

Guidelines on Management of Working Animals

TE Simalenga, S Sibanda & P Jones



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Report to the
Water Research Commission

compiled by

TE Simalenga, S Sibanda & P Jones
Institute for Agricultural Engineering
Agricultural Research Council

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Water Research Commission
Private Bag X03
Gezina, 0031

orders@wrc.org.za or download from www.wrc.org.za

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- Growing Green Maize on Canal Schemes in Vhembe: Production Guidelines (WRC Report No. TT 567/13)
- Production Guidelines for Small-Scale Broiler Enterprises (WRC Report No. TT 568/13)

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Some of the data and information used in this report was retrieved from FAO and Palabana Manuals on Training of Draft Animals.

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CHAPTER 1. PRINCIPLES AND SELECTION GUIDELINES OF WORKING ANIMALS

1.1 SELECTION GUIDELINES OF WORKING CATTLE

The Nguni cattle and their crossbreds may all be used successfully for draught work. In general, local indigenous cattle breeds are more suitable for work on smallholder farms than temperate breeds or their crosses (Figure 1.1). This is particularly important in semi-arid areas which have inadequate feed supply and veterinary services.



Figure 1.1 Nguni cattle at work

Cattle in Limpopo live in a delicate balance with many stress-causing aspects of their environment, including heat, diseases and lack of good quality feed. The additional stress of work can seriously disturb this balance unless the animals are very well adapted to that particular environment. Local cattle breeds are better adapted to the prevailing climate, to the local disease challenge, to the quality and quantity of available food and to the traditional management systems.

1.1.1 Size and breed

Large working cattle can perform more work than smaller ones because about 10% of the weight can be transferred to draught power. Animals of temperate breeds and their crosses are often bigger than local breeds. With high levels of management and favourable environments such large animals can make good work animals.

Most smallholder farmers do not endeavour to own specialized work animals. Their need is for animals with many different characteristics, including the ability to survive under simple management conditions. Large animals are more expensive than smaller ones, and require more food. They entail greater risk; for example the death or incapacity of one work animal is more serious for a farmer who owns two large animals

than the one who owns four smaller ones. Also as draught animals often have multiple social and economic functions, a large number of smaller animals are considered more useful in terms of economic flexibility.

Local cattle breeds in villages are often small in size. Due to this, some extension staff and other interested parties may sometimes suggest that these animals be replaced with imported animals to improve by crossbreeding or selection. This needs to be thought through carefully. The size of village animals is often closely related to the environment. Work animals of exactly the same local breeds are generally much bigger when raised on government stations or agricultural colleges. This suggests that much can be done to improve animal size by improving village animal management. Furthermore, if the environment (food availability and disease) causes the well-adapted local animals to be small and stunted, it would probably have a worse effect on exotic animals or crossbreeds, which would be more susceptible to the tougher village conditions.

Large exotic breeds are preferable in those areas where climatic, nutritional and disease stresses are low such as highland areas and where the animals are maintained entirely for special work functions (such as forestry, road construction and for full-time transport on commercial farms).

Crossbreeds of local/exotic cattle are usually intermediate, being larger than local animals but less well adapted. Sometimes such animals are easily and quite cheaply available, e.g. surplus males from a dairy programme. Farmers who have adequate feed and good health care facilities may try using such animals for work.

Generally, small farmers manage better off with the available indigenous breeds. They can select individual animals that suit their needs and budgets. Farmers can achieve considerable improvements in size and working performance through supplementary feeding and better training if this is economically justifies. This is of less importance for plough oxen used during a short time of the year but highly essential with conservation tillage and transport work.

1.1.2 Sex

Males are heavier than females within the same cattle breed and age groupings. Bulls are the strongest work animals. Uncastrated bulls are regularly used in some countries, however, castrated bulls (known as oxen, steers or bullocks) are more commonly used for work and they are the dominant working cattle in South Africa. They are almost as strong as bulls, but are less aggressive. Oxen are generally the choice of transport entrepreneurs and those farmers needing working animals throughout the year.

Females (cows) can also be used for draught work (Simalenga et al 2003). They are not as strong as oxen and they need good care if they are to be reproductively efficient. It is necessary to plan the mating and the work periods, so that the cows do not have to work hard in their last two months of gestation, or immediately after calving. The main

advantage of cows is that they can produce milk and calves as well as draught power. Experience from Uyole, Tanzania, shows that a team of cows can plough more land in a day than oxen can as the cows move faster and cover more ground in a day.

As farming systems intensify, and management improves, cows tend to be increasingly used for work. In some countries in Asia, about 80% of work animals are female. In several parts of West, Central and Southern Africa it is fairly common for cows to provide draught power, and up to one-third of work animals in some villages may be females.

In theory, a working cow is unlikely to give as much milk or as many calves as a non-working cow, if both are maintained under ideal conditions. In practice, the close attention given to working cows means they can sometimes achieve a better reproductive performance than non-working animals maintained in herds. It is common in many countries to use cows which do not conceive to pull a plough. After a short period of work they usually come on heat and conceive successfully.

Whatever the reproductive performance of a working cow, it is always better than that of an ox. Thus, replace existing oxen with cows is of good economic returns, particularly for farmers who only use their animals for a short time each year. Cows are therefore likely to be the choice of farmers who know how to manage their animals well, who have few animals and do not have much work for the animals each year.

1.1.3 Conformation

Conformation refers to the shape of an animal's body. Cattle should have good solid legs and knees. Animals with bowed legs and/or knock-knees have difficulty in walking and should not be used as working animals. The legs should be straight and well-muscled, with strong, thick hooves that do not separate too much when the animal is walking. Animals should have a deep, wide chest, a medium length neck and a straight and wide back (Figure 1.2 and Figure 1.3).

A well-developed hump is a good feature, though not essential. Contrary to popular belief, animals without humps can be yoked effectively.

1.1.4 Temperament

Animals should have a good temperament and not be aggressive towards people and other animals. Bulls may exhibit this character as they become older and so castration is generally practice with male animals. Castration at too early an age will cause stunting of growth. A certain amount of lively spirit in an animal is considered good, and very placid animals may end up being lazy and lethargic. Animals which always walk in front or remain behind should not be selected.

1.1.5 Determining age of cattle

The best method of estimating an animal's age is to examine the incisor teeth of the lower jaw (Figure 1.5). Young cattle have a full set of 8 milk teeth or incisors at an age of 3 months. These are replaced as the animal becomes older. Beginning at about 2

years the first 2 permanent incisors erupt. At 3 years the second set erupts and at 4 years the third set are visible. At about 5 years the animal has usually reached maturity and permanent corner teeth replace the last two milk incisors. As the animal becomes older its teeth show different wear patterns. Older animals show more wear.

As alternative method of estimating an animal's age is to count the rings on the animal's horns. From the age of 2 years, a single growth ring appears each year (Figure 1.4).

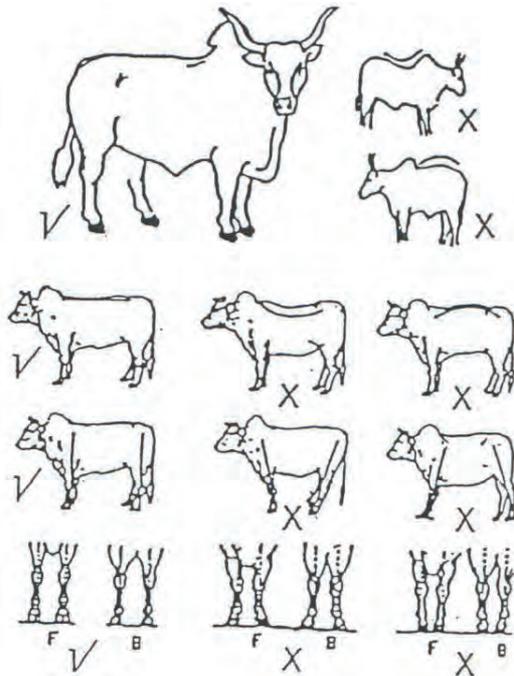


Figure 1.2 Desirable and undesirable conformation features of draught cattle

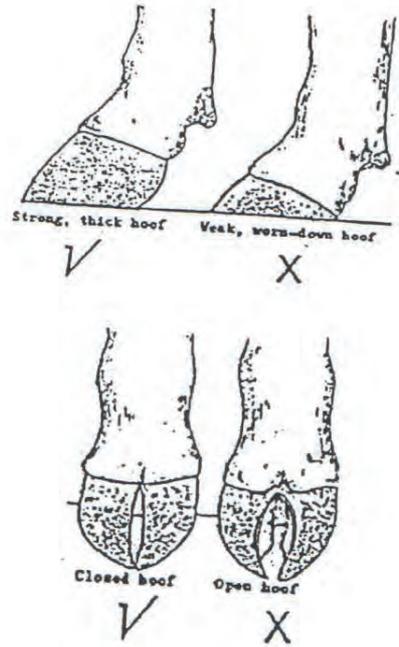


Figure 1.3 Conformation features of hooves

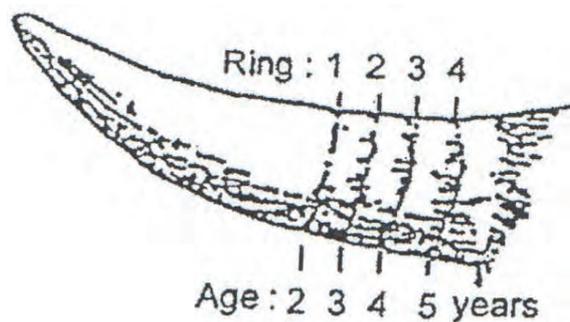


Figure 1.4 Annual growth rings on a horn of an ox

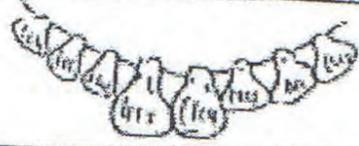
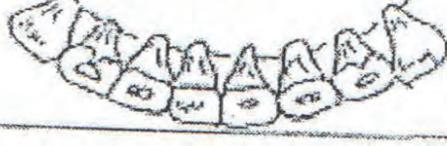
	1-12 months, 12 milk teeth
	2 years 2 incisors
	3 years 4 incisors
	4 years 6 incisors
	5 years 8 incisors
	6 years 10 incisors used
	7 years 12 incisors used
	8 years 12 incisors used

Figure 1.5 Teething key for cattle up to 8 years of age

Age and weight ration

The age/weight ratio should be considered in selecting animals for draught. An older animal (4-5 years) is hard to train and its working life is shorter than that of a younger animal (2-3 years). In addition, an older animal has reached its mature weight, thus limiting any profit from the eventual sale of the animal for meat. Except for little weight gain a small but mature animal might be suffering from body weaknesses which reduce its value as a draught animal. A young animal is light, cheap and easier to train, and has a good potential for growth and development of muscle strength. It does not reach its full capacity for a year and subsequently its work output is initially less than that of a heavy mature animal.

Selection can be done from the farmer's own cattle herd as early as when the animals are 4-5 months old. The actual training should start when the animal reaches a weight of 175-200 kg. When buying a steer it is essential to link the age-weight characteristics to make a good choice of draught animals, which can serve well for many years. In some areas the local breeds are small and one has to use good local judgment in the selection process. Cattle over 300kg should not be selected for training, as they can be cumbersome at training and difficult to control.

The weight of a steer is best measured with a cattle scale but if not available it can be estimated by measuring the girth and the length of the body (Figure 1.6) and using a table to estimate the weights. The measurements must be taken to estimate the weights. The measurements must be taken:

- In the morning before the animal drinks water
- With the animal standing squarely and holding its head in the normal position
- From the left side of the animal because the right side may be distorted by the amount of food in the rumen.

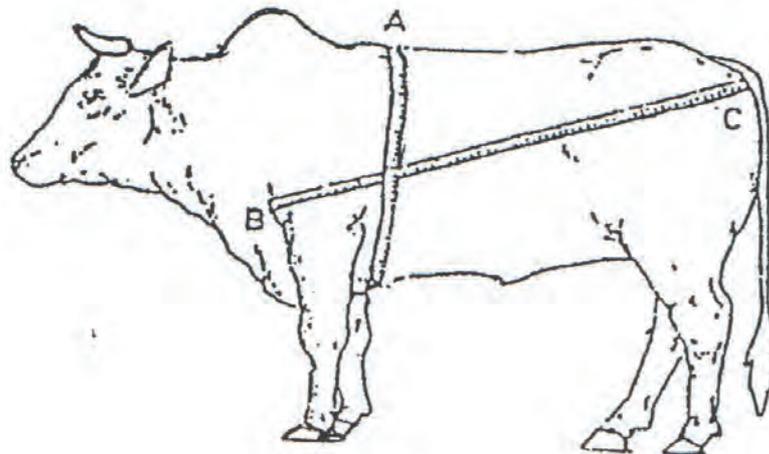


Figure 1.6 Measuring girth (A) and length (B-C)

By referring to Table 2.1 a farmer can get a good estimate of the weight of the animal being measured. For example, a girth of 146 cm and a length of 133 cm will give an estimated weight of 269 kg. For selection purposes, eliminate cattle with weights outside the out lined figures.

