An historical perspective on animal power use in South Africa

by

Bruce Joubert

Early reports

The first known reports of animal traction in South Africa come from the early European explorers and date back to as early as 1488, when Bartholomeu Dias first sighted the Cape and named the bay where he made his land fall *Angra dos Vaqueiros*, which means `Bay of Cowherds' (Burman, 1988).

The western and south-western Cape was at that time inhabited by the `Khoi-khoi' who belonged to the same racial group as the `Bushmen'. Early Dutch settlers named these people `*Hottentots'* after their language, which had many clicks. The Khoi-khoi were pastoralists and kept large herds of cattle and sheep. They were semi-nomadic and moved about within a large but defined area as the grazing dictated. The Khoi-khoi were first and foremost cattle people. Their cattle, which were large, long-horned animals with a typical zebu hump, were their most prized possession and provided them with food as well as power.

Khoi-khoi oxen were trained as pack animals and would respond to verbal commands and whistling. Household goods were transported on the backs of oxen when the groups moved. No record exists of any sledge, cart or implement being pulled. Some of the oxen were also trained for war and had sharpened horns. They were used to rush at the enemy causing confusion or to form a threatening barrier, behind which the men could shelter and from whence they could attack.

The history of animal power in South Africa actually goes back to long before the first settlement by European peoples at the Cape of Good Hope in 1652.

First European settlement at the Cape

In 1652 Jan van Riebeeck landed at the Cape, with instructions from the Dutch East India Company to establish a replenishment station for their ships, which plied between Europe and the far East. The Dutch, in Holland, used mainly draft horses to pull their carts, wagons and farm implements. Owing to the nature of sea travel in those days van Riebeeck brought no horses or carts with him. Furthermore he brought no long-term supplies of food, as the Dutch East India Company expected his people to grow their own grain and vegetables and to barter animals from the Khoi-khoi. For bartering purposes they offered copper wire, copper plates, beads, tobacco and liquor in exchange for cattle and fat-tailed sheep. The building of the first European settlement was achieved largely using human power, although a few oxen bartered from the Khoi-khoi were used to pull a carpenter's cart.

At this time their were no indigenous horses in South Africa and the only animals available for draft were Khoi-khoi cattle. The absence of horses may have been related to the presence of horse-sickness which occurred throughout the lowland areas of central and southern Africa. This restricted the spread of all equids except the zebra in the region. Much as van Riebeeck wanted horses, he could only obtain them by shipping them in, which at that time was a difficult and often unsuccessful exercise. Thus logistics and horse-sickness enabled the indigenous ox to play an important part in the European colonisation of South Africa.

The first imports of horses came from Java and belonged to the Dutch East India Company (Agriculture, 1957). After 1665, *free burghers* were allowed to own and breed horses. Within some fifty years, the Company had bred up about 400 horses, while the *free burghers* had over 2000. Although these numbers were low, the horses played an important role for riding and military purposes in the newly-formed colony.

The first donkeys and mules were landed at the Cape in 1656, but there is little mention of their

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use on a large scale until the latter half of the eighteenth century.

Jan van Riebeeck needed some form of land transport for heavy goods. Realising that oxen were the most practical draft animal, he commissioned the first South African ox wagons to be constructed from wood that was cut in the local forest. The wagons were used for hauling firewood and building timber as well as stone for the construction of the fort. These wagons formed the prototype of what was later to be called the *kakebeen* wagon due to its resemblance to the jaw bone of an ox (Bosman, 1988). It was a replica of the farm wagons used in Holland and Germany at that time, and remained largely unchanged for some 200 years.

Exploration

The mandate of the first settlement was to provide a refreshment station for shipping on the Far-East run. It was not long, however, before exploration of the interior began. Portuguese stories of the famous golden city of Monomatapa led to a succession of trips into the interior to try and find this city. These journeys, along with trips to establish the presence of copper, to trade with the Khoi-khoi and to hunt for ivory, led to the exploration of the immediate interior (Bosman, 1988; Burman, 1988). Most of these expeditions were undertaken using oxen and wagons. Horses were used for riding by those fortunate enough to own one and donkeys were, to a small extent, used as pack animals. The trips were difficult owing to the lack of any form of roads and the rough nature of the terrain (Mentzel, 1944). Despite this, the ox wagon, pulled by a span of ten oxen found its way into apparently inaccessible areas and proved to be very adaptable.

Early settler farmers

In 1657 Jan van Riebeeck released some of the Company servants and gave them farms along the Liesbeek river. These farmers were provided with a plow, a harrow, spades, picks, shovels and axes as well as 12 draft oxen, which had been trained to the plow (Moolman, 1989). The idea initially was to encourage these *free burghers* (as they were known) to grow fruit and vegetables for supply to the passing ships. Due to the low prices which they got for their produce, it was not long before some farmers realised that there was a more lucrative type of farming involving cattle and sheep (Botha, 1962).

Cattle were in demand for food and draft power and their production was easy and more reliable than crops. All the farmer needed was a herd, a wagon and draft oxen. Thus equipped the farmer could move freely beyond the borders of the established colony as the grazing dictated. It cost very little. The `farmer' had no farm, but lived in a wagon, benefiting from his herds, the abundance of wild game and by trade with the Khoi-khoi. These were the first of the *trekboers*.

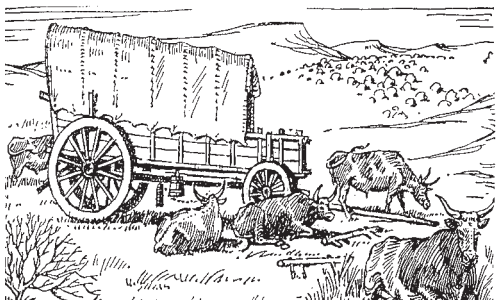
The *trekboers*

Exploration and trading expeditions were few and far between and it was actually the *free burghers* who `opened up' the interior for the Europeans. These *trekboers*, as they eventually came to be known, fell into three categories, the hunters, the traders and the cattle farmers (Bosman, 1988; Burman, 1988). The hunters were the first to move into an area. As the herds of game were reduced they moved further ahead in search of more, to be followed by the traders and cattle farmers who were then able to trade and utilise the abundant grazing.

Local inhabitants of the area were the `Bushmen' and the `Khoi-khoi'. The former retreated ahead of the *trekboers* in company with the game upon which their livelihood depended. The latter remained in the areas benefiting from the grazing which became available for their cattle (Burman, 1988).

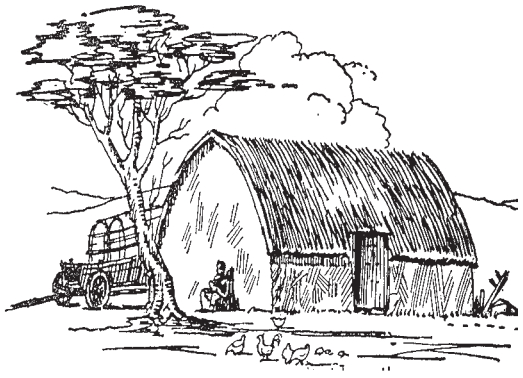
By 1720 stock farming had increased greatly and the borders of the colony had expanded significantly. *Free Burghers* were granted loan farms which they could hire for very low rents and which they could exchange for other farms when the grazing ran out (Bosman, 1988). Stock numbers owned by the Free Burghers at this time had increased to over 20 000 cattle and 130 000 sheep. Farmers were forced by

Kakebeen wagon of a `trekboers'



Source: Bulpin, 1974

circumstances to live further apart due to the need of large areas for grazing (Burman, 1988). As a result they became more independent and resourceful. They became inured to loneliness and inclined to *trek* at the slightest provocation. Some farmers tended to settle and remain on their loan farms but many others continued to lead a semi-nomadic existence as *trekboers.* They combined the roles of hunter, trader and cattle farmer and tended to live on the interface between the Colony and what were to the Europeans `the unknown territories' to the north and east.



