European Journal of Biological Sciences 4 (3): 96-104, 2012
ISSN 2079-2085

DOI: 10.5829/idosi.ejbs.2012.4.3.6648

Strategies for Improvement of Draft Animal Power Supply for Cultivation in Ethiopia: A Review

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Abstract: Improved use of draught animals' power source for agricultural production is the most appropriate and relevant form of strategy for smallholder agriculture due to economical, technical and agro-ecological problems associated with mechanized agriculture. Use of animal power generally enables farmers in Ethiopia to increase agricultural production and hence, contributes a lot towards ensuring food security in the country. Effective use of draught animal power requires understanding of the animals' draught capability, husbandry requirements, nutrition and other factors which influence performance. In this review, strategies or options that enable to improve draught animal power supply which include improvements in working strategies, care and management, nutrition/feeding, healthcare, harnessing techniques and genetic quality are highlighted and discussed. Heat stress, poor nutrition and management and improper harnessing system, the existence of an array of infectious and parasitic diseases are some of the factors that can be attributed for the inefficient utilization of draught animals. The absence of works to improve traits for work performance indicates least emphasis given to promote draught animal power. Finally, possible strategies for optimum utilization and for maximizing the performance of draught animals for agricultural operations in Ethiopia are recommended.

Key words: Cultivation · Draft Power · Ethiopia · Harnessing

INTRODUCTION

Draught animals play an important role in agricultural production and transport sectors in sub-Saharan Africa in general and Ethiopia in particular. Although draught animal power has been superseded by tractors on many of the large commercial farms in Africa, it remains a relevant farm technology in a small-scale agriculture, mainly for economic and agro-ecological reasons. Purchase and maintenance costs of tractors are high in many of the sub-Saharan African countries, whereas animal power is cheaper, locally available and easy to maintain when compared with motorized forms of power. Some cultivatable areas, particularly on hillsides and in steep valleys are inaccessible to tractors and can only be worked by animal or manual power [1].

The majority of farmers in sub-Saharan Africa including Ethiopia practice small-scale mixed farming on areas of less than four hectares. For these people draught animal power offers a feasible alternative power source to manual power in the cultivation of food crops and cash crops. Animal power was introduced in the sub-Saharan Africa over the last century and its use has been increasing in recent years. However, manual labour still predominates. People provide 89% of the power used in land cultivation, while draught animals supplied only 10% of the farm power input. Therefore, for sub-Sahara Africa and many developing countries, draught animals, technology has been qualified as an ecologically sustainable means of increasing agricultural production, reducing human drudgery and improving the quality of rural life. There is a need to promote the use of draught animals in sub-Saharan Africa to fill the gap between the

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Table 1: Draught Animal populations of Ethiopia according to Schwartz and Doli [4]

No	Draught Animals	Number in millions
1	Oxen	9-10
2	Horses	1.6
3	Donkeys	5.7
4	Camels	1.7
5	Mules	1.5

deteriorating levels of food production and the increasing demand for food [2].

In Ethiopia, draft animal power particularly those of oxen is the main source of power for agricultural operations. Unlike most countries of Sub-Saharan Africa the use of oxen for agriculture dates back to several millennia. However, the use and management of draft animals in Ethiopia is merely of traditional and probably is the least exploited. Although the country has huge draft animal power resource (Table 1), did make use of this resource towards ensuring food self sufficiency to the steadily growing population. The prevailing poor management, nutrition, health care and harnessing systems of draft animals are some of the factors responsible for the poor performance and inefficient utilization of draft animal power [9].

The supply of satisfactory levels of draught animal power at the right time for crop production requires sound management of draught animals throughout the year. Relevant features of draught animal management include -adequate feeding, health care and appropriate use of animals to ensure their sustained use on-farm. Adequate feeding to meet the nutrient requirements of draught animals' is a major constraint facing farmers using animals' power in semi-arid areas. Reasonable level of animal productivity can be expected from natural pastures during the rainy season. However, during the long dry season feed resources become increasingly scarce and their nutrient content is low. The resulting feed shortage causes dramatic losses of live weight in draught oxen [2].

To be successful in crop production, farmers using draught animal power need to understand the animals' requirements. Also, efficient use of working animals depends on the capabilities of the animals for work, knowledge of their husbandry requirements and all other factors, which influence their performance [5].

The objective of this paper is therefore;

- To provide a comprehensive review of the different strategies to Improve the efficiency of utilization of draught animal power particularly for agricultural activities in Ethiopia.
- To recommend possible and/or relevant strategies that help to improve the efficiency of utilization of draft animal power as well as the performance of draft animals in Ethiopia.

Strategies for Improvement of Draught Animal Power Supply: The main species of draught animals used for cultivation in Ethiopia are oxen. The use of oxen for crop production in this country dates back to several millennia. Despite the huge draught animal resources of the country (Tables 1 and 5), the use of other species such as horses, donkeys, camels and mules for cultivation are quite limited. In addition to their popularity in the transport sector. Donkeys are being preferred to cattle for tillage in parts of sub-Sahara Africa owing to their better comparative advantages to survive and perform during draught under poor feed recourses [1]. Horses and mules usually used for cart puling rather than ploughing. Camels are used for mining, cart puling and even for draught power supply [4] in Ethiopia. Previous works indicate that donkeys could be cheap alternative draft power sources for tillage if managed and used proper conditions. The use of the huge equine resource of Ethiopia as draft power sources for cultivation will therefore improves the availability of draft power and thus alleviates the problem of draft power scarcity for timely cultivation [3, 6].