Table 2.1 *Estimated weights of cattle*

(A) Girth cm	(B-C) Length cm																
	120	126	131	136	141	146	151	155	161	166	171	176	181	186	191	196	201
	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205
120-125	169	179	186	193	200	207	214	221	228	235	244	249	256	263	270	277	284
126-130	186	194	201	209	217	221	232	239	247	254	262	269	277	285	292	300	307
131-135	201	209	217	225	234	242	250	258	266	275	283	291	299	307	315	324	332
136-140	216	225	234	243	252	260	269	278	287	296	304	313	322	331	340	348	357
141-145	232	242	251	262	270	280	289	298	308	317	327	336	346	355	365	374	384
146-150	249	259	269	279	289	300	310	320	330	340	350	360	370	381	391	401	
151-155	266	277	288	298	309	320	331	342	353	363	374	385	396				
156-160	284	295	307	318	330	341	353	365	376	388	399						
161-170	302	314	326	339	351	363	376	388	400								
171-175	340	354	368	382	396												
176-180	359	374	388	402													
181-185	380	395															
186-190	400																

1.2 CARE AND HUSBANDRY OF WORKING CATTLE

Working animals are valuable assets that need careful attention. The prevention of injuries and disease is better than cure. Proper management with daily inspection, good handling and careful husbandry of the animals reduces health problems. Simple attention to animal condition, feeding and provision of adequate water is basic to maintaining animals in a healthy state so that they can work well.

Farmers participating in workshops for the preparation of this report claimed that they have meagre knowledge of what to do when and ox gets sick or wounded and extension workers do little to help them. In consequence they slaughter the animals to avoid unnecessary economic losses. The farmers expressed great interest in obtaining knowledge on how to care for the draught animals as they realized the importance of getting good work out of them.

1.2.1 Daily care

Work animals like routine. It is good to keep to a regular schedule for grooming, health checks, watering, feeding and grazing. Animals should be fed and water daily, with grazing/feeding allowed whenever possible.

At the beginning of the working day call the oxen if they are outside or go up to them if they are in their stable. Greet them by name and continue talking to them in a nice way. Farmers throughout the world talk to their working animals and develop closer relationships with them. If animals are fed supplements this is a good time to give them some. If there is no supplement, bring some form of treat such as a small amount of salt on the palm of the hand, some grass, grain or fruit. This encourages the oxen to enjoy human company and to develop a desire to serve man at full capacity.

Daily grooming of animals does not only keep them clean but also promotes a good working relationship between the handler and the animals. It allows the handler to observe any problems, signs of sickness, injuries, sores, wounds, eye irritation or damaged horns. The animals can be lightly brushed in the direction of the hair (i.e. head to tail) with suitable hand brush (a scrubbing brush with plastic or fibre bristles is satisfactory). This removes dirt and promotes close contact with the animals. Some farmers do not bother with grooming, thinking perhaps that it is not essential for work, but the few minutes devoted to this are beneficial in the subsequent responsiveness of the animals and lessens injury time.

When grooming, the following 10 points should be checked as a daily routine to make sure that each animal is normal and healthy:

- Breathing normally and chewing the cud
- On raising itself, stretches legs and passes dung
- Dung piles up (not liquid) and urine is normal
- Walks normally
- Coat is smooth and shiny
- Ears alert, moving to and fro
- Eyes bright and clean
- Muzzle cool, moist and not watery
- No fresh wounds or swelling, no ticks
- Good appetite, no rapid loss of condition.

Hooves should be regularly cleaned and checked for cracking or rot. Foot problems can lead to lameness which makes the animal unable to work. Foot problems are rare if stables and sheds have a clean dry surface. Paddocks or standing areas outside the shed should be well drained. Animals which stand in mud can more susceptible to serious hoof problems.

Animals should be checked for ticks each morning and if found removed immediately. Any sore or wounds should be cleaned with a solution of salt and water or with a wound cream or antiseptic, if available. Wounds should be kept free of flies and cleaned daily until they are sealed and dry.

Healthy animals tend to flock together, feed together and rest together. They are also curious and inquisitive. If they move away from the herd it is a sign that something is not right.

Time spent watching animals is usually time well spend because it assists in developing an ability by the farmer/stockman to distinguish the normal from the abnormal behaviour.

1.2.2 Getting ready for work

Check that the yoke is in good condition and that there are no splinters or frayed guides. It should be comfortably fitted and should not rub excessively to cause blisters or sores.

Check halters, coupling and steering reins to ensure that they can be properly fitted and used correctly.

1.2.3 Working schedule

Work should be carried out during the cooler hours of the day if possible, i.e. the early morning and/or late afternoon. Cattle seldom work well between 10:00 am and 3:00pm when the sun is the strongest. In some countries animals start work by moonlight and finish before the sun gets too hot. Cattle should not be worked for more than 6 hours a day; 4 hours is the norm. While working, animals should be rested if they show signs of distress (excessive salivation, excessive sweating, panting, staring eyes). It is important for the animals and handlers to take a regular five-minute break every 30 minutes. The fields should not be too long (less than 200m) as the turning at the end is also a recovery period.

1.2.4 Grazing

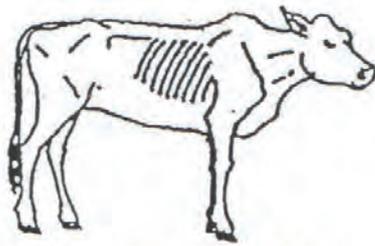
Animals need at least 6 hours a day for grazing if they are to obtain enough food. Even 6 hours may not be enough if the pasture is poor or scarce, and the work hard. Do not keep animals in their night pen longer than necessary, although cattle do need several hours a day for ruminating. It is always beneficial to reserve some good grazing land for the draught animals.

These simple grazing routines are usually sufficient for plough-oxen, which work for a short time of the year. However, if more work is required there is a need for supplementary feeding to meet the nutritive requirements for continuous work.

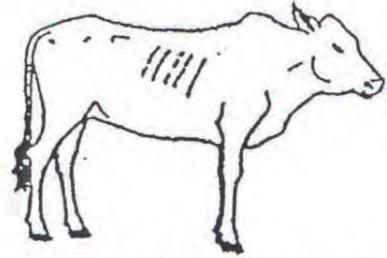
Working oxen should be given supplements feed like bran, bean straw and other nutritious crop residues immediately after work. This should be a routine and a continuous activity to serve as a reward to the oxen for good work. Usually it is often more profitable to keep the oxen under zero-grazing conditions than it is to keep dairy cows.

1.2.5 Animal condition

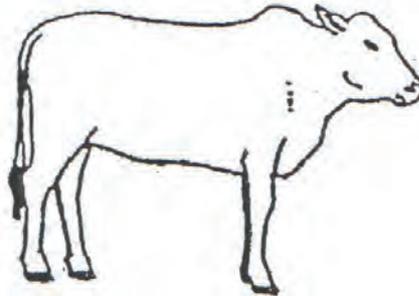
The condition of all work animals should be regularly assessed (Figure 1.7). If an animal is in poor condition, it may be necessary to feed it some supplement. Animals in poor condition can work for only a limited time and continued loss of condition can be serious and even life threatening.



a) Undernourished – this animal may die if worked. It needs feed supplements urgently



b) Thin – This animal should be able to work as a plough ox for a short time, but supplementary feeding is recommended particularly for more continuous work.



c) Reasonable condition – This animal should work well as a plough ox even if not given extra feed. However, supplementary feeding is required for continuous work to maintain condition.

Figure 1.7 Body condition of working cattle.

1.3 SELECTION GUIDELINES OF WORKING HORSES AND DONKEYS

Buying a donkey or a horse involves considerable investment by the farmer so its worth selecting a good animal, which will live and work well for a long time. It will represent good value of money.

1.3.1 Conformation

The relationship between the structure and function of a donkey or a horse is referred to as its "conformation". A horse or donkey is more likely to work without strain or injury if it has a good conformation.

A horse should have "clean" symmetrical limbs that can move without the joints being jarred. The horse's head should be in proportion to the rest of its body, and its neck should be well set into broad sloping shoulders. A stocky horse with a short back and broad chest is ideal for work (e.g. Figure 1.8). It is stronger and so able to work well in a cart than slightly built animal, with long legs or one that is very narrow in the chest.

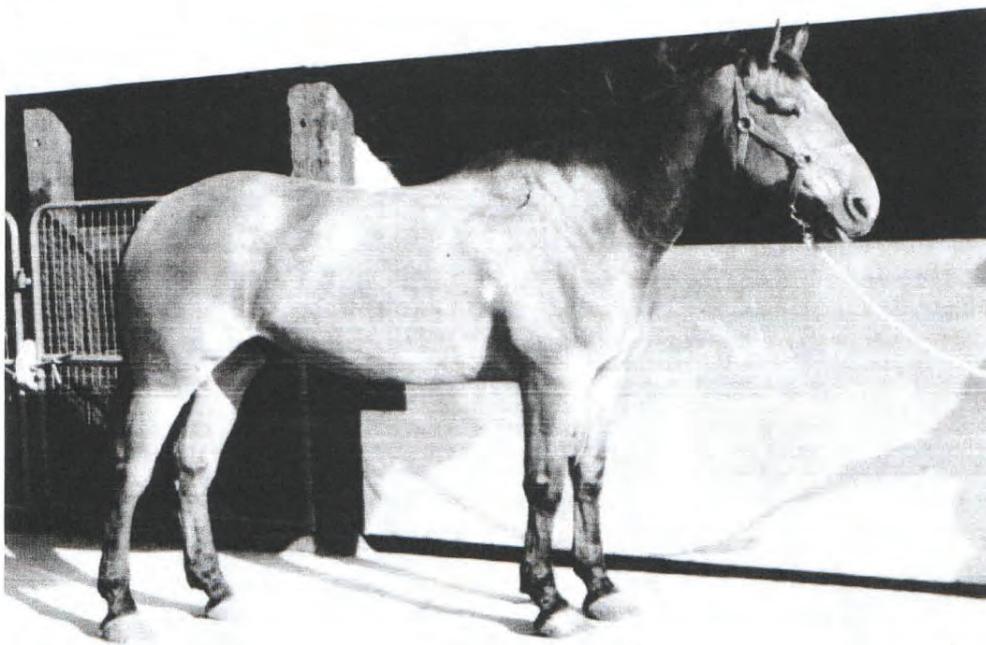


Figure 1.8 A horse with good conformation

A donkey is smaller and narrow with a smaller distance between front legs and neck (chest) than a horse. It should however also be in proportion and sturdy. Do not select a donkey with a small slight body and large head. This generally means that it has not been fed well while young and so its growth has been stunted. A large donkey is better for work than a small one of the same age.

The legs and joints are important in a working horse or donkey. The legs undergo much stress when the horse or donkey is working. Good conformation prevents abnormal strains from developing and causing injury.

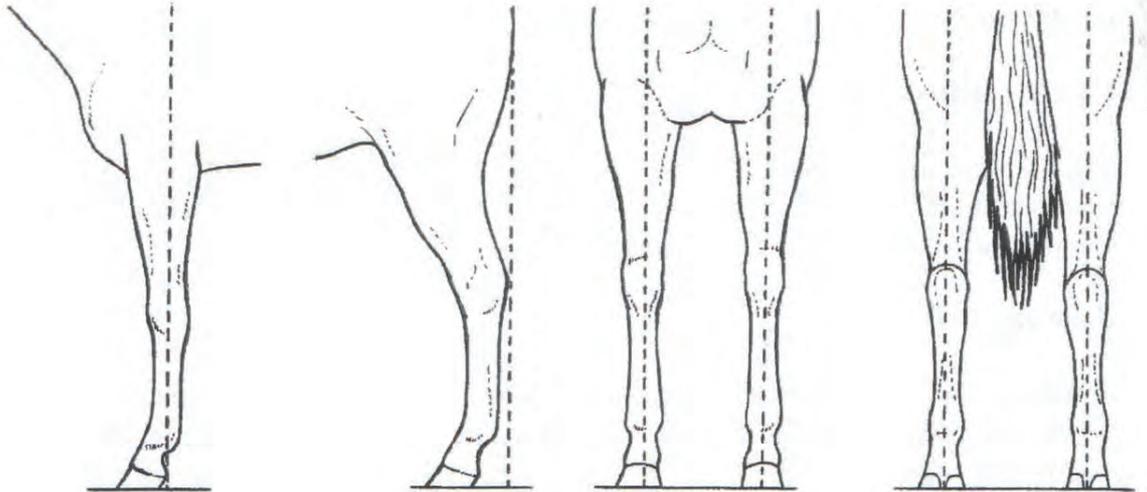


Figure 1.9a Limbs of good conformation

The horse or donkey should be able to stand square, with the hind legs exactly behind the forelegs. Each pair of legs should match, with joints the same size and both legs vertical (Figure 1.9a and 1.9b). Small joints on a large horse or large joints on a small horse can cause problems. The same is true in a donkey.