Source: Bulpin, 1974

`Hartbeeshuis' and `kakebeenwa' of `trekboer'

The *trekboers'* existence was centred around their wagons and the temporary houses (*`hartbeeshuisies')* which they erected and then abandoned when they moved on. They *trekked* into town as seldom as possible. This was only to replenish stocks of gunpowder and shot, to buy coffee, tea and sugar, to visit the church to legitimise marriages, to baptise and to record the birth of children and to record loan farms (Bosman, 1988).

By the year 1760 most of the west coast as far as Namaqualand, and the south coast as far as the Great Fish River and bordering on the little Karoo had been `opened' up and was sparsely inhabited by *trekboers* (Botha, 1962). The way to the north as well as to the east was relatively unknown to the Europeans.

During the next forty years *trekboers* consolidated their position in the area. Numerous parties of private travellers who were mainly hunters, scientists and clergy also covered the area.

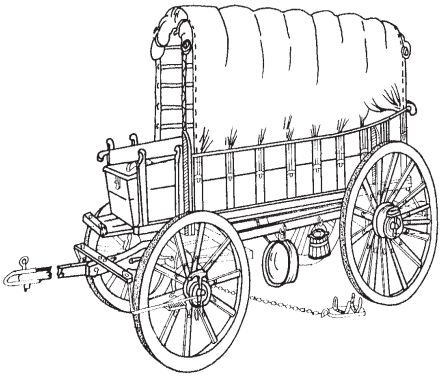
The kakebeen wagon

The *kakebeenwa* consisted of two separate parts, the carriage and the wagon which rested upon it (Burman, 1988). The carriage comprised two pairs of wheels attached to *`axle-trees'* and linked by a wooden *`perch*'. The axle assemblies contained the rear and front wheels, which turned on wooden axles fashioned from a single tree and tapered at each end. The wheels were dished outward at the rim (ie, hollowed like a saucer with the *`nave*' at the bottom of the hollow) to give the wheel greater strength. The rear wheels were about 1.5 m in diameter with 14 spokes and seven *`felloes*' bound together with an iron rim shrunk over the *felloes*. The front wheels were about 1 m in diameter having 10 spokes and 5 felloes. Both sets of wheels were spaced about 1.5 m apart. Although the front wheels were not small enough to turn under the wagon, the angle of the dished spokes allowed a reasonable turning circle. Each wheel was held onto the ends of the axles by means of an iron plate and *linchpin*.

On top of each *axle-tree* lay a strong timber *transom* upon which the wagon rested. Front and rear assemblies were connected by the *perch*. This beam was connected to the rear axle assembly by means of a V-shaped guide. A beam passed through the front axle assembly and had a horizontal slot in front to which the draft pole or *disselboom* was connected. This beam was connected to the front assembly by two guide arms which enabled the *disselboom* to turn the front wheels. As a safety precaution an additional iron perch was secured above the wooden perch (Burman, 1988).

The wagon body was about 4.6 m long and 0.85 m wide at the bottom. A wooden framework called the *tilt* was provided for the tent covering. This tilt was 1.7 m in height above the bottom of the wagon. The wagon also had wooden sides, 0.6 m high in front rising to 0.85 m at the rear. The floor was constructed of 50 mm thick planks. The *tilt*,

Kakebeen wagon



Source: Bosman, 1988

which was covered with `Hottentot matting', a painted canvas and topped with a sailcloth cover, included flaps to close up each end. The tilt was made 770 mm shorter than the wagon so as to allow space for the driver's seat, which comprised a box in which tools could be kept and on which two people could sit. The different parts of the wagon were fashioned out of different types of wood, each with the special qualities required for the function of the part, which gave the wagons great resilience. The overall assembly could also be easily dismantled for repair or to facilitate handling over rough terrain. The oxen were attached to the 3 m long *disselboom* which was fashioned from a single tree trunk (Burman, 1988).

The oxen were attached in pairs to yokes which lay over the shoulders and against the *skof* of each ox. Four vertical holes in each yoke housed the yoke *skeys*, 500 mm long by 75 mm broad with two slots in one side, which hung on either side of the neck of each ox and were secured underneath the dewlap of the oxen by means of a rawhide *strop*. The rear pair of oxen had a wider yoke than the others and were secured to the *disselboom* by means of a tow chain which was made of eight plaited rawhide thongs or *riems*. Each successive pair of oxen was then secured to the pair in front by a similar *riem* or tow rope. In later years rawhide tow rope was replaced by an iron chain (Bosman, 1988; Burman, 1988).

Ten oxen generally formed a span for these wagons and each pair were inspanned with their yoke and *skeys* and a rawhide *riem* linking their horns. The lead oxen were normally led by a span leader or *touleier*, with rawhide *riems* attached to the horns of each ox. The whole span of oxen would then be driven by the driver who used a long-handled whip, with a long rawhide thong and a buckskin whiplash to aid the control of the oxen. He also used verbal commands and called each ox by name, when more effort was required of it (Burman, 1988).

Trek equipment and accessories

A number of items of equipment and accessories were required when travelling by ox wagon (Burman, 1988). These were:

- Lifter or jack to enable the wagon to be jacked up to remove a wheel.
- Tar bucket in which was kept a mixture of animal fat and tar for lubricating the wheels.
- Water cask for drinking water.
- Step which was mounted under the wagon and on which rested the tar bucket, lifter jack and water cask. The step was placed on the ground to gain access to the wagon.
- Seat box containing tools which was mounted in the front of the wagon.
- Brake shoes used to brake the wagon and which were hung near the wheels.
- Whips, which comprised a long, wooden handled ox whip for driving the span and a *sjambok* and for goading the rear oxen when the weight of the wagon rested upon them or for dealing with any reluctant ox.

The whip, the length of which depended on the number of oxen in the span, comprised the handle, the whip, the thong *agterslag* and the end *voorslag.* The whip was ideally made of sable or giraffe hide, but often of ox hide, tapered towards either end and connected at one end to a bamboo handle and at the other end to the *agterslag*. The *agterslag* was tapered towards the *voorslag* and was made of ox hide. The *voorslag* which was also tapered to its tip was usually made of kudu or bushbuck hide. The *sjambok* was usually made of rhinoceros or hippopotamus hide and was about 2 m long (Burman, 1988).

Braying of rawhide

The whip, riems, strops and thongs used when working with oxen were made out of rawhide prepared by the *trekboers*. `*Braying*' was the process by which rawhide was prepared for making harness and leather ropes or *riems*. The fresh bullock hide was wetted and buried in the dung of the cattle *kraal* for about two days. The heat from the fermentation which took place in this period resulted in the removal of the hair without damage to the hide.

Gathered together from the sides the hide would then be hung in a tree from one end, with a weight, often a wagon wheel attached to the other. It would then be kept moist and twisted clockwise and anticlockwise repeatedly until, after some four days, it became white on the outer surface. It would then be greased with fat to soften it. Twisting would then be continued until the hide became pliable and white through to the innermost fibres. Between the time when the hide was first hung up and completion of the process, it was stretched out laterally between poles and hacked with a blunt

hoe to expand it and remove the connective tissue.

The making of riems was a similar process, but the fresh hide with hair removed was usually cut into a continuous strip 75 mm broad starting from the outer perimeter of the hide and working inward in spiral fashion. The entire length was then wound round and round between the low branch of a tree and a weight, usually a large stone with a curved branch attached to it suspended at the lower end of the windings. The weight was repeatedly twisted by means of a long pole placed in the space between the stone weight and the curved branch, alternately clockwise and anticlockwise. The rawhide was periodically greased to render the riem white outside and inside and completely supple. Both processes took one man about seven days.

Under this treatment the leather became soft and pliable and very strong. Thongs called *riempies* made of soft buckskin, treated in the same way, were used for pointing whiplashes, repairing harness and for other purposes for which twine might be needed (Wallace, 1896).

