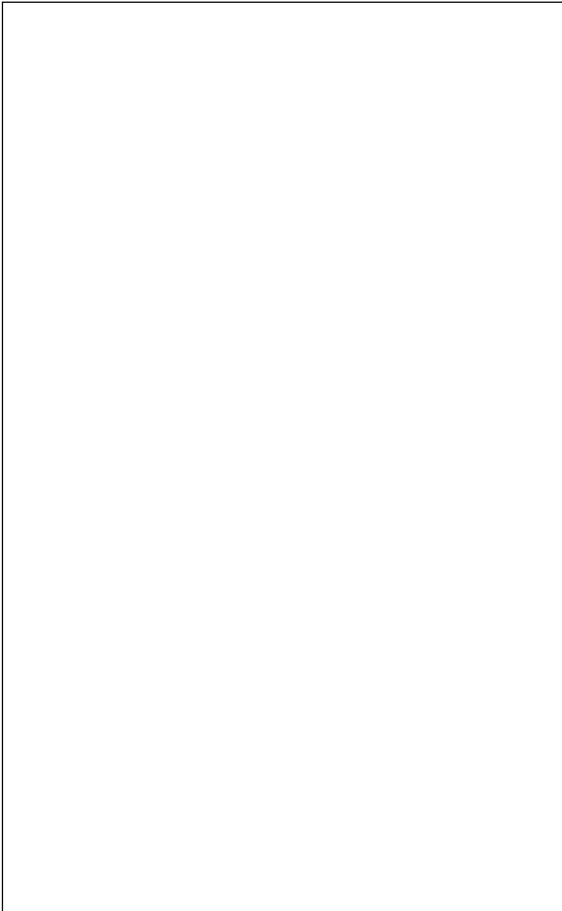


PLATE 13:

Zimbabwean donkey with
simple water carriers.

(P. Jones)

RECENT PUBLICATIONS

- Amran, F.A. Ahmad, D. and Roy, S.K. (1999). Energy requirement of disk plow combined with a rotary blade in wet clay soil. *International Agricultural Engineering Journal* **8**(3), 175-184.
- Bolanos Ortega, M. de F. (1999). Situation and importance of animal traction in several areas in Nicaragua. [Spanish]. *Tropenlandwirt* **100**(1), 31-49.
- Chang, C.S., Correa, W.A. and Magalhaes, P.S.G. (1998). Positioning the centre of resistance of mouldboard plough to improve its performance. [Portuguese] *Engenharia Agricola* **17**(4), 65-73.
- Desbiolles, J.M.A., Godwin, R.J., Kilgour, J. and Blackmore, B.S. (1999). Prediction of tillage implement draught using cone penetrometer data. *Journal of Agricultural Engineering Research* **73**(1), 65-76.
- Dijkman, J.T. and Chirgwin, J.C. (1997). Animal energy: an undervalued and under-utilised resource. Paper presented at the first Caribbean Workshop on Energy and Environment. Cienfuegos, Cuba, 26 - 28 March 1997.
- Dijkman, J.T., Sims, B.G. and Zambrana, L. (1999a). Availability and use of work animals in the middle Andean hill-farming systems of Bolivia. *Livestock Research for Rural Development* **11**(2).
- Dijkman, J.T., Sims, B.G. and Zambrana, L. (1999b). Mejoramiento de tracción animal: Temas y opciones no tradicionales. Memorias del Primer Seminario Taller del Proyecto Mejoramiento Tracción Animal (PROMETA). Cochabamba, Bolivia, 3 - 5 febrero, 1999. pp. 119-125.
- Goe, M.R. (1999). Influence of slope and stone cover on tillage operations in the Ethiopian highlands. *Soil & Tillage Research* **49**(4), 289-300.
- Ibanez, M., Reyes, J.F., Lanuza, P. and Melo, P. (1998). Design, construction and evaluation of an animal drawn grain drill for small farmers, by reusing parts of discarded seeders. [Spanish] *Agro-Ciencia* **14**(2), 347-351.
- McDermott, J.J., Randolph, T.F. and Staal, S.J. (1999). The economics of optimal health and productivity in smallholder livestock systems in developing countries. *Revue Scientifique et Technique Office International des Epizooties* **18**(2), 399-424.
- Natsis, A., Papadakis, G. and Pitsilis, J. (1999). The influence of soil type, soil water and share sharpness of a mouldboard plough on energy consumption, rate of work and tillage quality. *Journal of Agricultural Engineering Research* **72**(2), 171-176.
- Poje, T. (1998). Energy consumption by implements with active working elements during soil tillage. [Slovenian] Actual tasks on agricultural engineering. Proceedings 26th International Symposium on Agricultural Engineering, Opatija, Croatia, 3-6 February 1998. Zavod za Mehanizaciju Poljoprivrede, Agronomski Fakultet Sveucilista a Zagreb, Zagreb, Croatia, 1998. 227-234.
- Saqib, M., Muhammad, G., Khan, A., Asi, M.N. and Inayat, A. (1998). Trypanosomiasis in a draught donkey. *Pakistan Veterinary Journal* **18**(4), 231-232.
- Sims, B.G., Zambrana, L. and Dijkman, J.T. (1999). PROMETA: El proyecto de mejoramiento de tracción animal en Bolivia. Logros y perspectivas. Memorias del Primer Seminario Taller del Proyecto Mejoramiento Tracción Animal (PROMETA). Cochabamba, Bolivia, 3 - 5 Febrero, 1999. pp.1-10
- Wang ShiXue and Junichi, K. (1998). Analysis of the forces acting on a plough to invert furrow slice at the same position. [Chinese] *Transactions of the Chinese Society of Agricultural Machinery* **29**(4), 40-45.