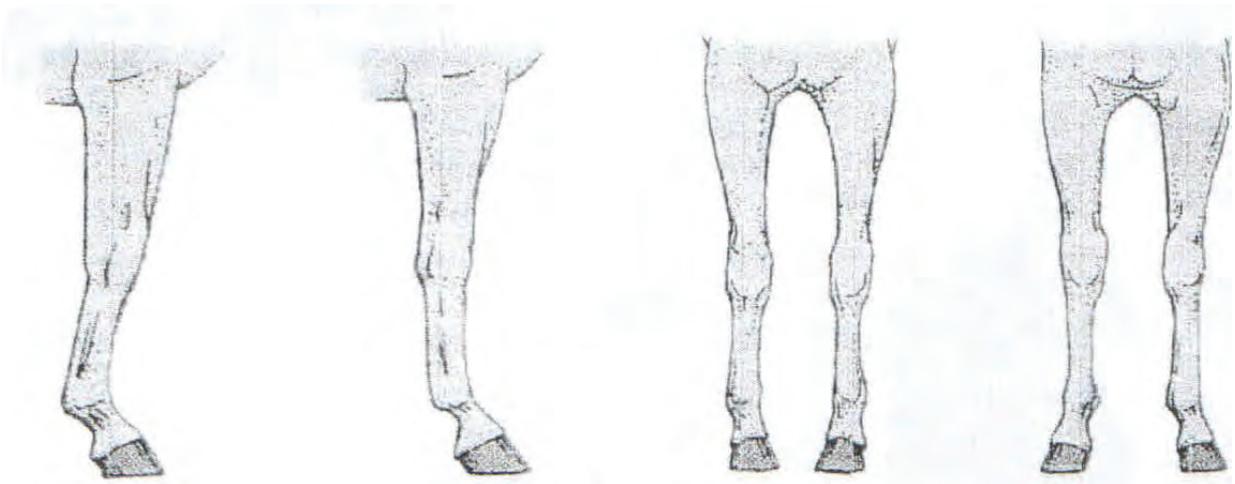


Figure 1.9b Limbs of poor conformation

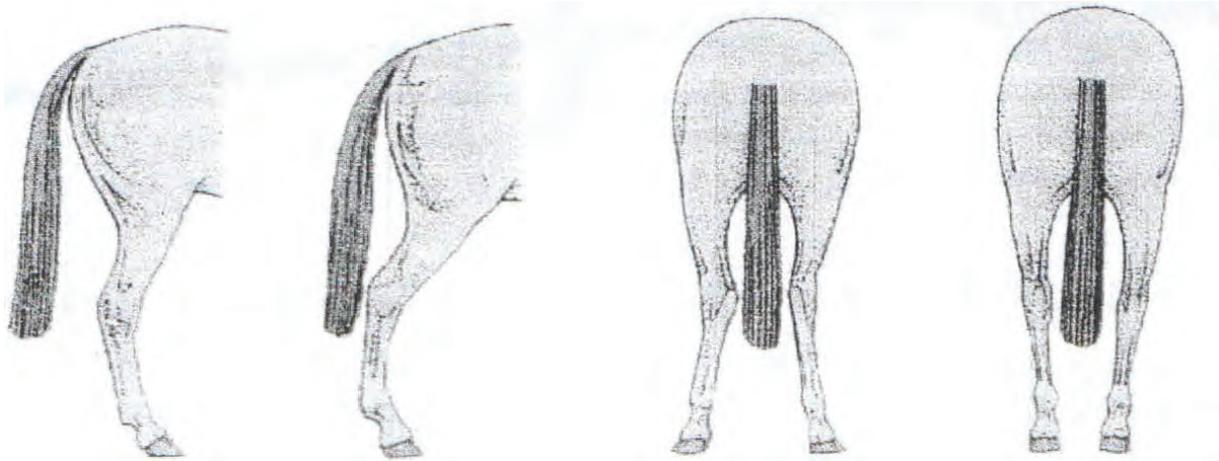


Figure 1.10a and 1.10b Limbs of poor conformation

Seen from the side, the legs should be straight, apart from the angle at the hock. The feet should not turn out or in. There should be no swelling or puffiness around the joints and tendons. When the horse walks the legs should not knock or rub together. This can best be seen by asking someone to walk the horse towards and then away from you. Figure 1.10 (a & b) gives some examples of poor limbs on horses; the same generally applies to the donkey.

1.3.2 Feet and hooves

The horse's hoof is a variation on a claw or a human fingernail. The rigid wall forms a broken circle, with the flexible heel region across the open arc (Figure 1.11). This allows the hoof to change shape slightly with the stresses of weight bearing, helping it act as a shock absorber when the foot hits the ground. The horse's weight is actually suspended on the hoof walls rather than supported by the soles. Although hind feet differ slightly in shape from front feet (they are more oblong shaped than round) they are otherwise the same in structure. Both front feet should be a similar size and shape and so should both hind feet. It is important to make sure the feet are not misshapen. This will cause problems later on even if the animal seems fine.

On the underside of the foot the horn of the sole should be hard, not soft and flaky and the frog should be dry. The sole should be slightly concave (Figure 1.11). The frog acts as a spring, absorbing the impact as the foot hits the ground.

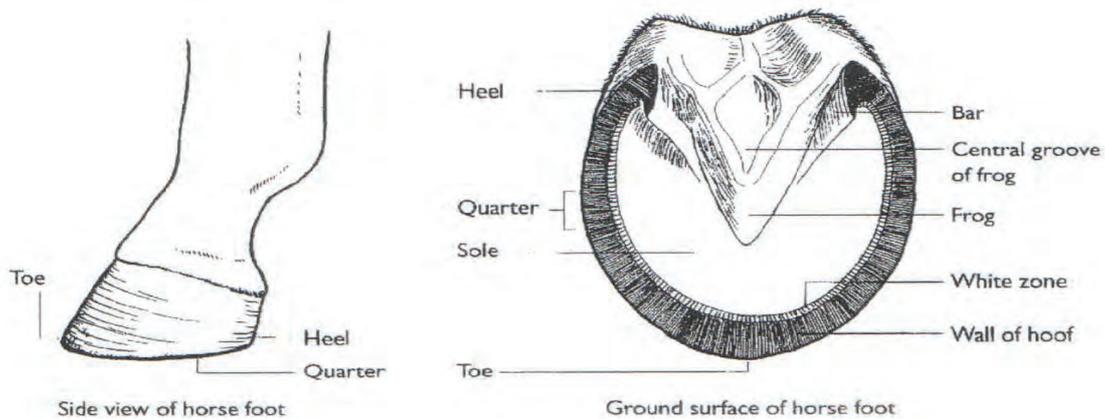


Figure 1.11 The foot of a horse

A donkey's foot is more upright than a horse's foot and has a different shape. Because of this, the sole has a different shape (Figure 1.12).

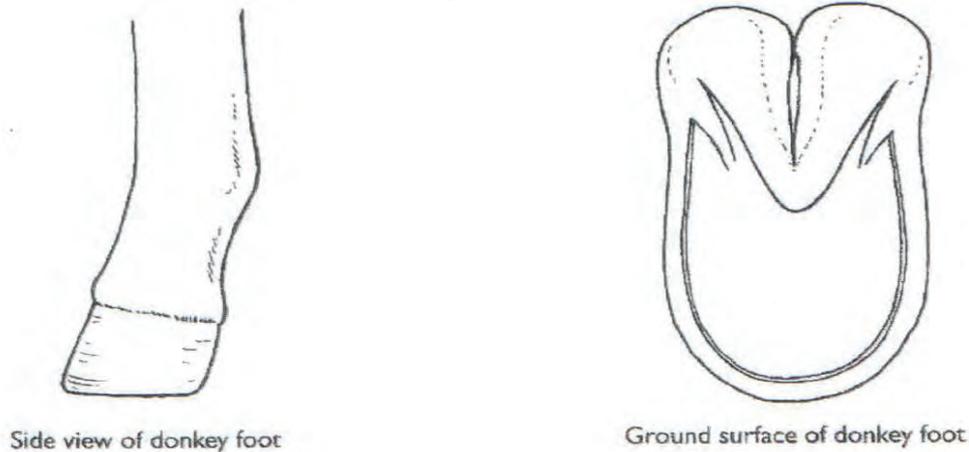


Figure 1.12 The foot of a donkey

The hoof – The outer surface of the hoof is made up of a protein called keratin. It is formed by the cells in the coronary band in tubular structures that run vertically down the hoof wall. A healthy hoof has a smooth surface, without any ridges or cracks. This grows continuously like our fingernails. If it grows faster than it is worn down in work, then the feet will need trimming to prevent them getting out of shape or too long.

It is important that the hoof and pastern should be in line, as in Figure 1.13. The pastern is the joint just above the hoof, between the foot and the fetlock. This line can be influenced by the way in which the hoof is trimmed. The straight line is lost if the hoof is trimmed too much at the front or back as shown in Figure 1.14

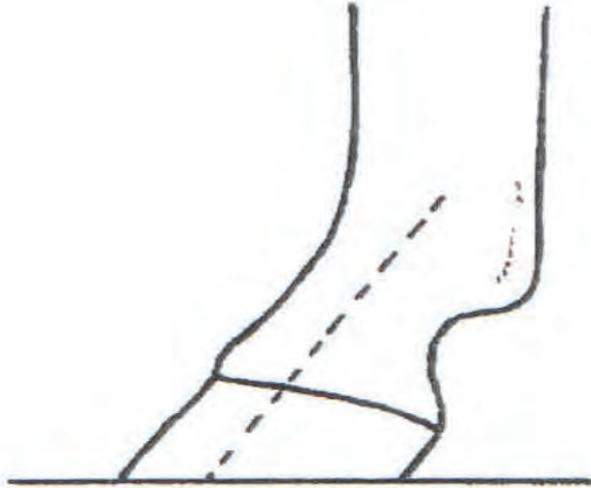


Figure 1.13 Hoof and pastern in straight line

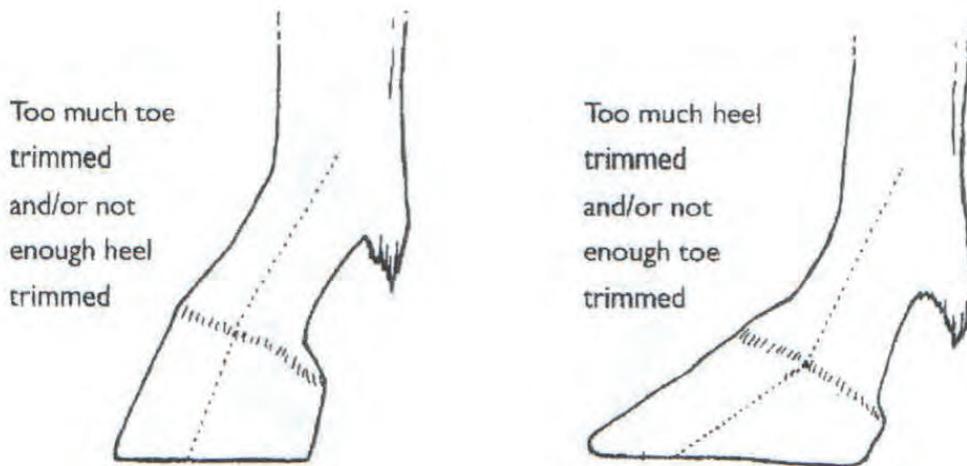


Figure 1.14 Hoof and pastern not in a straight line

Do not buy a horse or donkey that is lame. When a horse or donkey is lame it does not take its weight evenly on each leg as it moves. This is more noticeable when the horse or donkey is trotting, so have somebody trot it towards and away from you and across in front of you so you can check.

1.3.3 Teeth, tongue and jaws

Horses and donkeys teeth keep growing during their lives. As the animals graze and chew, the teeth wear against each other.

The cheek teeth are also called the “molars”. Horses and donkeys use these teeth to grind and the food before swallowing it. The canine teeth are found in the mouths of males between the front teeth and cheek teeth. They are rarely found in mares. The front teeth are also called “incisors”. They are used to bite and pluck grass and roughage when grazing or feeding from a trough. There are six pairs of front teeth.

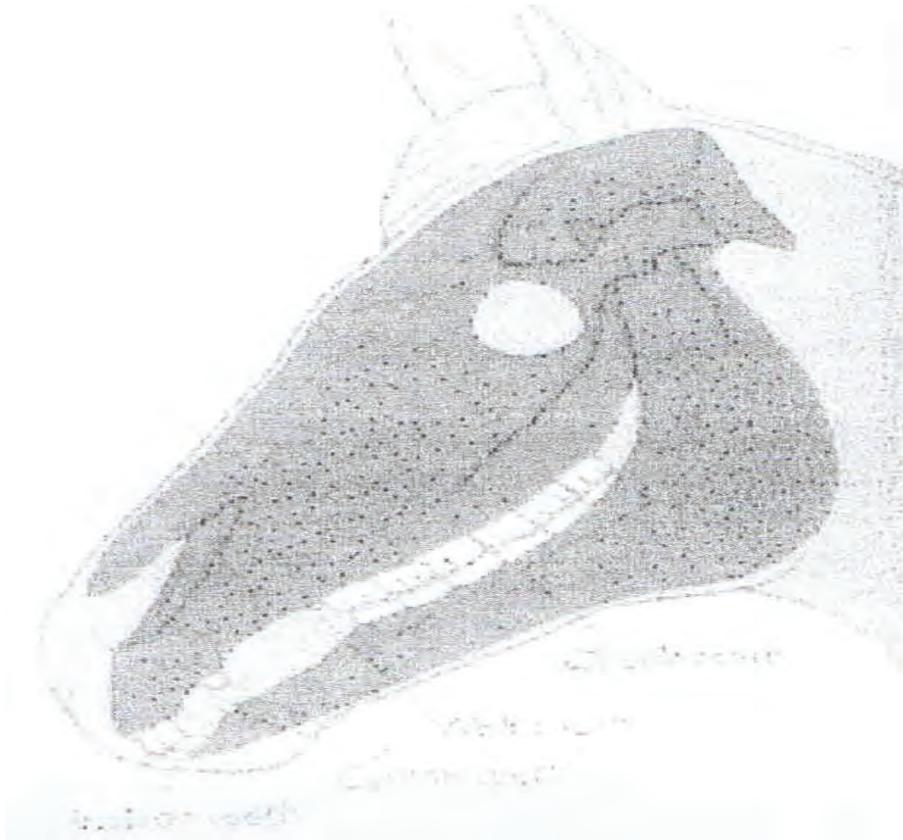


Figure 1.15 Equine teeth

It is important that each pair of front teeth meet their counterpart in the opposite jaw evenly, so they cut properly. In some horses the upper jaw is longer than the lower jaw, causing the upper teeth to be in front of the lower teeth. A horse or donkey with this problem is called “parrot-mouthed” (Figure 1.16). When the lower jaw is longer, the horse is called “sow-mouthed”. Horses and donkeys rely on grazing a lot to obtain food and so need to be able to cut the grasses and vegetation efficiently.