Trek oxen

Several types of work oxen were used by the different peoples in South Africa. Over the years, the best-known breed was what came to be called the *`Afrikaner*' (Bosman, 1988). This animal was developed from the original Khoi-khoi cattle and was a large smooth-haired and long-horned beast with great strength and resistance to the local diseases. They were usually broken in and trained for draft use at the age of three years. The *trekboers* used an ox language adapted from that of the Khoi-khoi to control their oxen. In addition each ox had its own name to which it would respond. Typical commands were: *hoi hoi* for fall in to be inspanned, *uit* to bring the oxen into line, *hek* for go, *woa* for stop, *haar* for turn right, *hot* for turn left.

Inspanning oxen involved assembling them in a line facing the yokes and trek riems, which had been laid out in a line from the *disselboom* by calling *`hoi hoi'* to the oxen. The riems were then placed around the horns of each pair of oxen. Inspanning began by placing the yoke over the *skof* of the right hand (*haar*) ox and securing the *strop* under its dewlap between the two *skeys*. The left (*hot*) ox would then have the yoke put over his *skof* and secured.

Inspanning usually started with the rear pair followed by the front pair and thereafter the remaining oxen would be inspanned. When outspanning it was usual to start with the centre pair and finish with the lead pair (Bosman, 1988; Burman, 1988).

The *touleier* walked in front holding the lead riems (fastened around the horns) while the driver walked on the left side of the span next to the rear ox, *agteros*, using his whip and talking to his span as the situation demanded.

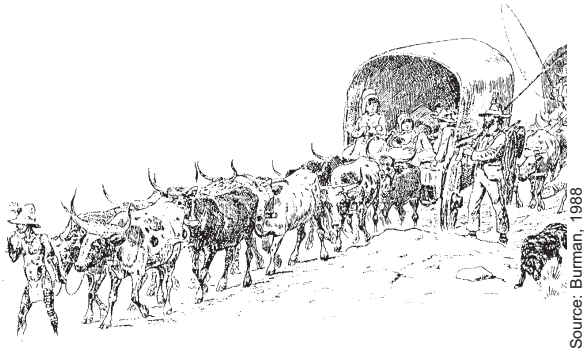
On trek a span of oxen could travel at between four and five kilometres per hour. During the `Great Trek', for the sake of the accompanying sheep, the trekkers did not exceed 10 km per day. A day's journey with oxen was called a *skof* and when no small stock were in company involved a total of 6-9 hours inspanned per day. In winter, three 3-hour shifts made up a *skof* during which up to 36 km could be covered. In summer, two 3-hour shifts made up a *skof* and 24 km could be covered. It was customary to travel in the early mornings and late evenings in summer and to rest up during the heat of the day (Burman, 1988).

Feeding the oxen was of great importance and enough time had to be set aside each day to enable them to obtain sufficient grazing and water for their proper maintenance and to enable them to pull their load. The quality of the veld grasses varied with the time of the year and the locality and this had to be taken into account.

Oxen on trek responded to instructions and trekked long distances up and down hills, over rocks, along precipices, through hollows, drifts and swollen rivers and over turf plains. They were scared by veld fires and the presence of wild animals. They had to endure intense heat and cold, rain and hail. There were no cattle-sheds or veterinarians and no grooming. Tsetse fly and ticks, sore hoofs and tired bodies were all part of their existence. Sometimes they were subjected to severe treatment by their drivers, who in the harsh circumstances sometimes resorted to dreadful measures to get the last bit of work out of the oxen.

The `Great Trek'

The farmers and *trekboers* of the Cape were by 1834 finding British rule even more restrictive and frustrating than the old Dutch East India Company rule had been. Three secret expeditions, or *commissions*, were sent out to


Source: Burman, 1988

Early `trekkers'

South West Africa, the Zoutpansberg area of the Transvaal and to Natal to investigate the possibility and advisability of trekking to, and settling in, these areas (Burman, 1988). By 1835 several groups were preparing to trek out of the Eastern Cape. The `Great Trek' began in 1836 and continued intermittently until 1852 (Bosman, 1988). It involved some 10 000 men, women and children. These trekkers were descendants of the *trekboers* and had a heritage of nearly 150 years in which the ox and wagon had formed the hub of their nomadic existence. Several parties of trekkers, under different leaders, left the colony all of them moving through what is today the Orange Free State. From here the parties chose two directions, one north into the Transvaal and the other east into Natal (Bosman, 1988; Burman, 1988).

The going was not easy as there were no roads. Confrontation with mainly Zulu-speaking Nguni peoples resulted in conflict, with loss of life and property on both sides. Diseases took their toll of both humans and animals. Through all these adversities, the mainstays of the *voortrekker* existence were their oxen, their horses and their wagons. The wagons were their home, their transport and even their fort in times of conflict (Burman, 1988).

The *laager* was widely used during the `Great Trek' as a major form of defence (Burman, 1988). This involved linking all the wagons involved in the group end to end or in some cases side by side. The *laager* was generally circular, but in some cases square, triangular or semicircular depending on the circumstance. Wagons were arranged end to end with the disselboom of each wagon running under the body of the next. A space of 1.5 m was left between each wagon for access (and the use of firearms if necessary). The wagons could be lashed together by riems and chains and all the spaces between the wagons and underneath could be filled with thorn bushes lashed in position. At least one gateway was left in every *laager* usually one wagon length wide, with a wagon kept on hand with which to close the opening if necessary.

Setting up a *laager* demanded some planning and preparation. It had to be on level ground with a good field of view, it had to make good use of the high ground and be close to an adequate source of water. In addition there needed to be a good supply of grazing for the oxen and stock as well as firewood, and thorn bushes for fortification.

Some simple arithmetic was involved in setting out a *laager*. It was necessary to multiply the length of the wagons by their number and to add 1.5 m for the space between each wagon plus one wagon length for the gateway. This gave the circumference of the *laager*, which when divided by six gave the radius. After marking the centre it was then possible to step out the radius to each wagon in turn as it was drawn into position. There was no maximum number of wagons that could be used for a *laager*, but the minimum number was accepted as being 12 for a circular *laager*.

The first recorded *laager* was used by Simon van der Stel on his journey to Namaqualand in 1685 (Burman, 1988). Thereafter the *laager* was used by both the *trekboers* and the *voortrekkers* on many occasions when they felt

`Over the pass'


Source: Burman, 1988

their lives were threatened. It was a very effective form of defence when properly prepared.

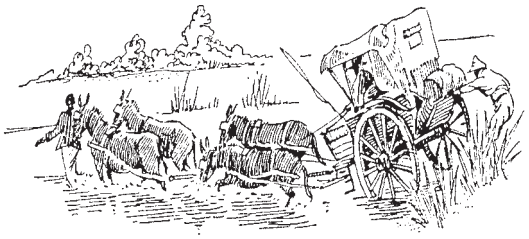
One of the largest gathering of *voortrekkers* during the `Great Trek' was at Winburg in what is today the Orange Free State where 1000 wagons were congregated. The practical implications of such a gathering are quite thought-provoking, considering that this would have represented at least 6000 people, 10 000 draft oxen and large herds of cattle and sheep (Burman, 1988).

The Dorsland Trek

After the `Great Trek' several Boer republics were formed which ultimately were reduced to the *Zuid Afrikaanse Republick (ZAR)* and the *Oranje Vrystaat (OVS)*. Despite the foundation of these republics some boers were not entirely satisfied. By 1874 farmers in the Rustenberg area had decided to trek yet again even though they had good farms and no clear `axe to grind' against the state and its leaders. They appeared compelled by a desire to trek. They sold their farms and readied their wagons. This trek which involved several different groups under different leaders was to become known as the *Dorsland Trek* (`thirstland' trek). It passed through present-day Botswana and Namibia and into Angola. It was a hard trek due to the desert conditions in some of the areas traversed and the shortage of water. Some of these trekkers settled in Angola and others in South West Africa. Some returned to the ZAR. Why did the people of the *Dorsland* trek leave the ZAR to trek again and struggle against drought, hunger, thirst, fever and possibly hostile people? The answer appears to be simply the *`trekgees'* or a desire based on over two centuries of trekking to `follow the will-o'-the-wisp into the wilderness' (Botha, 1962; Bosman, 1988; Burman, 1988).