Similarly if either the tongue or lips is permanently damaged, then the horse or donkey will find it difficult to eat the food. Always check in the mouth to see that the tongue is not damaged.

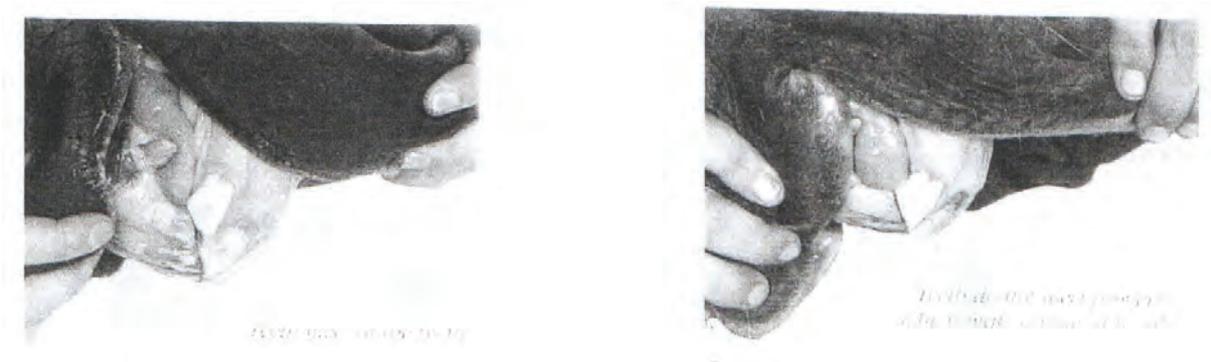


Figure 1.16 A good mouth (left) and “parrot” mouth (right)

1.3.4 Age estimation

The ideal animal for work is one that is fully-grown but not so old to be incapable of working well. Therefore the ideal age to work a horse or donkey is 4-15 years. Before four years old the animal is still growing and is not strong enough to work. The bones, tendons, joints and muscles are still developing. To work a horse or donkey hard before 4 years old can cause permanent damage to the animal, stunt its growth and reduce its useful life span. Hence when selecting a horse to be used for work it is important to know how old it is.

You can estimate the age of the horse or donkey by looking at the changes in growth and in wear of the front teeth.

Horses and donkeys like humans first grow a set of temporary or “baby” teeth, and later adult teeth. Unlike humans, horses’ and donkeys’ teeth keep growing during their lives and their teeth wear down as they eat.

Using the teeth to tell the age up to 4½ years old is accurate. This is because it is based on seeing which of the front teeth have grown. After 4½ years old the teeth can only give a guide to the age. This is because after this time, age is estimated by how much the front teeth have worn down. This can vary depending on the type of food that the animals are eating.

Horses

Horses have six top and six bottom front teeth, three on each side of each jaw. A foal grows all the temporary set of teeth in the first year of his life.

The adult teeth come up later (Figure 1.17). The middle (central) pair of adult teeth appears when the animal is 2 ½ years old. The next adult front teeth grow through when 3 ½ and the last pair (corners) at 4 ½ years. The adult teeth are much bigger than the temporary teeth.

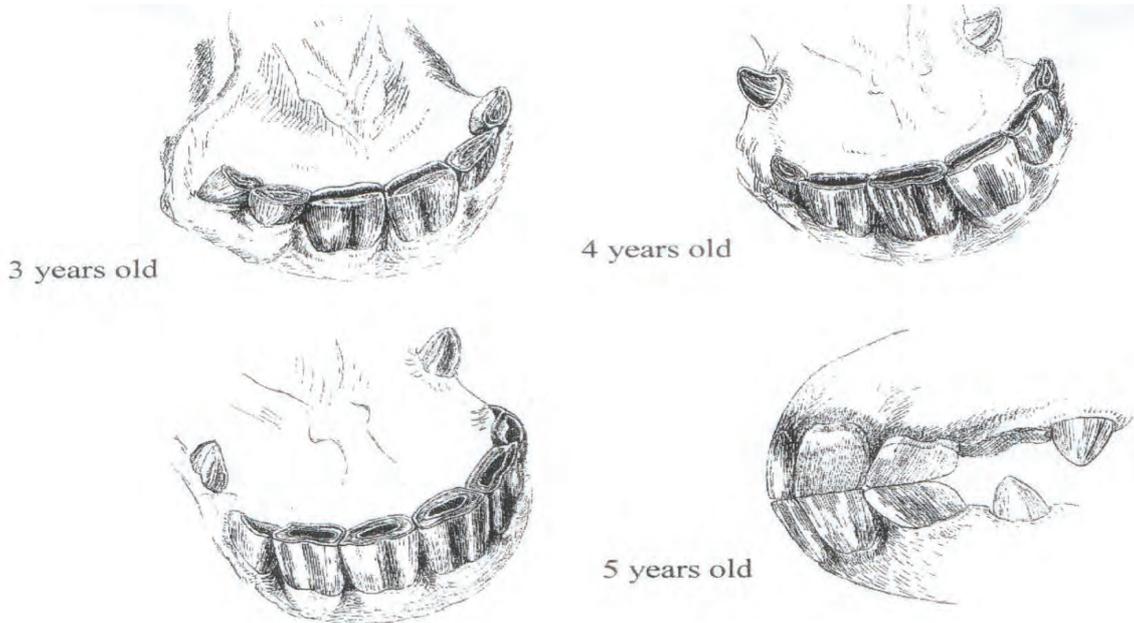


Figure 1.17 Front teeth of horses three, four and five years old

The horse has all its adult teeth at five years old. In the next years the age is estimated by looking at the amount of wear of the front teeth. This is shown as a change in the pattern on the biting surface of these teeth. The pattern changes because the tooth is not the same inside all the way down.

If the whole tooth was removed from the head of a young horse it would look like the example in Figure 1.18

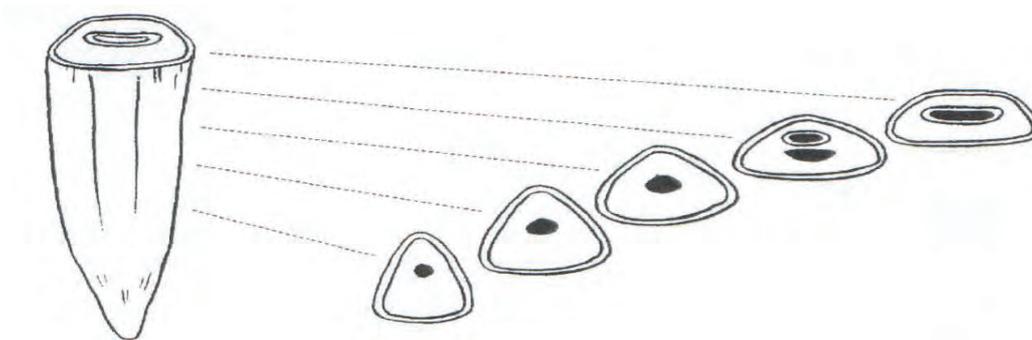


Figure 1.18 Cross-section of a front tooth as it grows and is worn down

If the tooth was cut across in different places (Figure 1.18) it would show how it would look on the biting surface as the tooth wears down during the horse's life. When they first come through, the front teeth have a hollow in the biting surface. This is called the cup. As the horse gets older, this hollow gets more circular and grows to the back of

the tooth, it is then known as a mark. A dark line is seen on the biting surface, in front of the cup. This is called the star. Later the mark grows out and only the star is left on the biting surface.

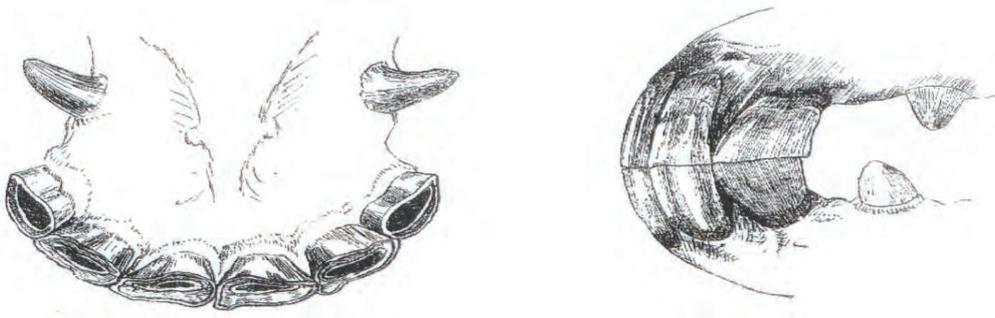


Figure 1.19 Teeth of a horse six years old

As the horse ages the angle of the teeth when viewed from the side increases, which can also be a rough guide to its age.

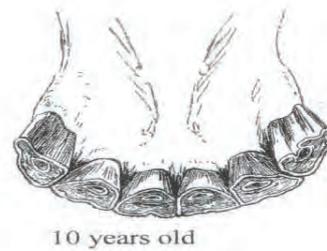


Figure 3.13 - Teeth of horses seven, ten and fifteen years old



Figure 1.20 Teeth of horses seven, ten and fifteen years old

Donkeys

Donkeys also have six pairs of front teeth. Ageing by growth of new front teeth is similar to horses. New adult front teeth appear at 2 ½, 3 ½ and 4 ½ years old. Aging donkeys up to five years old is done in the same way as for horses. After that there are some differences:

- Donkeys' corner teeth may not be fully in wear until 9-10 years old (compare the horse – six years old).

- The cups can still be seen in some donkeys' lower front teeth until around 20 years old. In horses, the cups disappear by 10 years old.
- The groove, which occurs from 9 years of age in the horses' upper corner front teeth, does not appear in donkeys. The hook on the same tooth, which is seen in horses, is not a reliable guide for ageing a donkey.

1.3.5 Size of working animal

It is worth remembering that the larger the animal, the more power it is able to generate and therefore the more work it will be able to do. However just as importantly the larger the animal the more food it will need to maintain it during the year. This is a big consideration when it comes to ensuring that the animal is in a good condition so it is ready to work well at the start of the cropping season.

1.3.6 Temperament

Horses like people vary in temperament, some are easily disturbed and excitable, others are quiet and not easily upset. However the experiences the animal has while it is young have a marked effect on how it behaves. Adult horses that are aggressive or easily frightened when handled are likely to be like this because of the way they have been handled when they were young and being trained for work. Check what the animal does when you approach it from the front and walk around it with your hand moving over the back. The animal should not tense up or your approach or flinch when it is touched. If it does this it is likely to be because it has been beaten or roughly handled by its previous owner. It will need more careful handling and will be less easy to work than an animal that is confident, relaxed and trusts the person using it for work.

A young animal that may have had little handling will be more nervous and this needs to be taken in the consideration when assessing temperament. A good horse or donkey owner will handle the animal from birth so it becomes accustomed to people and to being led, so that when it is old enough to work it will be easy to train.

1.3.7 Colour

The colour of a horse does not matter when it comes to selecting an animal for work. However if the other attributes are good and it is a choice between one horse or another it is a good idea to choose the one whose colour you like best. In this way you are already developing a liking for the animal and are therefore more likely to care for it. Some people have superstitions about colours. In some cultures black horses are considered very lucky, in others they are thought to be bad luck. Hair whorls similarly are thought to bring luck, depending on where they are positioned on the animal, although they do not have a direct effect on the animal's physical ability to work.

1.3.8 General Advice for owners/buyers

When buying an animal for draft purpose, it is important to observe the following key attributes:

- Look at its conformation, check legs, body, feet, teeth, tongue and jaws:
- Legs should be straight with no swelling on tendons or joints
- Chest and body should be broad
- Feet should be evenly shaped, smooth hoof surface, dry hard soles
- Tongue should not be damaged or cut, teeth should meet evenly, cheek teeth should not be sharp.
- Check age. The ideal age of a working horse or donkey should be 4-12 years old
- Select size, a large size of animal can do more work but eats more
- Select temperament
- Select colour

The characteristics discussed here are the main ones that need to be considered in selecting a horse or donkey for work, whether it is at a market or from another farmer. The same considerations apply whether the horse is a young animal or one that is already trained to work. Make sure the farmers you advise get good value for their money when they buy a horse or donkey for work. The cheapest is rarely the best.

CHAPTER 2. PRINCIPLES OF TRAINING ANIMALS FOR DRAFT USE

2.1 ASSESSING THE SUITABILITY OF ANIMALS FOR WORK

When assessing the suitability of an animal (Cattle or Donkey) to be trained for work, the following characteristics should be taken into consideration:-

- i. **Breed:** go for locally available (indigenous) animals. These are adapted to physical and climatic conditions of the area. These will be resistance to common diseases in the area.
- ii. **Health:** Avoid animal that have suffered or are suffering from major disease, including physical disabilities. Check out for lameness and also blindness-common in donkeys.
- iii. **Age and weight:** Training in cattle should not commence before the animal is 2,5-3 years old, at this age, cattle should be about 200-250kg.
- iv. **Temperament (behaviour):** This is reflected in an animal's reactions to its environment. Very aggressive or very docile animal should not be selected. Select an animal which is alert, active and responds calmly to its surroundings.

2.2 TRAINING PRINCIPLES OF WORKING ANIMALS

Many farmers do not spend much time and effort on proper training of their animals for draft work. As a result many draft animals are poorly trained. Poorly trained animals are:

- Difficult to use; would be more aggressive and disobedient
- Do not obey/ do not know verbal comments
- Because of difficult to use and aggressiveness, woman and children cannot use them
- Requires 2 or even 3 persons to control the animals while working
- Almost impossible to use in precision- operations like weeding and planting: other-wise the crop will be damaged or planting lines will not be straight.

Seven principles have been identified worldwide (FAO, Palabana). These will help and guide you in training draft animals:-

- i. Be calm, firm, patient and consistent in handling the animal. Don't be afraid.
- ii. Follow a routine pattern and repeat many times all aspects of training
- iii. Only proceed to the next step of training after animals is very good in previous step

- iv. Reward good performance; e.g. pat on the body, praise words, short break
- v. Punishment is like shouting or beating will only make the animal uneasy and even aggressive.
- vi. Use training aids where necessary, e.g. ropes.
- vii. Spoken commands should be few in number, simple and short in words.

2.2.1 Best time to train your draft animals

- Plan to do the training of your draft animal during the dry season; a period you are less busy. You need 4 to 5 hours per day in the early and/ or late hours of the day, for 4 to 5 weeks.
- Start the training 4-5 weeks before the on-set of the rain (cropping) season. This allows the animal more practice in the season without a break after training.

2.2.2 Draft animals training:

A 4-step methodology is recommended in the 4 step training process 4 -step training process

Step 1:

This is about establishing manual relationship between animal and person, i.e. about domesticating the animal. The following procedures may be followed:

- riem the animal directly or with the help of a stick.
- while holding the other end of the riem let the animal walk around the kraal as you give the "GO" command. While pulling on the riem give the "STOP" command.
- At this stage also give the animal a NAME. After walking a while remove the riem and repeat the procedure. Continue this step until the animal is competent.

Normally 3-4 hours per day for 2-3 days.

Step 2:

This step involves three things:

- Introduce the yoke and let the animal get used to having a yoke on its neck.
- Pairing the animals and getting them used to working as a team.
- Working as a team in more open unrestricted area with the commands walk, stop, turn right, turn left.

After walking for a while, remove the yoke and give the animal brief rest (reward), then yoke them again then repeat the process. Continue with the exercise until animal shows competence; Normally 3-4 hours a day for 4-7 days.

Step 3:

The aim here is to develop the animal muscles and stamina and train them to pull loads and to walk in straight line in a field with crops. They also learn to walk in the furrow.

- Hitch different weights (logs are recommended) to the animals and walks around. Start with lighter ones and progressively over days increase up to maximum of about 50kg.
- While pulling a log let (1) the animal on the left walk in a furrow (2) both animals walk along pegs set in straight rows.

Addition commands at this stage are to reverse, Go straight and follow a furrow. This exercise should be carried out repeatedly every day for 3-4 hours per day for 4-8 days.

Step 4:

This is the final step and now we begin to introduce the animals to implements and carts. At this stage you are using all the commands the animals have learnt.

You hitch implements and actual work. e.g. ploughing, harrowing, etc.and hitch a cart and move around. This exercise should be done repeatedly for 3-4 hours per day for 1-2 weeks.

If animals are left for several days without being trained, they may forget everything learnt previously. It is also recommended that training of animals is timed such that this last step leads in the beginning of the cropping.



Figure 2.1 Training working animals to walk in straight lines.

The aim here is to develop the animal muscles and stamina and train them to pull loads and to walk in straight line in a field with crops. They also learn to walk in the furrow.

- Hitch different weights (logs are recommended) to the animals and walks around. Start with lighter ones and progressively over days increase up to maximum of about 50kg.
- While pulling a log let (1) the animal on the left walk in a furrow (2) both animals walk along pegs set in straight rows.

CHAPTER 3. FEEDING GUIDELINES OF WORKING ANIMALS

3.1 ENERGY AND FOOD REQUIREMENTS: DONKEYS AND CATTLE

All animals need food to keep them alive, but an owner of animals needs to keep them in good condition whether they are to be sold or used for work. Buyers will not pay for animals in poor condition, and animals in poor condition cannot produce good work. An owner should be able to see when an animal is in poor condition: it will move slowly, eat slowly, and the skin between its ribs will sink down, so the ribs can be clearly seen and felt. Such an animal is not supposed to be worked or sold.

Sometimes the poor condition of the animal will be due to illness, but it can also be due to lack of proper food. Lack of proper food can itself lead to illness, so an animal's food is the first place to look for problems.

Working animals need to be able to convert their food into energy, rather than into fat (including milk) or even muscle. Some types of animal and some breeds of animal will do this better than others, so you need to know the differences between the species and breeds.

Table 3.1 Some general species differences in food conversions

ANIMAL SPECIES	PROPORTION OF FOOD CONVERTED INTO		
	ENERGY	MUSCLE	FAT
Donkeys (<i>Equus a. Asinus</i>)	High	Low	Low
Cattle (<i>Bos primigenius</i>)	Low	High	Medium
Horses (<i>Equus f. Caballus</i>)	High	Medium	Low

Muscle growth does not necessarily mean strong muscles. Donkeys in fact have stronger muscles than the other two species, as they have been bred exclusively for work. Horse muscles, bred for speed, are not the best for heavy work.

After that, the choice of food is important. All animal feeds should contain the following elements, in quantities which vary according to animal, environment, and circumstances:

Energy/Carbohydrates: mostly starches, sugars and oils contained in grains and fruits, these convert most easily into energy, but they are far from being enough. Different animals process different foods in different ways, and the same foods will not suit all.

Roughage/Cellulose: the cell walls of plants, a major part of all plant material, comprise cellulose, which is partly converted into energy in the rumens of cattle, but not all animals are ruminants. Donkeys and horses employ different parts of their digestive systems, donkeys more efficiently than horses.

Proteins: are the amino acids that help a body grow and repair itself. Sources of protein include legumes such as lucerne, whole grains and oil seeds such as sunflower and ground-nuts. Although protein can also be converted into energy by animal digestive processes, too much protein can cause health problems.

Minerals: usually in the form of salts, minerals maintain health and strengthen bones. Small amounts of a wide variety are needed. Working animals, because they sweat, may need replacement of sodium chloride (common salt) in larger amounts. However, some animals, like donkeys, store water in their blood cells, and too much salt can disturb the necessary balance and create damaging thirst. Salt is usually provided to cattle in the form of “licks”, solid blocks. But it is often mixed with urea, good for cattle but not for donkeys and horses, so it is better to give measured amounts in the food of horses rather than giving them a lick, and probably better to avoid giving any salt to donkeys.

Vitamins: usually available in food which is fresh, vitamins are also important to health. Providing a variety of feedstuffs ensures the full range that may be needed; otherwise supplements should be given when lacks are apparent.

Water: this is needed by all animals so that they can function, but some animals need more than others, not only according to body weight or work, but also according to species. It is necessary to know how much is needed in situations where water may be limited.

Table 3.2 Some differences in food requirements for different working animals

ANIMAL SPECIES	SOME RELATIVE FOOD REQUIREMENTS		
	ROUGHAGE	PROTEINS	WATER
Donkeys (<i>Equus a. Asinus</i>)	High	Low	Low
Cattle (<i>Bos primigenius</i>)	Medium	High	High
Horses (<i>Equus f. Caballus</i>)	Low	High	Medium

Each element of an animal's diet needs to be kept in balance with the others to maintain good health. For each type of animal, and sometimes for each individual animal, the required balance may be different.

In laboratories and scientific tests, amounts are expressed as “dry matter” (DM), i.e. weights of the food with moisture removed, for better comparison and also because the inclusion of moisture can disguise how nutritious the food would be. This is also how

food is often provided to animals unable to graze: dry. Nonetheless, if food can be given fresh and not dry, it will contain more vitamins.

Also important are the proportions of “digestible protein” (DP), because not all plant protein can be digested by certain animals. “Total digestible nutrients” (TDN) are also often mentioned, and are regarded as “digestible energy” as well.

Table 3.3 Some approximate food values of commonly available animal feeds

	TOTAL DIGESTIBLE NUTRIENTS (TDN) % of DM	DIGESTIBLE ENERGY (DE) Mcal/kg	ROUGHAGE (FIBRE) % of DM	DIGESTIBLE PROTEIN (DP) % of DM	OTHER NUTRIENTS % of DM
Bran: residue of seed components after milling and refinement.	70	3	57	17	1.5
Chaff: outer seed casings of cereal crops, including groundnuts, after winnowing. Also any dried food plant that is finely chopped up.	60	3	90	10	10
Chops: chopped up whole maize cobs.	High	high	high	medium	medium
Grains: seeds of cereal crops, including soya and sunflowers.	90	4	4	10	0.35
Hay: dried grasses, including leaves.	60	3	70	20	2
Lucerne: leafy leguminous crop.	58	2.5	83	19	1.5

	TOTAL DIGESTIBLE NUTRIENTS (TDN) % of DM	DIGESTIBLE ENERGY (DE) Mcal/kg	ROUGHAGE (FIBRE) % of DM	DIGESTIBLE PROTEIN (DP) % of DM	OTHER NUTRIENTS % of DM
Molasses: by-product of sugar production.	72	3	0.5	6	1.5
Silage: fermented hay.	72	4	73	9	0.6
Stover: stalks and leaves of cereal crops remaining after harvest.	Medium	high	high	low	high
Straw: the dried stalks of grasses and crops.	Low	low	high	low	low

Poultry litter is included in some cattle diets, making them rich in protein as well as cellulose. However, it is dangerous to give the wastes of one animal to another, and very dangerous for donkeys and horses.

3.2 THE FEEDING ENVIRONMENT

Only observation of an animal, perhaps with veterinary help and blood tests, can ensure that an animal is receiving the right food elements in the right quantities. An owner's experience will help, as an animal in good condition will behave in an alert way, its eyes bright and its coat shining and healthy. There are ways of arriving at "Body Condition Score", but they are still far from scientific.

The environment in which an animal lives and works is the main determinant of its food needs. In general, animals may be kept under a variety of feeding regimes, which can be classified as follows:

Free grazing, good: where animals have all-day access to veld which shows no signs of overgrazing and is well covered with plants. However, different kinds of veld suit different kinds of animal: cattle and horses require more grass, donkeys require more bush, and each type of animal, even each individual, will prefer some plant species to others. If all these requirements are satisfied, then all that needs to be considered are the hours of work – discussed below – to determine if an animal is getting enough, or whether supplements should be supplied.

Free grazing, poor: where animals have all-day access to veld which shows signs of overgrazing, i.e. some of the ground is bare. No matter what the differences between veld type and animal type, almost certainly working animals will need supplementary feed, even when they are not working.

Limited grazing: where animals are only allowed on a small area of land which may or may not be well vegetated, but does not contain a great variety of the plants which they need. This limit may also refer to time.

Zero grazing: where all the food and water is brought to an animal and it does not have access to any veld. In such cases, not only does a great deal of care have to be given to making sure all the right elements are in place and in balance, but the animal must have enough *exercise* to keep its digestion operating.

3.3 THE TIMING OF WORK AND FEEDING

First of all, the age of the animal must be taken into account. If an animal works before it is mature, damage can be done to its body, particularly its skeleton, so that it will be in pain and work inefficiently for the rest of its life.

Table 3.4 Some general species differences in age at which heavy work can begin (training should start earlier)

ANIMAL SPECIES	AGE TO BEGIN WORK (months)
Donkeys (<i>Equus a. Asinus</i>)	~36
Cattle (<i>Bos primigenius</i>)	~48
Horses (<i>Equus f. Caballus</i>)	~36

Different types of animal eat and drink different amounts at different frequencies, so the timing of their work needs to be different. If animals are worked all day and every day, they may not be getting enough food because they may not have enough time to eat. Especially if the feeding regime is a free-grazing one, they will also need enough time to find their food.