Roads, passes and rivers

The first recorded road in South Africa was the wagon road between Table Bay and the forest above Kirstenbosch. All the early roads started as wagon tracks which were worn in places into sandy ruts in dry weather and into muddy holes in wet weather. Repairs were seldom undertaken, for as soon as one part became impassable, the route was changed a little. It was said there were places with as many as 32 parallel tracks to chose from on the main wagon route from Port Elizabeth to Cape Town



Source: Bulpin, 1974

Mules crossing river

(Burman, 1988). A network of roadways developed in the Cape as the *trekboers* settled. These were usually rough wagon roads linking the farms with the nearest village and they were later developed into proper roads.

In the frontier areas roads were generally nonexistent and wagon trains had to make their way across country, over rivers and up passes to cross the mountain ranges. Many of the passes were used regularly as they were the only known ways over the mountains, but for the first 200 years only wagon tracks linked them (Burman, 1988).

Bridges were also nonexistent until much later in the history of the country and much time and effort was expended in negotiating rivers particularly in the rainy seasons. Towards the end of the nineteenth century the construction of proper roads and bridges began to take place mainly in the vicinity of the towns but latterly even on the main routes between the major centres.

The `bokwa' transport wagon

The `Great Trek' was the beginning of the `opening-up' of the majority of South Africa to wheeled transport. Until that time the *kakebeen* wagon had sufficed as a mode of transport. This wagon however, although ideally suited as a mobile home, could only carry some 1800 kg of payload. Traders needed vehicles larger than this (Burman, 1988).

The establishment of towns in the interior such as Graaff-Reinet, Grahamstown, Kingwilliamstown, Pietermaritzburg and Bloemfontein and latterly Kimberley, Pretoria and Johannesburg, introduced the need for regular transport services to bring supplies from the coast and to return produce to the coast. Initially transporters used *kakebeen* wagons but these were superseded by a larger transport wagon with iron axles, which first emerged in the 1860s (Burman, 1988).

The *bokwa* transport wagon could carry about three tons of payload and in 1890 it cost about £ 100. It had a mass of 1500 kg with a length of 5.5 m. The floor was 1.2 m wide (often of Baltic deal) while the top side beams were made of stinkwood. The undercarriage consisted of two *scammels*, two *axle-beds* and a *drieboard* all of black ironwood. The ironwood beam underneath, which rested on the axle beds, was 3.5 m long. The diameter of the rear wheels was 1.5 m and of the front 1.3 m. The *naves* were made of yellow wood, the spokes of *assegaai* wood and the *felloes* of white pear or bitter almond. The axles were made of two iron halves forged together. The brake shoes were of ironwood while the wheel rims were of iron, 75 mm wide. The draft-pole or *disselboom* was of black ironwood.

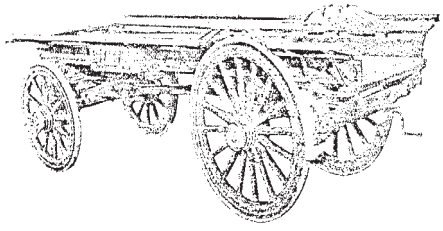
Eight yokes were used to inspan sixteen oxen. The stinkwood yokes were 1.6 m long and 75 mm in diameter, with four slots cut in them to receive the sweet thorn *skeys* or yoke keys. The span of oxen was driven by a driver who walked alongside on the the left using a leather thonged whip and led by a *touleier* as was the case with the *Kakebeen* wagon.

The first recorded wainwright was Jan Theunissen of Zouelen who built his first wagon in the Cape in 1655 (Burman, 1988). Thereafter the industry grew steadily and reached its heyday in the 1880s when wainwrights were to be found at all the major towns throughout the country.

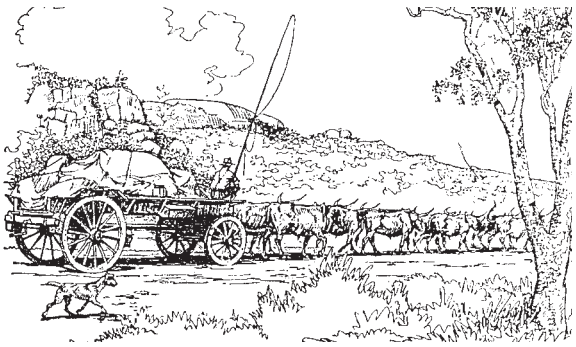
The `transport rider'

The commercial transporter or `*transport rider*' was the main means of transport for commodities between the coast and the interior during the latter half of the nineteenth century. They were also used by travellers. Horse- and mule-drawn coaches and the railways superseded them in certain areas, but until these modern conveniences arrived the ox wagon was the main means of communication. Travel was slow but also relatively inexpensive. In a country without roads and where grazing had to be found anyhow, anywhere, the ox was admirably suited, being the embodiment of power, endurance and patience in difficult surroundings.

`Bokwa' transport wagon



Source: Burman, 1988



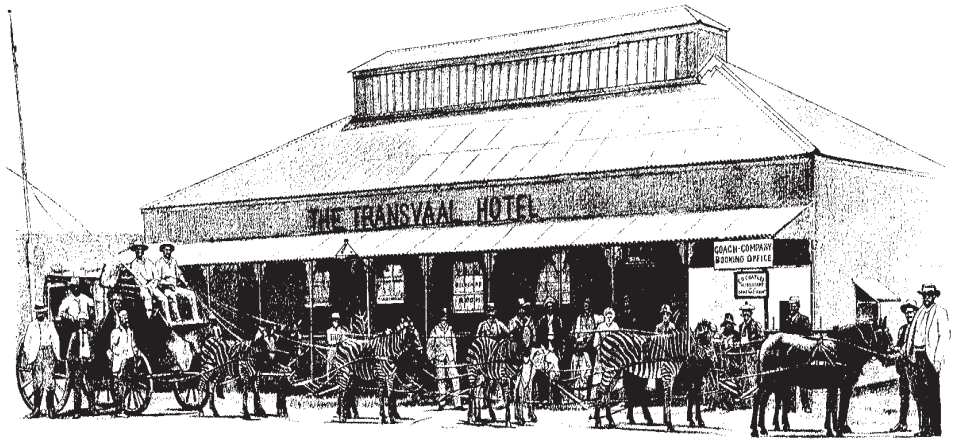
Source: Bulpin, 1974

Transport rider

Generally only two *skofs* per day were made. These were a very early morning *skof* from 2 am to 6 am and an evening *skof* from 4 pm to 8 pm. By travelling at night, the heat of the day was avoided, and there was adequate time for grazing during the day.

Grazing played an important role in transport and during times of drought it was not uncommon for commerce to be crippled through lack of transport. Transport wagons were used effectively in the Eastern Cape, from the coast to Kimberley, from the coast to the Reef and from the Eastern Transvaal to Lorenço Marques. In 1885 the cost of wagon transport ranged from R 0.75 to R 1.50 per 50 kg depending on distance and quality of the road. It has been estimated that in the first ten years of the history of Kimberley nearly 18 500 transport wagons travelled into the town. As the railways began to spread to the main centres the use of transport wagons for long hauls changed to one of providing a service from the railhead to the depots and from the farms to the towns.

In 1896 the outbreak of rinderpest, which had spread down from the north, killed thousands of cattle and left many of the transport riders without traction animals (Burman, 1988). In addition, disease control measures required restriction of movement across borders, which made it almost impossible for many transport riders to operate. For a short while mules and sometimes even donkeys were used to pull the wagons. In the Anglo-Boer war of 1900-1902 the army commandeered all the wagons for military use, and this effectively ended



Source: Clutton-Brock, 1992, after Tegeteier and Sutherland, 1895

Zebras and mules harnessed in Northern Transvaal at the end of the nineteenth century

transport riding with wagons as a major means of inter-city transport. Thereafter ox wagons were used mainly for local and on-farm transport.

Horses, zebra, donkeys and mules

Horses

The first horses landed at the Cape in 1652 came from Java (Agriculture, 1957). They were small, but were strong and hardy and formed the basis of what came to be known as the `*Cape Horse*' and what we know today as the `*Basuto*' and the `*Boerperd*' (Child, 1967). Further Javanese horse shipments were landed at the Cape and local breeding enabled stocks to be built up. However, in 1689 the Dutch East India Company stopped supplying horses to the settlers, being of the opinion that they should make use of the indigenous zebra and qwagga, which were not affected by horse-sickness, for riding and draft purposes. Horses were not imported in any appreciable numbers again until about 1780, when shipments were brought in from South America, England and the United States of America. Thereafter horses were imported from time to time from Europe, the Americas and from the East (Hocking, 1975).

Initially the use of horses was confined by horse-sickness to high altitude areas in the summers, with temporary use in the lowland areas in the winters. The introduction of a horse-sickness serum by Sir Arnold Theiler in 1909 allowed more widespread use of horses.

Horses in South Africa were used for riding, pack, carriage and agricultural draft purposes. Draft horses were used initially as cart horses to pull wagons and carts but during the nineteenth century increasing use was made of them to draw carriages and coaches as well as harrows, planters, cultivators, mowers, rakes and plows. The latter task was however generally left to the draft oxen.

Horse breeding in certain highland areas (eg, around Colesberg) became popular in the early nineteenth century when the British required high quality remounts for their cavalry in India (Van der Merwe, 1981). The *Cape Horse* was used in this breeding programme and was used to develop the *Boerperd* in South Africa and the *Basuto pony* in Lesotho. These two breeds were used mainly as saddle horses for riding purposes but both were sure-footed, hardy animals with `good wind' and staying power (Louw, 1948; Child, 1967).

Heavy draft horses were apparently first introduced in the Western Cape during the nineteenth century. They included the Percheron from France, the Shire from England and the Clydesdale from Scotland. In 1910 the first draft horse studs were set up by the Union Government at several of their colleges of agriculture notably Elsenburg in Western Cape, Grootfontein at Middleburg in the Karroo and at Cedara College in Natal (Agriculture, 1957).

Zebra

It is interesting to note that attempts were made to train and use zebra because of their resistance to horse-sickness as far back as the eighteenth century (Wallace, 1896). The trials were generally unsuccessful and the only record of some success in this regard is of trained zebra belonging to a Mr Zeederberg of Pietersburg, who had a team of them pulling his stage coach from Pietersburg in the Northern Transvaal to the Tuli area in Botswana. Mr Zeederberg found that they had

no staying power and furthermore he believed that they did not have the right build to make them comfortable for riding (Bulpin, 1974).

Donkeys

The first donkeys were imported into South Africa in 1656 and they were used mainly as pack and on-farm draft animals in the western parts of the country for the first one hundred years (Wallace, 1896). After that their usage spread to other areas where they were used by `European' farmers, hunters and transport riders as well as by `African' farmers.

Mules

Mule breeding only became an accepted farming practice when grain growing became widespread in the Western Cape towards the end of the eighteenth century (Schreuder, 1948). During the nineteenth century thousands of mules were used in the coach services from coastal towns to the interior, particularly to the major mining towns such as Kimberley and Johannesburg. Mules were also used to a large extent in agriculture and forestry, and also during the Anglo-Boer War.

Horses and mules were preferred for fast travel by coach and carriage, while oxen were preferred for the haulage of the heavy transport wagons (Child, 1967). Mules were generally regarded as being hardy, tough and better able to exist on poorer quality food than horses. They were also able to sustain a more reasonable work output under rough conditions. Horses although preferred for their speed required high standards of management and feeding to sustain a good performance.

The use of mules and horses suffered a number of setbacks in the early twentieth century with the introduction of railways on many major routes (Child, 1967). The Anglo-Boer war and the First World War resulted in the loss of thousands of horses and mules in South Africa. It was estimated that five million horses were lost in Europe during the First World War, which accelerated the trend to replace work animals with motors (Blakewell, 1991).

Animal mistreatment

An historical aspect of animal traction which is not widely documented but which is referred to by a number of historians is that of draft animal mistreatment (Burman, 1988). It would appear that in the days when animals were used for traction purposes on a large scale that mistreatment was not uncommon. It may have been caused by ignorance and frustration, possibly associated with poorly-trained staff or poorly-trained animals, or both. This was in an era when there was neither proper training of those who owned and worked with draft animals nor adequate legislation to protect the animals against mistreatment.

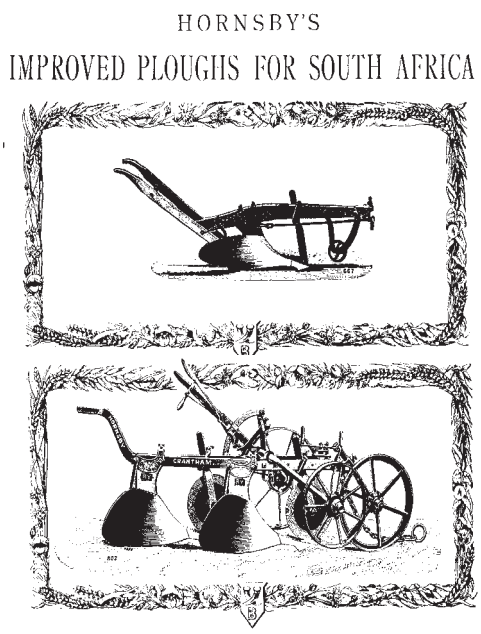
Indigenous traditions

The use of large longhorned cattle by the Khoi-khoi is the first recorded employment of animal power in South Africa (Bosman, 1988; Burman, 1988). Although these people did not, as far as is known, pull anything with their oxen, they trained them well to verbal commands and used them as pack animals and in battle (Burman, 1988). Many of the Khoi-khoi were ultimately absorbed by the Xhosa-speaking peoples and their method of training, controlling and using oxen seem to have been adopted into Xhosa culture. Xhosa cattle were predominantly *Nguni*, which were a smaller breed but which were, like Khoi-khoi cattle, hardy and able to thrive under the severe South African conditions (Bosman, 1988). Initially the Xhosa used their oxen as pack animals and for riding, but early in the nineteenth century they began to use oxen for pulling sledges and for the cultivation of crops.

During the nineteenth century the Xhosa and the Basuto began to use horses in high-lying areas where horse-sickness was not a threat (Child, 1967). The use of draft animals for the cultivation of crops spread northwards during the early part of the nineteenth century throughout the rest of South Africa under the influence of the early settlers and missionaries. A few of the transport riders were indigenous Africans. By the end of the nineteenth century indigenous people making use of draft oxen or donkeys for the cultivation of crops and for pulling sledges and carts in most parts of South Africa. The number and proportion of indigenous African farmers using animal power gradually increased during the first half of the twentieth century.

Agricultural implements

The unreliability of the climate, dangers of pests (eg, locusts and armyworm) and unremunerative crop prices tended to discourage farmers from investing in farm machinery. Nevertheless, as time went by the



Source: Hornsby, 1891

Hornsby plows for South Africa from 1891 catalogue

following types of animal-powered farm implements became common in South Africa.

Plows

The old `75' was a widely-used strong and cheap single-furrow mouldboard plow with a wooden beam. It was later replaced by lighter and better constructed implements which were more expensive. These were single-furrow plows such as the Ransome, the Swedish, the Steel Swift and the Oliver, all of which could be used for deep first plowing.