Cattle, as ruminants, eat large quantities but digest their food slowly and so feel hungry less often. Donkeys eat less but digest fast, but both types of animal must be allowed to eat as much as they can **before** they start work. Free grazing animals must have at least 6 hours a day in total to find their food. If they are locked up for the night before they have eaten properly, they will be tired the next day.

To some extent, the animals themselves will indicate the limits of their working hours. They will work well and willingly (if properly trained), but when they are tired and hungry they will slow down. At that stage they must be allowed to rest as well as eat, and drink if they want to. For donkeys it is recommended that they be given one hour of rest after

every two hours of work, and no more than six hours of work in a day. When they do work, their “tractive effort” is much greater than that of other animals.

All animals, but cattle and horses more than donkeys, will have difficulty both working and eating in **high temperatures**, so they should have their rest periods at the hottest times of day.

3.4 AMOUNTS OF FEED

The amounts given here assume a zero grazing feed regime, i.e. these are the **total** daily amounts needed by each animal, but they should be divided up so as to be given on at least two occasions in a day, say morning and evening. How much should be provided as a simple supplement to grazing will depend on the feeding environment and the condition of the animal.

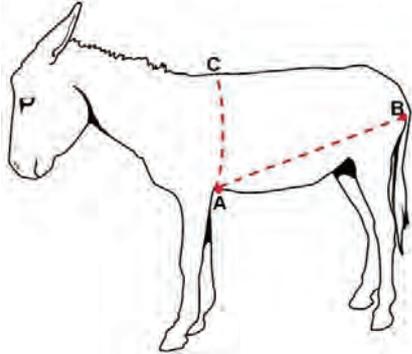
More simply, here, amounts are also expressed as “per kg bodyweight”, meaning they must be multiplied by the weight of the animal in kg, although for larger animals, the multiple is slightly lower. In the field, it may be necessary to determine the actual weight of an animal so as to adjust the quantities. Ways of estimating animal weight using an ordinary tape measure are suggested. Special “weigh tapes” calibrated in kilograms may also be obtained, and also “nomograms” calibrated according to formula so that a line joining two of the measures on vertical scales intersects with a third vertical scale to show the resulting kilograms.

The weight of the animal should be established **before** it begins a programme of work and when it is in top condition. Then, while it is working, checks can be made to ensure that it is not losing weight. Accurate estimates of weight are obtained, as shown below, by calculating from two measures: body length and heart girth. However, changes after that can be checked simply by measuring heart girth (C in the diagrams below). If this becomes smaller, and the animal is not sick, then certainly it will require more feed.

Recommended quantities for daily feeding not only vary according to species of animal, but also according to what is required of it – in this case, work. If pregnant or lactating animals are used for work, additional feed may be needed, especially proteins.

The tables below list commonly available feeds. If any of these are replaced with another kind of feed, the proportions and quantities will change according to feed composition, for which the table above is a guide. Maize stover is not included because, in the interests of Conservation Agriculture, it is recommended that this is left on the fields and not fed to livestock.

3.4.1 Donkeys (*Equus africanus asinus*) Estimating body weight



1. Measure the length of body from the elbow (A) to the pin bone (B), preferably using a stiff metal tape.
2. Measure the body circumference or heart girth (C) from the base of the withers, down under the belly, just behind the elbow and foreleg, and all the way back around.
3. After these measurements are made in centimetres – use the formula (heart girth^{2.12} X body length^{0.688}) ÷ 3801 = weight in kilograms.

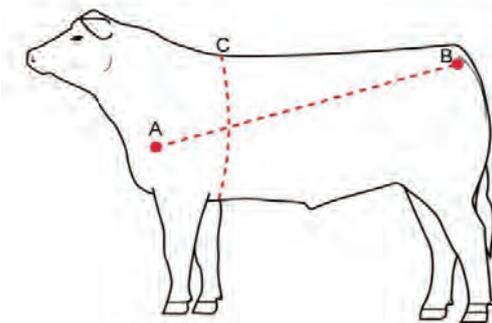
Heart girth can be used alone, but less accurately, in the following formula:

$$\text{Heart girth}^{2.65} \div 2188 = \text{weight in kilograms}$$

Table 3.5 Recommended daily feeds

FEED	DAILY AMOUNT PER ANIMAL (Average Weight 150 kg)	Daily g/ kg body weight
Straw	5 kg	33
Grain (maize kernels)	1 kg	6
Molasses	10 g	
Salt (sodium chloride)	-	
Water	15 litres	0.1 litres

3.4.2 Cattle (*Bos primigenius*) Estimating body weight



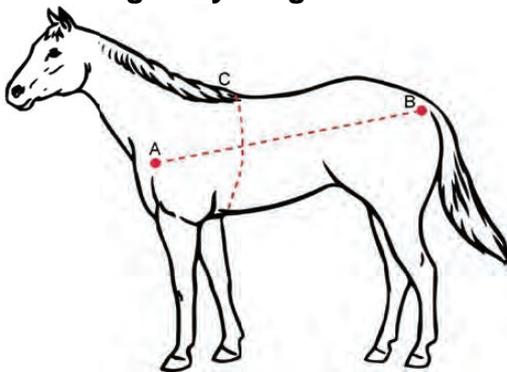
1. Measure the length of body from the point-of-shoulder (A) to the point-of-rump or pin bone (B).
2. Measure the body circumference or heart girth (C) from a point slightly behind the shoulder blade, down the fore-ribs and under the body behind the elbow all the way around.
3. After these measurements are made in centimetres – use the formula: (heart girth X heart girth X body length) ÷ 10844.4 = weight in kilograms.

Table 3.6 Recommended daily allowances for body maintenance

FEED	DAILY AMOUNT PER ANIMAL (Average Weight 500 kg)	Daily g/ kg body weight
Straw	20 kg	17
Grain (maize kernels)	2 kg	6
Molasses	100 g	
Salt (sodium chloride)	10 g	
Water	40 litres	0.08 litres

3.4.3 Horses (*Equus ferus caballus*)

Estimating body weight



1. Measure the length of body from the point-of- shoulder (A) to the point-of-rump (B).
2. Measure the body circumference or heart girth (C) from the base of the withers, down under the belly, just behind the elbow and foreleg, and all the way back around.
3. After these measurements are made in centimetres – use the formula (heart girth X heart girth X body length) ÷ 2120067.3 = weight in kilograms.

Table 3.7 Recommended daily allowances for body maintenance

FEED	DAILY AMOUNT PER ANIMAL (Average Weight 250 kg)	Daily g/ kg body weight
Hay (<i>NB horses can't digest straw</i>)	10 kg	
Grain (maize kernels)	2 kg	
Molasses	30 g	
Salt (sodium chloride)	5 g	
Water	30 litres	

3.5 CONCLUDING REMARKS

Correct and proper feeding of your work animals can be a big difference for both of you and your animals. Remember proper feeding is more than just sending the animals for grazing. Animals, just like people, will need different types of feed to get their requirements for growth-maintenance, production/reproduction and protection. A work animal will need particularly energy giving feeds.

Working animals must have good food and clean water every day. Ensure that your donkey has unlimited access to clean, fresh water. A donkey can drink 8 -20 litres of water per day, more if its working or the weather is hot. Donkeys are normally very choosy about what they drink and may refuse to drink dirty water. As a rule of thumb, donkeys must graze 6 hours per day, 1 hour before work, otherwise give them supplementary feeds of 6 kg of roughage plus 1 kg of concentrate plus 10 litres of clean drinking water.

Energy: is required for practically all life processes of the animal. All internal organs including production of, e.g., milk and muscle powers to do work require energy. Carbohydrates are the most important source of energy. Young and leafy fodder crops, molasses, grains, e.g. maize are the main source of carbohydrates.

Minerals: have many important functions in the body, including giving the animal's skeleton structure rigidity and strength. Salt (sodium chloride) is one important mineral requirement in animals. This is critical in working animals which will lose salt through sweating. So always give some salt to working animals.

Proteins: are required for growth work and body maintenance and protection. Shortage of protein will lead to a weak animal because of loss in body weight, reduced feed intake and reduced resistance to diseases. Main sources of protein for animals include legume fodder crops, oil seed products such as oil- seed, sunflower and ground- nut.

Vitamins: these are very important to an animal but are only required in small quantities and it is very unlikely that animals fed on fresh feedstuffs will suffer vitamin deficiency.

For the animal to get sufficient materials (protein, minerals, energy and vitamins) it should take in sufficient feed (dry matter). How much dry matter an animal takes in depends on:-

- Age of the forage (an animal will consume more of young leafy plants than overgrown mature ones)
- Palatability of the feed
- Condition of the animal, sick or health
- Time available for feeding

Table 3.8 on next page gives nutritional content of some common animal seeds.

Table 3.8 Nutritional values of some common animal feeds

Feed Type	DM%	SE	Energy	Protein
Roughages	Dry matter		(Total Digestible Nutrients)	(DCP) Digestible
			(TDN)	Crude protein
Natural Pastures young	18-25	Medium	High	Medium
Natural Pastures old	18-25	Medium	High	Low
Nappies grass	16-19	Medium	High	Low
Maize stores	40-50	Medium	High	Low
Sorghum stores	90	Low	Very low	Low
Soya beans stores	85	Low	Very low	Low
Groundnut hay	90	Medium	Medium	Medium
Banana Leaves	15-18	High	High	High
Lucerne	17-25	High	High	High
Grass hay	85	Low	Medium	Low
Cereals				
Corn and cob meal	88	High	Very High	Low
Brewer's meal	20-25	High	Very High	High
Other products				
Poultry Manual	90	Low	Low	High
Molasses	75	Medium	High	Low

CHAPTER 4. HEALTH CARE GUIDELINES OF WORKING ANIMALS

4.1 MANAGEMENT OF HEALTH: WORKING DONKEYS AND CATTLE

For working animals, **emotional** health comes even before physical health, because an unhappy animal is not likely to work efficiently and is more likely to get sick. A good relationship with its handler is required, but even more must an animal be friends with others in its team. What must be avoided is separating animals that are friends.

All animals can get sick and those animals *not* born and bred in Africa or in the environment where they work, are more likely to get sick. This is why it is better to choose indigenous **breeds** as work animals, or donkeys – which have been African from the beginning.

The **equipment** used by animals is the most common cause of injury and can also result in avoidable overwork. Each species of animal requires different equipment because of their different body shapes and rates of work. Be sure that the equipment you are employing is suitable for the animal you are using and the work it is doing. All animals which pull wheeled vehicles or carry backloads should have breeching straps. Donkeys and horses cannot use yokes. Donkeys cannot use straps over their necks without suffering damage.

Animal health can be seriously affected by **overwork**, so close attention must be paid to the “timing of work and feeding” described in “Feeding guidelines for working animals”. Health is also affected by living conditions: all animals should have somewhere dry where they can take shelter in poor weather and lie down to sleep comfortably. All the animals mentioned here can sleep standing, but that is not the way that they get proper rest. In the case of working animals, feet and legs are very important, so they must be kept clean and free of injury.

All the same, a **good diet** is the most important factor in animal health, which is why this is discussed separately in the feeding guidelines. Without a good diet and being in good condition, any animal will get sick more easily. The various ways in which an animal can get sick can be divided up as follows:

Internal parasites (worms of various sorts which live and breed inside an animal) interfere with digestion so that the food it eats does not actually feed it.

External parasites such as ticks not only take an animal's blood and so weaken it, but they also carry diseases from animal to animal.

Infections spread by crowded conditions and the sharing of food and water are another way in which diseases are carried from animal to animal.

Injuries can not only interfere with the work of an animal, but if they are left untreated, may leave an animal in so much pain that it will spend the rest of its life not working properly, and its life will be shortened. Untreated wounds may get infected and cause fevers such as tetanus and the animal's death

Poisoning by eating the wrong food or plants, sometimes because the animal is not familiar with a new area.

All these can be prevented by good management. According to the species of animal, some can be expected to be more common. Cattle in particular suffer from a range of tick-borne diseases, so dipping is very important. Cattle dips may be poisonous for donkeys and horses, but donkeys in particular usually keep themselves free of ticks. Deworming is also advisable for all species, but care must be taken. Some of the remedies for cattle can poison donkeys and horses.

Table 4.1 Susceptibility of different animals to the causes of disease

ANIMAL SPECIES	Frequency of causes of common illness				
	Internal Parasites	External Parasites	Infections	Injuries	Poisoning
Donkeys (<i>Equus a. Asinus</i>)	Medium	Low	Low	High	Low
Cattle (<i>Bos primigenius</i>)	Medium	High	High	Medium	Medium
Horses (<i>Equus f. Caballus</i>)	Medium	High	High	High	Medium

According to the kind of animal, the illnesses caused will be different, and some of the specific ones, with symptoms and treatments, are listed below. In most animals, the signs of illness are unmistakable, and a good manager will immediately know that something is wrong if the animal.

- is weak and not able to work
- has droopy ears
- is losing weight
- has closing, weepy or dull eyes
- has a hot, dry muzzle or it is discharging mucus
- is slow to respond to stimulus
- rejects friends
- rejects food or water

One of these alone may indicate a temporary problem, but the animal should be watched until it changes back to normal. A number of these signs together is cause for worry, and a vet should be consulted before the animal becomes incurable. It may meanwhile be spreading infection to other animals, so should be isolated from contact with them, but not so that it feels alone, which may make it worse. All these animals are herd animals, and suffer if they are separated from the herd.