One of the most popular plows of the nineteenth century was the `*Oliver*', a single-furrow chilled plow. This was a *centre-draft* plow with its beam resting on a pivot at the top of the standard so that its direction could be changed and the draft maintained in the centre of the beam. This plow also had the advantage that all the main wearing parts were detachable and replaceable at low cost.

Two- and three-furrow mouldboard plows such as the `Howard', the `Eckerst', `Germanzas', `Ransome' and `Oliver' were also used widely and were considered more economical to operate than the single-furrow plow. Twelve oxen were used to pull a three-furrow plow with an effective width of 690 mm. Six mules would pull a two-furrow plow, with an effective width of 460 mm. To open and close irregularly shaped lands two mules drawing a single-furrow plow were used to reduce the effect of trampling the surface which had already been plowed. Two wheels fitted to the plows were preferred. The plows were generally `one way', but apparently reversible `two way' plows were also used.

In South Africa quick grass `*kweek*' has always been a problem and to ensure that the roots were properly buried the share needed to be pointed and not too broad. The standard or main perpendicular support of the body had to be placed about 100 mm behind the front edge of the mouldboard doing the perpendicular cut and 75 mm nearer the furrow side than is usual on plows used on clean lands. This resulted in the roots (which were inclined to form in a tangle around the standard) slipping off into the furrow and being buried. A `*skim coulter*' with a pointed share was used to cut the roots near the surface (Wallace, 1896).

Harrows

The old Dutch triangular harrow, with sides 2.7 m in length and having wooden tines through each side was widely used in the early days of European settlement. During the latter part of the nineteenth century the iron zig-zag harrow drawn by six to eight oxen or four to six mules or horses was preferred. Harrows were also used for covering seed grain after sowing.

The disc harrow also became popular in the late nineteenth century. It was used mainly for breaking down the furrow slices after plowing, killing annual weeds and covering maize trash. This implement would sink into soil as much as 100 mm under its own weight and further if additional weights were added. It was not suitable on lands where couch grass was a problem as it was an ideal way of encouraging the growth of this pest (Wallace, 1896).

Rollers

The Cambridge or ring roller was widely used as a clod crusher and pulveriser and to obtain the optimum degree of compaction for sown seed. The fluted edged rings of the Cambridge roller were said to reduce light soils blowing away in the wind (Wallace, 1896).

Planters

Horse- and mule-drawn seeders were widely used in the Western Cape and elsewhere for planting small grain and pastures. Two- and four-row crop planters drawn by a two or four oxen were introduced in the early twentieth century and were widely used for planting maize.

Cultivators

Heavy cultivators as used on farms in Europe were replaced in the nineteenth century by lighter weight low-draft cultivators. These were more thorough in the way that they stirred the soil surface, removed the weeds and aerated the soil. They could be used with the Cambridge roller to prepare a seed bed. A pair of oxen (or mules) was used to pull them (Wallace, 1896).

Hay-making implements

Hay-making equipment was introduced in the nineteenth century in the form of `finger' cutter-bar mowers. These were powered from a ground wheel and pulled by four oxen or two large draft horses. After cutting, the hay was turned and raked into windrows using a rear-acting, curved-tine hay rake pulled by a pair of oxen or a single draft horse.

Reaper binders

In the grain-growing areas a self-binding, reaper drawn by three draft horses or six oxen was used for harvesting ripe grain crops, such as wheat, barley and oats. This replaced the scythe which was used in earlier days and continued to be used on small farms even after the introduction of the reaper binder (Wallace, 1896).

Dam scoops

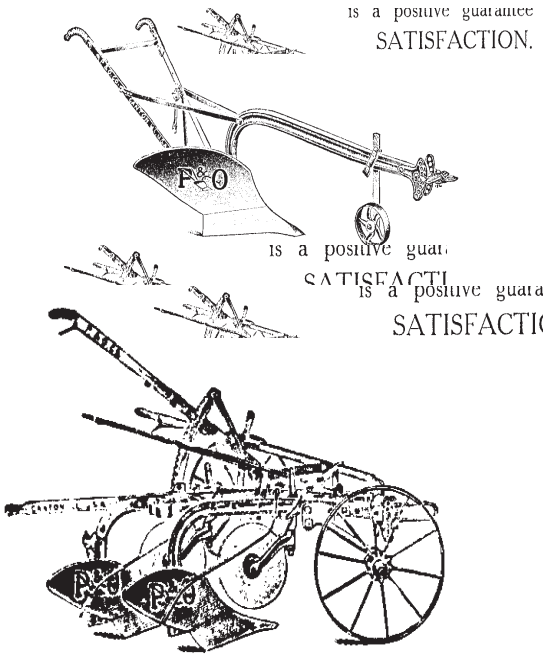
Dams were constructed using spans of four to eight oxen pulling a dam scoop. The size of the dam scoops varied as did the number of oxen needed to pull them (Wallace, 1896).

Carts and wagons

On farms, the ox wagon was the most common method of transport, but horse- and mule-drawn wagons and carts were used in areas where proper roads existed. Wooden sledges drawn by four to six oxen were also popular for collecting wood and transporting water and other light loads around the farm. These tended to be replaced by `scotch carts', usually drawn by two or four oxen and had a wide range of uses on the farm (Bosman, 1988).

Twentieth century animal traction

Towards the end of the nineteenth century, railways and the use of steam traction had begun to gain acceptance in the more developed areas of the country and on major transport routes. In 1891-92 there was a severe outbreak of horse-sickness in South Africa, which resulted in large losses of horses, mules and



Source: Advertisement in 1915 Farmer's Annual

P & O plows imported into South Africa from USA in 1915 by C W Champion of Port Elizabeth

donkeys (Child, 1967). In 1896 there was the rinderpest outbreak, which resulted in the loss of about three quarters of the oxen in all the provinces except the Western Cape. These events, coupled with the losses of horses and mules which occurred during the Anglo-Boer war and the First World War, accelerated the move towards motorised transport in South Africa (Child, 1967; Blakewell, 1991).

The introduction of the internal combustion engine in the early twentieth century gained wide acceptance during the 1920s. Motorised transport expanded rapidly and mechanisation spread into the large-scale agricultural sector. In 1921, tractor plowing trials were held at the experimental farm of the Transvaal University College (now University of Pretoria), and their success encouraged adoption. Nevertheless, the new technology was neither cheap nor without its problems. There was considerable discussion during the 1930s as to the relative merits of tractors and animals. This is illustrated by some quotes from a contemporary farm management handbook (Dawson, 1931) many of which appear just as pertinent today.

> *"Conditions governing the economic justification for the use of tractors are so little understood that we see farmers with a limiting insufficiency of capital, in areas marginal to crop production, unhandicapped*

by shortage of labour wishing to purchase tractors."

"There can be no doubt that in very many cases in South Africa, the ownership of a tractor is a luxury and not an increase in economic efficiency. Wealthy farmers can afford a luxury – poorer farmers cannot. There is undoubtedly the temptation to acquire a tractor by those whose circumstances do not warrant it."

"The use of the ox in farm husbandry is not a sign of backward farming, it is rightly the correct reaction to economic forces resulting from the low price of labour and to a certain extent of land."

"Whereas the tractor is a rapidly wasting asset, oxen usually appreciate in value."

"A hundred acre farm does not give sufficient scope for the full use of a tractor, whereas a 600 acre one does."

"The smaller farmer is always at a disadvantage."

"Tractors are likely to prove most beneficial on the very large farm in the best arable areas where capital is sufficient. They are seldom justified where labour and land are cheap or when capital is scarce."

"There are immense areas of South Africa that favour the ox – in these areas the use of the tractor is likely to prove unfavourable, and its use by men with small capital, little short of disastrous." (Dawson, 1931).

However, in the large-scale sector farmers generally did have large farms and capital. The introduction of the three-point linkage and the power-take-off on tractors revolutionised the role that tractors were able to play in farm mechanisation. Thus tractorisation was rapid. In 1939 there were still one million horses on large-scale farms as well as many oxen, but by the end of the 1950s, the large-scale commercial farms (`white' farms) had generally replaced draft animals with tractors for all plowing. The complementary use of animals continued for some time, with horses or oxen being used for weeding (eg, in vineyards) or on-farm transport. These too gradually died out, not necessarily for economic reasons (they were often cheaper) but sometimes because people felt them to be old-fashioned.

This shift to tractors was associated with the development of a sophisticated industry manufacturing and distributing the relevant machinery. Government-funded institutes undertook associated research and development and there were centres where academic and hands-on training were offered. In addition government-funded organisations provided advice and extension in the planning and costing of tractorised mechanisation programmes to the large-scale farmers.

The situation on the small-scale (`black') farms since the second world war has been somewhat different. The smallholder farmers and communities have continued to use animal traction for transport and general agricultural purposes as described elsewhere in this volume. A small number of firms have manufactured and distributed animal-drawn equipment and sales have remained buoyant. Government-run, subsidised tractor hire schemes have been introduced and widely used in many of areas without real success.

Despite the continuing importance of animal power, government-sponsored research, development, training and extension in the field of animal draft has ceased to exist since the 1950s. For the last forty years there have been no institutions in the country which have offered training in animal traction or which carried out research and development in this field. Expertise in training and caring for animals, making and repairing harness and equipment and the art of implement setting and operation in the field has been handed on from farmer to farmer and from parents to children. Good practices (as well as bad ones) have therefore been perpetuated within the farming communities.

For the last forty years it has been widely believed that the shift towards tractor-powered mechanisation which has taken place on large-scale farms would ultimately take place in the smallholder farming areas as well. It has been anticipated that animal traction would be eventually phased out. During this period agricultural students at universities and colleges have graduated without any formal or informal training in animal traction. The result is that many of the agricultural decision makers of today have little knowledge of animal traction and do not consider it as a power option. Animal traction generally has a poor image in South Africa at the present time.

Conclusion

To many South Africans today, accustomed to motorised transport and mechanised agriculture, animal traction and the use of animal-drawn carts, wagons and farm implements seem to belong to another era. Yet only one hundred years ago the ox-wagon was one of the most important means of transportation and the wagon-building industry one of the largest. Horses, mules, donkeys and oxen were widely used for riding, pack and tractive purposes on farms, in industry and by the military.

Without these animals, which played such an important role in developing this country, it is difficult to envisage how things might have turned out. The history of the country contains a wealth of animal traction experience, going back to long before the first European settlers. Then, for 270 years from the days of the first European settlement until the end of the First World War animal traction was the principal form of tractive power as the infrastructure of South Africa was developed. While animal power has largely disappeared from large-scale industries, it remains extremely important to the country as a whole.

The purpose of this chapter has been to give the reader a brief insight into the role that animal traction has played in the past with a view to emphasising the need of capturing as much of the old experience, skills and technology as possible so that it can be retained and incorporated in the animal traction developments of the future.

References and bibliography

AAS, 1994. *Abstract of agricultural statistics.* Department of Agriculture, Pretoria, South Africa.

Allen W R, Kydd J H and Antczak D F, 1993. Interspecies and extraspecies equine pregnancies. pp 536-553 in: McKinnon A O and Voss J L (eds) *Equine reproduction*. Lea and Febiger, Philadelphia, USA.

Agriculture, 1957. *Horses and mules*. Handbook for farmers, Volume 3. Ministry of Agriculture and Government Printer, Pretoria, South Africa.

ARDRI, 1988. Draught power in rural Ciskei. *ARDRINEWS* (Sep) p3. Agricultural Rural Development Research Institute (ARDRI), University of Fort Hare, Alice, South Africa. 8p.

ARDRI, 1989. *Lima development report*. Agricultural Rural Development Research Institute (ARDRI), University of Fort Hare, Alice, South Africa. 95p.

Auerbach R M B, Nichol G D and Gandar M V, 1991. *The tractor as a multipurpose machine in KwaZulu*. Investigational Report 44, Institute of Natural Resources, University of Natal, Pietermaritzburg, South Africa. 85p.

Auerbach R M B and Gandar M V, 1994. *Energy and smallscale agriculture*. Paper 7, Energy Policy Research and Training Project (EPRET), University of Cape Town, South Africa.

Bembridge T J, 1987. Crop farming system constraints in Transkei: implications for research and extension. *Development Southern Africa*, 4(1): 67-89.

Bembridge T J 1987. Aspects of cattle production in Transkei. *Suid-Afrikaanse tydskrif Veck*. 17(2): 74-78.

Bembridge T J, 1991. *An agricultural extension and training strategy*: Phase 2 report. Department of Agriculture, Gazankulu Government, Giyani, South Africa. 121p.

Blakewell D, 1991. *Heavy horses on the farm*. Video produced by Renaissance Vision in association with Norfolk Shire Horse Centre, UK.

BLS, 1994. Animals of the Bible: the donkey - Equus asinus. *Star in the East* 112(4): Inside front cover. Bible Lands Society (BLS), High Wycombe, UK.

Bophuthatswana, 1992. *Bophuthatswana national agricultural policy*. Planning Division, Department of Agriculture and Natural Resources, Mmbatho, Bophuthatswana, South Africa. 25p.

Bosman D, 1988. *Die verhaal van die trekos*. Promedia Publishers, South Africa.

Botha, C G, 1962. *General history and social life of the Cape of Good Hope*. C Struik, Cape Town, South Africa.

Bulpin T V, 1974. *Lost trails of the Transvaal.* Cape and Transvaal Printers, South Africa.

Burman J, 1988. *Towards the far horizon.* Human and Rousseau, Cape Town, South Africa.

Child D, 1967. *Saga of the South African horse*. Howard Timmins, Cape Town, South Africa.

Clutton-Brock J, 1992. *Horse power: a history of the horse and the donkey in human societies.* Harvard University Press, Cambridge, Massachusetts, USA. 192p.

Colvin P M, 1989. *Cattle interest groups: Biyela study area*. Interim report to KwaZulu Department of Agriculture. Institute of Natural Resources, University of Natal, Pietermaritzburg, South Africa. 27p.

Dawson E S, 1931. *Farm management in South Africa.* South African Agricultural Series Vol 9, Central News Agency, South Africa.

Derman P J and Poultney C, 1978. Agricultural reconstruction in a consumer society: the Mboza Village project. *Development Southern Africa* 4(3). 16p.

Farmers, 1915. *The farmers' annual and South African farm doctor*. Volume 3, 1915-16. Farmers Weekly, Bloemfontein, South Africa.

Farmers, 1993. Don't be an ass about donkeys. *Farmers Weekly (South Africa)* June 4. p44-45.

Farmers, 1993. Why subsistence farming. *Farmers Weekly (South Africa)* June 25. p58-59.

Farmers, 1993. Animal-drawn farm tools. *Farmers Weekly (South Africa)* July 9. p59.

Fischer A, 1989. *Agricultural decisions in a rural village: a case study from Mhala* [Gazankulu]. Document prepared as part of a research project on decision-making within the rural household on farmer and community support services. Development Bank of Southern Africa, Halfway House, South Africa. (unpublished). 62p.

Fowler, R M, 1995. Animal-drawn herbicide applicators for use in smallscale farmer weed control systems. In: Starkey P, Simalenga, T and Miller F, *Animal power for weed control.* Proceedings of workshop held 1-5 November 1993, Tanga Tanzania. Animal Traction Network for Eastern and Southern Africa (ATNESA), in association with Overseas Development Administration, London, UK. (in preparation).

Hocking A, 1975. *Beasts of burden.* Macdonald South Africa, Cape Town, South Africa.

Horsby, 1891. *Ploughs up to date. C*atalogue of ploughs manufactured by R Hornsby and Sons, Grantham, England. Reprinted (1984) by Lincolnshire County Council, Lincoln, UK. 68p.