Some problems are suffered by any type of animal, and if the animals are expected to work, these problems must be solved as soon as possible, especially if they affect the working parts of the animal, such as its legs and feet, and also the skin where the equipment will touch it. Irritations of the skin can be caused by insects or plants, and should be treated before they get worse. Weeping eyes likewise should be washed out with clean water, perhaps with a little salt dissolved in it. Any skin wound must be treated and rested, but some are indications of more serious diseases. The list in the Table 4.2 below do not cover all the problems, but only the more common or recent ones.

Table 4.2 Common Illness of working animals and possible treatment

NAME OF ILLNESS	SIGNS AND SYMPTOMS	TREATMENT
ABCESSES	Sores which are infected and do not heal	Remove pus and decaying flesh, then antibiotics.
BABESIOSIS/RED WATER/BILIARY	Red urine, face & body swollen, yellow colour of gums and eyes, fever, pounding heart, weakness and appetite loss.	Veterinary. (Tick-borne parasites burst red blood cells and affect liver, so early treatment vital.)
INFLUENZA	Discharge from nostrils; difficulty in breathing; weakness; loss of appetite; fever.	Antibiotics under veterinary advice; dry, warm environment, good ventilation and food.
INTERNAL PARASITES OF SOME KIND	Loss of weight and appetite; listlessness; possibly but not necessarily eggs and/or worms in faeces/droppings.	Drenching or dosing with one of the available worm medicines or "anthelmintic" drugs. Animal should not be worked until health restored. NOTE: drugs suitable for cattle not usually suitable for donkeys and horses.
LAMENESS DUE TO HOOF INFECTION	Limping; no obvious muscular trouble; no obvious wound; usually only one foot hot	Cold copper sulphate and vinegar soak for affected hoof/s, 10 mins x 2 daily.
LUNGWORM	Persistent coughing but without nasal discharge	Treat by drenching/dosing as for other internal parasites, <i>provided that</i> drug is suitable for animal species, and lungworm treatment is mentioned on bottle.

NAME OF ILLNESS	SIGNS AND SYMPTOMS	TREATMENT
MASTITIS	Udder much more swollen than normal for milk; nursing being rejected by mother before weaning age	Hot soak (cloth soaked in hot water) held to udder until cool, repeated often. Otherwise, veterinary advice and treatment.
SNAKE ATTACK	Swollen face (in the case of spitting cobra – in which case treat also eyes); difficulty breathing – but for different kinds of snakes there are different symptoms, and often no effective treatment	For eyes: strong solution of bicarbonate of soda. For rest, inject whatever anti-inflammatories are available together with antibiotics for 24-48 hours (veterinary supervision).
TETANUS	Difficulty chewing. Walking stiffly, eyes and nostrils wide, ears erect, shivers at sudden noise or movement.	Veterinary, but better to prevent by vaccination and prompt treatment of wounds.
TOOTHACHE	Animal allows food to fall from its mouth; reluctant to chew; growing thinner.	Professional treatment only, unless herbal remedies are known.
TORN MUSCLE OR LIGAMENT; SPRAIN	Limping; muscle or joint hot to touch and/or swollen; possible inability to rise from lying down. (This inability to rise can also be caused by general weakness due to starvation, in which case support as described.)	Apply cold soak to swollen area. Rest from work but not from gentle exercise. If animal cannot rise from sleeping or rolling, it must be helped up and during the day kept in a standing position, either in a crush-pen or by means of a cloth sling around its belly hung from the branch of a tree – the animal to be in the shade. Since it will not then be free to graze, the animal must be given low-protein food and water. This may have to continue for weeks.

Controlled and notifiable diseases – i.e. serious infectious diseases which must be reported to the Government Veterinarian so that measures can be taken to prevent further spread.

Table 4.3 Common disease of working animals and possible treatments

NAME OF DISEASE	SIGNS AND SYMPTOMS	TREATMENT
ANTHRAX	Rapid fever and death; on death, very dark non-clotting blood from nose and other openings.	Vaccination in area of occurrence; pregnant donkeys vaccinated only if outbreak; dead animals must be well burned and deeply buried.
NAGANA (Trypanosomiasis)	Dullness, weakness; anaemia; thinness; sensitivity to light; dragging hind limbs; loss of balance & paralysis, unconsciousness.	Eliminate tsetse fly; early diagnosis and treatment with "Samorin" or "Trypamidium".
RABIES	Change to unsociable or aggressive behaviour (where not sexual); grinding teeth; cries in throat; rigid paralysis; inability to swallow; foaming at mouth; death in 3-7 days.	Annual vaccination; destruction of infected animals, so get proper diagnosis. No cure.

4.2 DONKEYS (EQUUS AFRICANUS ASINUS)

Although donkeys can suffer from many of the above, they very seldom do. Note that donkeys, like horses, should **not** be dipped or dewormed using chemicals that are suitable for cattle. They do not get many ticks because they roll on the ground, and any that are found – such as the small pepper ticks on the legs – can be eliminated by applying Vaseline. If worms appear in their dung, they can be dosed with a preparation suitable for horses. Cattle do not suffer from the following:

Table 4.4 Illness and disease common to donkeys

NAME OF ILLNESS	SIGNS AND SYMPTOMS	TREATMENT
LAMINITIS/ "FOUNDER"	Limping; no obvious muscular trouble; no obvious wound; two or more feet hot; weight put on heels; some fever. Long-term effect: hoof overgrowth.	Reduction in diet protein. Cold soaks for feet. Exercise, but not work. Antihistamines (veterinary).

Additional controlled or notifiable diseases

NAME OF DISEASE	SIGNS AND SYMPTOMS	TREATMENT
DOURINE (another form of Trypanosomiases)	Fluid collecting under skin: especially under belly. Swelling of penis sheath and scrotum of males, and animal generally seems ill and feverish, so no confusion with common types of under-skin swelling.	Animal must be destroyed (?) to prevent any further spread, but worth professional advice. Can be treated, but in some countries not allowed. Castration an option.

4.3 CATTLE (BOS PRIMIGENIUS)

Cattle suffer from a range of diseases not known in donkeys or horses:

Table 4.5 Common illness and disease of working cattle

NAME OF ILLNESS	SIGNS AND SYMPTOMS	TREATMENT
GALL SICKNESS/ ANAPLASMOSIS	Fever, lethargy	Veterinary – tetracyclines (antibiotics)
HEARTWATER	Fever, lethargy, yellow colour of gums and eyes (no red urine)	Veterinary (antibiotics)

Additional controlled or notifiable diseases:

NAME OF DISEASE	SIGNS AND SYMPTOMS	TREATMENT
BOVINE TUBERCULOSIS	Weight loss, coughing, breathing difficulty, discharge from nose	Veterinary
BRUCELLOSIS/ CONTAGIOUS ABORTION	Large number of abortions in same herd	To prevent spread, animals with symptoms are usually killed.
EAST COAST FEVER	Fever and enlarged lymphnodes near the tick bite(s), loss of appetite, blindness, nasal discharge can be frothy, diarrhea, breathing difficulty, eyes and mouth very pale	Prevention by dipping, veterinary treatment.
FOOT AND MOUTH DISEASE (FMD)	Blisters and sores around feet and mouth. Fever.	To prevent spread, animals with symptoms are usually killed, and quarantine imposed.

LUMPY SKIN DISEASE	Fever, discharge from the eyes and nose, nodular, necrotic skin lesions, lumps and sores on skin, swelling of limbs and lymph nodes.	Prevention by vaccination only (viral cause)
RIFT VALLEY FEVER	Fever, loss of appetite,	Prevention by vaccination;

4.4 HORSES (EQUUS FERUS CABALLUS)

Horses suffer from more diseases than donkeys do, but the care for them is usually better, so prevention is also better. For the same reason, tick-borne diseases are less common in horses than in cattle.

Table 4.6 Common illness and disease associated with Horses

NAME OF ILLNESS	SIGNS AND SYMPTOMS	TREATMENT
EQUINE INFLUENZA	Nasal discharge, cough, fever and loss of appetite	Isolate from herd. Allow rest. Butazolidin to control fever and muscle stiffness.
STRANGLES	Face sores and swelling; cough, nasal discharge	Antibiotics, isolation to prevent spread; vaccination can prevent.
WEST NILE VIRUS	Muscle trembling, skin twitching, poor <i>coordination</i> , <i>stumbling</i> , <i>limb weakness</i> . Sleepiness, dullness, listlessness, facial paralysis (droopy eyelids, lower lip), difficulty with urination and defecation, and an inability to rise.	Vaccination for prevention; no treatment.

Additional controlled or notifiable diseases:

NAME OF DISEASE	SIGNS AND SYMPTOMS	TREATMENT
AFRICAN HORSE SICKNESS	Swelling of temples, fever, no appetite.	Vaccination for prevention; no cure.
DOURINE (another form of Trypanosomiasis)	Fluid collecting under skin; especially under belly. Swelling of penis sheath & scrotum of males, and animal generally seems ill and feverish, so no confusion with common types of under- skin swelling.	Animal must be destroyed (?) to prevent further spread, but worth professional advice. Can be treated, but in some countries not allowed. Castration an option.

4.5 CONCLUDING REMARKS

Contrary to many people beliefs, donkeys do get sick. It is, hence, important that you are able to notice when your donkey is sick so as to enable you to get a veterinarian in time. Here are some signs of sickness in donkeys:

- Donkey not eating
- Weak and not able to work
- Losing weight
- Eyes dull, closing, weepy
- Lack of response
- Rejection of friends/ matter
- Ears hanging down
- Muzzle hot, dry and discharging mucus

For good health of working animals, donkeys and cattle must have food and clean water every day. They should have enough time each day to rest, graze and drink. A healthy and well cared animal will be able to work well.

If you are using animals for transporting goods, do not overload the cart. Make sure the animals are rested regularly, and they should not go so fast that they start sweating and panting. If this happens they must be allowed to rest. Whipping and beating animals is cruel and a good owner or driver should not do this.

Animals working in a team should be of the same size. When parked, donkeys should be unhitched to give them time to rest and if possible to graze. As a rule of thumb, animals should not be worked for more than 6 hours per day with one hour break. Brush your animals often to remove grass seeds, burrs and dirt. If these are caught under the harness they can cause injuries.

If your animal is tired, weak, sick or in poor condition it must be rested in a good kraal. Check your animal's hooves every day when work is finished. Gently take out any stones from under the hoof. If the hooves are very dry, they should be treated with oil once a week.

CHAPTER 5. MATCHING WORKING ANIMALS TO IMPLEMENTS

5.1 INTRODUCTION

Does a farmer need 14 donkeys to pull a double furrow plough in sandy soils?
How many oxen are needed to pull a heavily laden ox-wagon weighing 1500kg?
How many horses should be hitched to pull a single furrow plough in sandy soil? And in heavy clay soils?

These are a few animal-implement matching problems that many researchers and farmers face. Farmers often think that they know the solution because they have been ploughing in a certain way for many years. Maybe they are right, but what if two oxen need to be sold and a farmer now only has two left? What implement should he now use, or will he have to stop ploughing?

By knowing the power available from different animals and teams of animals, as well as the power required to pull different implements, farmers and researchers can make sure that the job in hand is performed as effectively and fast as possible and necessary.

5.2 TERMINOLOGY

When working with animals and implements, a few key issues are of importance. These are explained below:

Working depth: The distance between the bottom of the cut furrow and the soil surface, measured in millimetres (mm).

Working width: The width of the slice of soil cut by the plough or the width of the soil that is disturbed by the implement, e.g. harrow or weeder, measured in millimetres (mm).

Working speed: The speed at which the animals are walking while working, as calculated from distance covered in time elapsed, measured in meters per second (m/s).

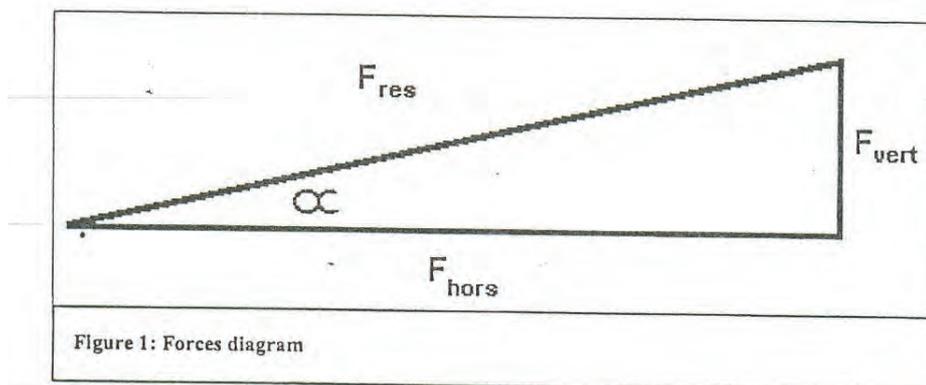
Time required, theoretical: The calculated time required to plough a surface until, e.g. 1 ha.

This is calculated by using the formula: $\text{time (h)} = \frac{\text{field width (m)} \times \text{field length (m)}}{\text{Width of cut (m)} \times \text{speed (m/s)} \times 3600}$

This does not take into consideration rest breaks for the animals, the time for turning at the end of the field, etc.