Joubert B, 1993. Inaugural meeting of the South African Network of Animal Traction (SANAT) 5 August 1993. *South African Network of Animal Traction (SANAT) Newsletter* 1:6-9. University of Fort Hare, Alice, South Africa.

Joubert B, 1994. Animal traction appraisal survey, South Africa. *South African Network of Animal Traction (SANAT) Newsletter* 2(1):9-14. University of Fort Hare, Alice, South Africa.

Joubert A B D, 1995. Weed control by smallholder farmers on maize lands in Ciskei, Eastern Cape Province, South Africa. In: Starkey P, Simalenga, T and Miller F, *Animal power for weed control.* Proceedings of workshop held 1-5 November 1993, Tanga Tanzania. Animal Traction Network for Eastern and Southern Africa (ATNESA), in association with Overseas Development Administration, London, UK. (in preparation).

Krecek R C, Starkey P H and Joubert A B D 1994. *Animal traction in South Africa: research priorities in veterinary science*. Foundation for Research Development, Pretoria, South Africa. 18p.

Krecek R C, Starkey P H and Joubert A B D 1994. Animal traction in South Africa: research priorities in veterinary science. *Journal of the South African Veterinary Association* 65(4):150-153.

Louw P K, 1948. *Landbou en veeteelt in die Kaapkolonie (1795-1806).* MA Thesis, University of Stellenbosch, South Africa.

Malan F S, Reinecke R K and Scialdo-Krecek R C, 1982. Anthelmintic efficacy of fenbendazole in donkeys assessed by the modified non-parametric method. *Journal of the South African Veterinary Association.* 53(3): 185-188.

McCutcheon R T, 1991. The main findings of the district pilot project of labour-intensive road construction and maintenance in Botswana and the implications for similar projects in South Africa. *Development Southern Africa*, 8(2): 149-170.

Mentzel O F, 1944. *A geographical and topographical description of the Cape of Good Hope*. Van Riebeeck Society, Cape Town, South Africa.

Moe J, 1915. The useful eland: riding, draught and pack animals. pp. 291-292 in: *The farmer's annual and South African farm doctor*. Volume 3, 1915-16. Farmer's Weekly, Bloemfontein, South Africa.

Moolman A, 1989. *Pionierboerdery aan die Kaap gedurende die Kompanjiestyd met spesifieke verwysing na die graanboerdery.* BA Hons Thesis, University of Stellenbosch, South Africa.

Nel C. 1993. More on animal power. *Farmers Weekly (South Africa)* Jun 18 p59.

Nel C. 1994. How important are draught animals? *Farmers Weekly (South Africa)* Nov 11 p54.

Nel C. 1994. The Golovan oxcart. *Farmers Weekly (South Africa)* Nov 18 p48.

Pereira E, 1993. *The unknown Pauline Smith.* University of Natal Press, Pietermaritzburg, South Africa.

Rose C J, Williams W and Ndawo S, undated c. 1988. *Draught power used in some of the rural areas of Ciskei.* Agricultural Rural Development Research Institute (ARDRI), University of Fort Hare, Alice, South Africa. 16p.

Schmidt M I, 1992. The relationship between cattle and savings: a cattle owner perspective. *Development Southern Africa*, 9(4): 433-444.

Schreuder J H D, 1948. *Die geskiedenis van ons graanbou (1752-1795).* MA Thesis, University of Stellenbosch, South Africa.

Schreuder P J v d H, 1938. *The breeding and management of stud donkeys and mules.* Reprint No 53 (Reprinted from Farming in South Africa, June and July). Government Printer, Pretoria. 13p.

Shackleton C M, 1993. Are the communal grazing lands in need of saving? *Development Southern Africa,* 10(1): 14p.

Starkey P, 1988. *Animal traction directory: Africa*. Vieweg for German Appropriate Technology Exchange, GTZ, Eschborn, Germany. 151p.

Starkey P, 1988. *Perfected yet rejected: animal-drawn wheeled toolcarriers*. Vieweg for German Appropriate Technology Exchange, GTZ, Eschborn, Germany. 161p.

Starkey P, 1989. *Harnessing and implements for animal traction.* Vieweg for German Appropriate Technology Exchange, GTZ, Eschborn, Germany. 244p.

Starkey P, 1992. *Networking for animal traction*. Network Discussion Paper 1/92. Animal Traction Network for Eastern and Southern Africa (ATNESA) and West Africa Animal Traction Network (WAATN). GTZ, Eschborn, Germany. 45p.

Starkey P, 1992. *Animal power in Namibia: present status and programme requirements*. Ministry of Agriculture, Windhoek, Namibia and Overseas Development Administration, London, UK. 58p.

Starkey P, 1993. *Animal traction networking in South Africa.* Report of a visit from 1-7 May 1993. Overseas Development Administration, London, UK. 13p.

Starkey P, 1993. Animal traction networking in South Africa: report summary of a visit from 1-7 May 1993. *South African Network of Animal Traction (SANAT) Newsletter* 1:4-5. University of Fort Hare, Alice, South Africa.

Starkey P, Mwenya E and Stares J (eds), 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. 490p.

Steyn G J, 1988. *A farming systems study of two areas in the Peddie District of Ciskei*. DSc Thesis. University of Fort Hare, Alice, South Africa. 531p.

Symons R E, 1915. The useful eland: its value as a domestic animal. p 291 in: *The farmer's annual and South African farm doctor*. Volume 3, 1915-16. Farmer's Weekly, Bloemfontein, South Africa.

Tapson D, 1988. Mechanization or animal draft? *Appropriate Technology Newsletter* (CSIR, Pretoria, South Africa) 5(2): 1-3

Tapson D R, undated. *The role of cattle in KwaZulu and implications for policy formulation*. Development Bank of Southern Africa, Halfway House, South Africa. (unpublished). 25p.

Tapson D R, 1990. *A socio-economic analysis of small-holder cattle producers in KwaZulu*. PhD Thesis, Vista University, Pretoria. 238p.

Tapson D R, 1991. *The overstocking and offtake controversy reexamined for the case of KwaZulu*. Pastoral Development Network Paper 31a. Overseas Development Institute, London, UK. 24p.

Tapson D R, 1993. Biological sustainability in pastoral systems: the KwaZulu case. pp 118-135 in: Behnke R H, Schoones T and Ceven C, *Range ecology and disequilibrium*. Overseas Development Institute, London, UK

Tapson D R and Rose C J, 1984. *An investigation into the KwaZulu cattle industry*. Report 2/84. Agricultural Rural Development Research Institute (ARDRI), University of Fort Hare, Alice, South Africa. 184p.

Tegetmeier W B and Sutherland C L, 1895. *Horses, asses, zebras, mules and mule-breeding*. Hoarce Cox, London, UK. (Cited by Clutton-Brock, 1992).

Theiler G, 1923. *The strongylids and other nematodes parasitic in the intestinal tract of South African equines*. DSc Thesis (Faculté des Sciences de l'Université de Neuchâtel). Government Printer, Pretoria, South Africa.

Tire M, Mothibi V and Tsamaesi P, 1993. *Report of baseline survey conducted at Vryhof*. Development Research, Department of Agriculture and Natural Resources, Mmbatho, Bophuthatswana, South Africa. 27p.

Van der Merwe F J, 1981. *Ken ons perde rasse*. Human and Rousseau, Cape Town, South Africa.

Van der Post A P, 1937. *Economics of agriculture.* Central News Agency, South Africa.

Wallace R, 1896. *Farming industries of the Cape Colony.* P S King and Son, London, UK.

Yoba P V, 1994. Mule breeding programme for the Transkei. *South African Network of Animal Traction (SANAT) Newsletter* 2(1):15-20. University of Fort Hare, Alice, South Africa.

Zaremba W, 1976. *Logging reference manual.* Vol 1. Timber preparation. Skidding by animals and tractors. Bulletin 52. Department of Forestry, Pretoria, South Africa. 377p,