Time required, actual: The actual working time is measured in the field while the animals are working. It is usually measured for part of an area and then extrapolated for the whole area.

Draft requirement or draft force: This is the force required to pull the implement through the soil. This value is influenced by the soil and implement parameters and the forward speed. The draft force (F_{res}) can be measured in the trek-chain and has a horizontal (F_{hors}) and a vertical (F_{vert}) component. It is expressed in Newtons (N), with $1 \text{ kgf} = 9,81\text{N}$. The vertical component is the suction or lift of the implement while the horizontal component is the actual “working” force required to pull the implement.



Power requirement: The power required to pull an implement can be calculated by multiplying draft force required in Newton's with speed in m/s ($P=F \times V$) and is expressed in Watt.

Power generated: The power available from an animal can be determined by using a treadmill, or by using a dynamometer (load-cell) between the harness and the load (implement, weighed sledge, etc.). One can differentiate between:

- *Instantaneous power*
The maximum power available for a short period (a few seconds)
- *Sustainable power*
The power that the animal can exert for prolonged periods of work (a few hours)

Specific area: The surface area of a cross section of a furrow slice, expressed in m^2

Specific power requirement: This is calculated in the quotient of the average power requirement and the specific area of the furrow slice. Expressed in KW/m^2

Specific soil resistance: The implement and soil parameters, together with the forward speed of operation determine the specific soil resistance. This can be used to give an indication of the efficiency of an implement where different implements are evaluated under the same soil conditions. Specific soil resistance is calculated as the quotient of the average of the horizontal component of the draft force and the specific areas furrow slice.

5.3 SOME POINTERS ON MEASURING TECHNIQUES

Measuring implement draft requirement:

- Specify the soil type and field conditions under which the tests were done
- Specify the soil moisture content
- If possible conduct penetrometer tests to find hard layers
- Ensure correct implement set-up
- Specify implement set-up
- Use experienced operators
- Work at normal speed of operation for animals, unless the aim of the test is to look at the influence of speed on implement performance
- Use properly set-up and calibrated measuring equipment
- Complete testing of a set of implements in 1 day (same soil conditions)
- Repeat measurements at least 4 times if possible

Measuring animal power output:

- Specify the equipment used and the testing conditions
- Ensuring measuring equipment is properly calibrated and set up
- Ensure that the animals are healthy and properly fed
- Ensure that the harnessing is correct
- Ensure animals are working under normal operating conditions
- Use experienced operators

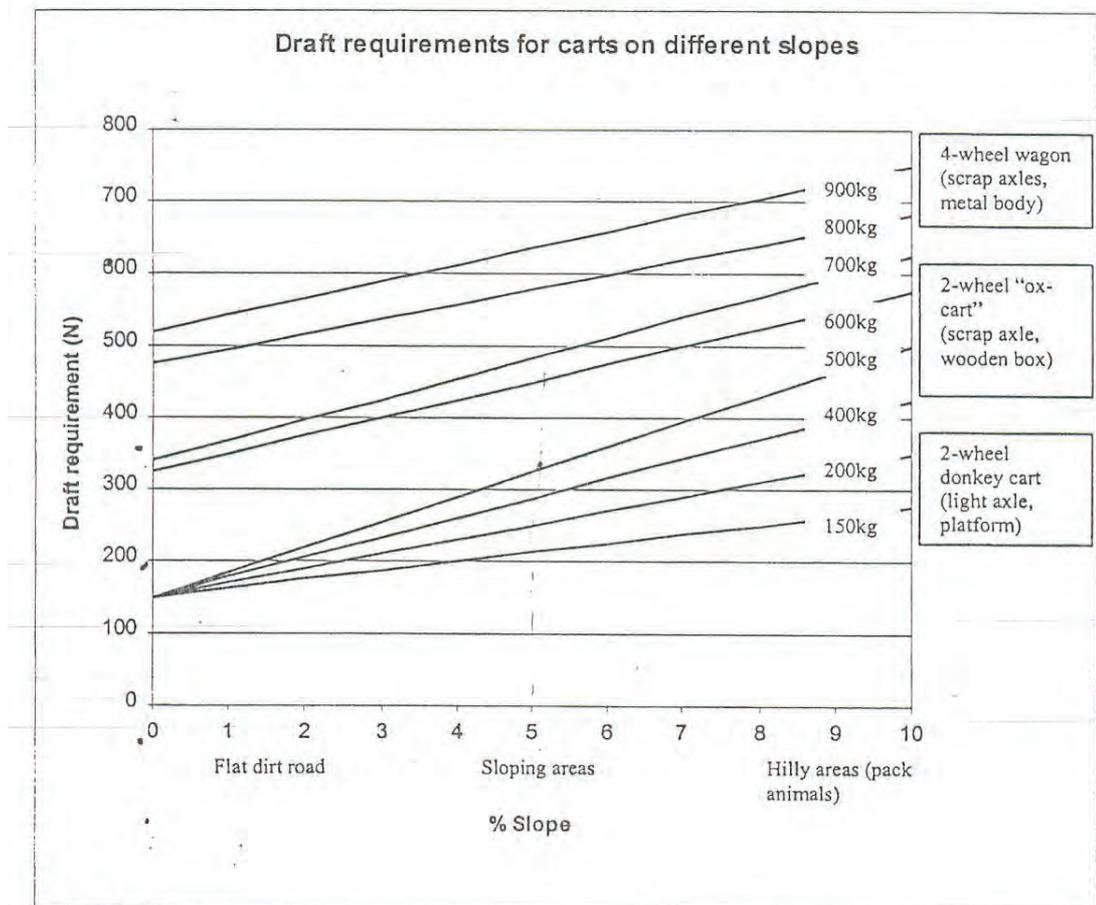
5.4 POWER REQUIREMENT OF DIFFERENT CARTS AND IMPLEMENTS

There are many variables when determining cart and implement draft. This includes operator experience, soil moisture content, soil compaction, type of soil (sand, loam, clay) speed of operation, condition of implement/cart, etc. One can therefore only get average figures for different implements, in other words, draft force needed is between so much and so much or this and that type of soil or under these conditions.

Though these figures are not exact, it still gives a good indication of the draft force needed, and allows the operator to determine how many animals will be necessary for the task in hand.

5.4.1 Carts

The graph below gives general guidelines for the draft required to pull different carts on different slopes. It also gives an indication of the correct proportioned weight of such charts. By reading the draft requirement values from the graph, and comparing this to the draft force available from different animals, the correct animal(s) can be chosen for the job.



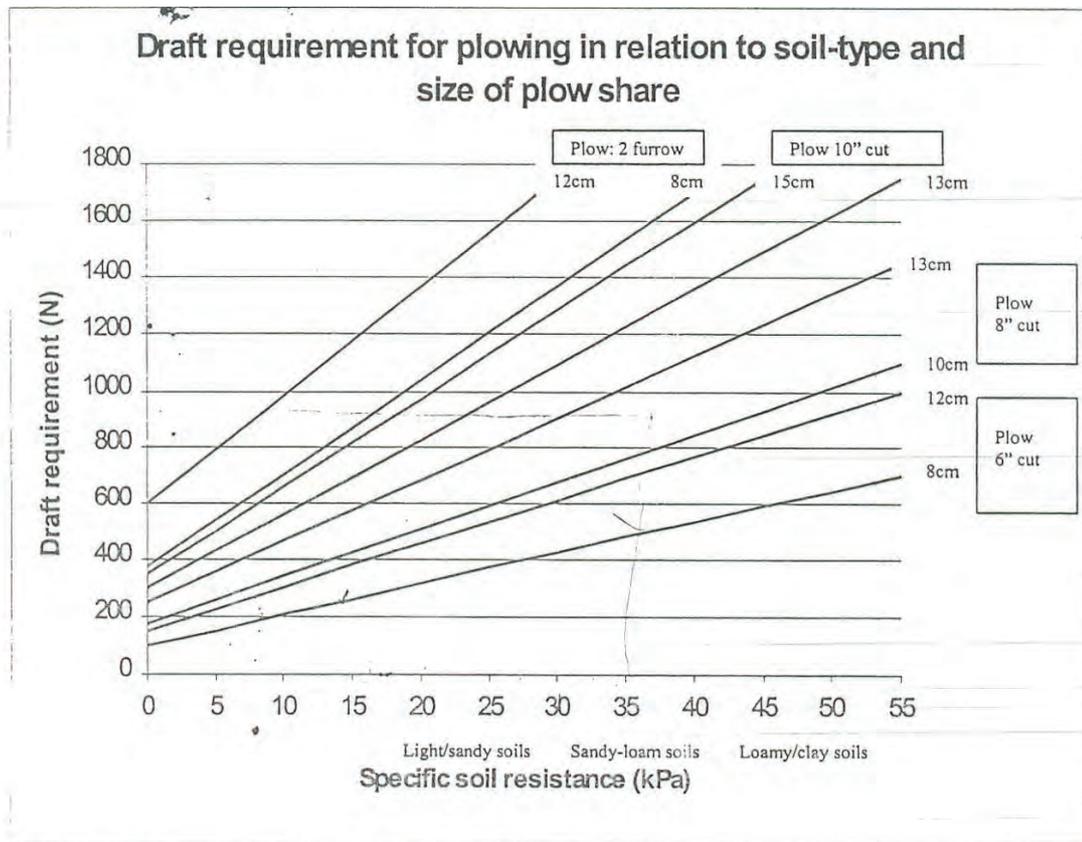
Graph 1

(Source: after Wanders and O'Neill)

Example: in a sloping area with inclines of average 5%, a 2-wheel cart with a wooden box and heavy scrap motorcar axle, weighing 600kg total weight (cart plus load), will require more or less 450N of pull to be moved.

5.4.2 Implements

The following graph gives an indication of the draft requirements of ploughs with different share sizes in different soil types. Once again, by matching the draft requirement of the plough with the power available from the animal(s) or vice versa, the optimum working combination can be obtained.



Graph 2

(Source: after Wanders and O'Neill, information from "Comparative testing of ox-drawn mouldboard ploughs", 1988 to 1991, Palabana, Zambia)

Example: In sandy-loam soils, (specific soil resistance of $\pm 35\text{kPa}$) a plough with a 10" shares, working at a depth of 15cm, requires more or less 1450N of draft force.

Note: the draft requirement figures in the graph tends to be a little on the high side when compared to other research that has been conducted. In practice the draft required might be a little less but one gets a clear indication of the required force needed to pull the ploughs.

Since there is not a lot of information available on the draft requirement of other animal draw implements, the results from trails conducted by Mbanje (Institute of Agricultural Engineering in Harare, 1997) and that of Meijer (Animal Draught Power Resource and Development Programme in Magoye, 1992) are given in Table 5.1 below. The results

of the trails were combined in the table, which will at least give some indication of the force needed to pull these implements. Tests at Matopos were conducted on sandy soils at a moisture content of 1.04% and those of Meijer as specified.

Table 5.1 Typical working depth and draft forces for various implements.

Implement	Working Depth (Mm)	Draft Force (N)	Meijer (Specific Soil Resistance, Kpa)
Ridger (Direct ridging) (Direct ridging) (Direct ridging)	200	900	-
	150	840	-
	130	987	
	100	745	23.3
	100	1 533	54.2
Harrow: diamond : zigzag : triangular (heavy) : triangular (light)	150	570	
	72	580	
	170	770	
	57	530	
	60	370	
Cultivator: 2-tine : 3 tine : lightweight (3 sweeps) : heavy (5 tine)	66	600	
	66	610	
	65	530	
	66	680	

5.5 POWER GENERATED BY DIFFERENT ANIMALS

In the Table 5.2 below, estimates of tractive effort produced by different animals are given. Matching the tractive effort of the animal with the values in the table and graphs above, will allow the user to select the right animal for the certain job. The draft available is also given as a percentage of body weight.

As a general rule of thumb the following percentages of draft force are usually accepted as the norm in international circles:

Donkeys: 18-20% of body weight
Horses and mules: 12-18% of body weight
Oxen: 10-12% of body weight

It is also important to note that for each pair of animals that are hitched, there is more or less a 10% loss in draft power available.

Table 5.2 Power generated by various working animals

Animal	Total weight (kg)	Draft force (N)	% of body weight
Donkey			
Light	125	345.4	27.63
Medium	150	416	27.73
Heavy	190	300	15.79
2 Donkeys			
	250	450	18.00
	300	600	20.00
4 Donkeys			
	601	914	15.21
6 Donkeys			
	821	755.5	9.20
Mule			
Light	200	320	16.00
Medium	600	960	16.00
Horse			
Light	345	415	12.03
Medium	500	630	12.60
Heavy	850	1 060	12.47
Ox			
Light	350	500	14.29
Medium	450	640	14.22
Heavy	900	900	10.00
2 Oxen			
	559	1 200	21.47
	608	1 147	18.87
	700	850	12.14
	780	1 060	13.59
4 Oxen			
	1 178	1 437	12.20
	1400	1 400	10.00

Note: The values given in the table are from actual tests carried out in different countries under varying field conditions and with animals of different temperament, level of training and fitness, ages, and with drivers with different levels of training and experience. All these factors have an influence on the capability of the animals that are being used in this trail. The values in the table for a single donkey for instance vary between 15.79% and 27.73% draft force of body weight.

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