Proper Working Strategies: The way draught animals are used the time, level and duration of work greatly determine their health and productivity [2].

Time and Duration of Work: The time of the day determines the work capability of draught animals. If the day is too hot it causes heat stress that will result in less performance. In hot climates, heat loss by convection becomes less effective than in a cool climate and hence the animal has to rely mainly on evaporative losses through sweating and/or panting and/or drooling. Failure to dissipate the heat associated with work limits the amount of work done in a hot climate. The heat accumulated leads to increase body temperature. An increase in RT to 42°C is usually associated with muscular temperature of 44-45°C. Such muscular temperature enhance rapid onset of fatigue due to neuro-muscular disorders leading to decreased performance. To avoid heat stress, oxen should be made to work during the coolest times of the day i.e. early morning (from 6-10:00 AM) and late afternoon (4:00-6:00 PM). The duration of work done by the animals generally depends on; food input or the body condition score (nutritional status),

physiological status particularly in females (non-pregnant cow can work for longer time without being stressed) and time as indicated above. Average working duration for oxen on ploughing that are on good nutrition and body condition is about 5-6 hours per day [7].

Avoid Seasonal Use of Working Animals: In most areas the use of oxen is seasonal associated with the cropping season which is the peak period of work. Thus oxen are almost left idle for the rest of the year. Due to this they will be stressed whenever they are called for work during the next cropping season. Stress effects may lead to increased susceptibility to various infectious agents. This seasonality can be avoided by using draught animals such as oxen for other operation throughout the year, for example for cart pulling to keep them exercised and/or trained throughout the year [1].

Care and Management: Working Horses: It is absolutely essential that horses have complete confidence in being handled by human beings before any attempt is made to train them, for either riding or harness work. With the exception of thoroughbred race horses, which commence training at two years old or earlier, most horses undergo a gradual training up to 3 years of age. This includes teaching them to be led and familiarizing them to bits, rollers and harness. In the fourth year, if sufficiently mature, breaking and schooling for riding or draught purposes can be done [8].

Grooming, which is a general care, is carried out not only for ensuring cleanliness and improves the appearance of the animal but also prevents disease and promotes health. Some important points of considerations during grooming of draft horses include:

- Thorough removal of dirt and dried sweat sticking to the coat using a dandy brush or a wisp of hay or straw. Then a body brush that penetrate through coat and contact with the skin can be used.
- Attention must be given specially to those areas of skin, which are in contact with the saddle or harness fittings where sweat may accumulate.
- Horses should be lightly groomed before going to work but should be given vigorous grooming on their return.

Horses need to be shod to protect the feet from excessive wear when working on hard surfaces, to prevent the wall from splitting and to prevent slipping. Only people who have had proper and sufficient training should attempt shoeing. But all people working with horses should recognize whether or not shoeing has been correctly carried out. The essentials of well-shod hoof are the following [9].

- The bearing surface of both shoe and foot should be level. The shoe rests on the barring surface of the foot which consists of the lower edge of the wall and includes a small part of each of the bars, a white line and small part of the margin of sole.
- The angle of the hoof should be maintained and each side of the foot should be level when viewed from rear and front.
- The outer edge of the shoe should follow the wall.
- Consistent with its ability to withstand wear and tear for a month, the shoe should be as light as possible.
- The minimum numbers of nails should be used and their points should emerge at the correct distance up the wall of the hoof.
- The outer surface of the wall should be untouched except for removing horn for the reception of clips and to make beds for clenches (small hooks).
- The frog, sole and bars should not be pared away, but loose fragments of cartilage can be removed.

Mules and donkeys are used mainly as draught or pack animals and occasionally for riding in other parts of the world. In Ethiopia they are mostly used for pack transport and mules for riding. They can maintain condition on approximately three quarters of the quantity of food necessary to support a horse of comparable size. They tend to be fastidious drinkers, should be watered three times daily and allowed plenty of time at the drinking trough to finish. Although liable to distrustful and intolerant of strangers they are cheerful and intelligent animals and appreciate firm but gentle handling. Housing need not be elaborate; an open shed for shelter in a w ell- fenced paddock supplies all needs. So far as disease control, management, handling and training techniques are concerned the application is the same as horses [10].

Care of the feet of working donkey or mule is important because their ability to work is dependent on their ability to move as in the case of horses. Similar to horses shoeing is required if they are made to work on rough ground surfaces.

Where animals are required to work on hard or metallic surfaces, particularly after a prolonged period at grass, they will almost certainly require shoeing if excessive wear and splitting of the hoof is to be a voided. I n shoeing a donkey or a mule a farrier employs almost exactly the same technique as he does for -the horse- using longer, narrow type of shoe for the mule and a

smaller version of the mule shoe for the donkey. Where mules and donkeys remain unshod and on soft ground it is important to ensure that the feet are given regular attention. The hoof of shod animals should be trimmed at four-to-six week intervals in order to maintain the normal foot axis and the correct proportions of the hoof. As a rule, the feet are inclined to grow higher at the heels and it is this area, which requires the most frequent attention. Each day the feet of all stabled donkeys and mules, whether shod or not, should be cleaned out with a hoof pick-working from the heel towards the toe and removing all dirt embedded in the central and lateral clefts of the frog [9,10].

Some of the recommended management measures for working oxen include the following.

- They should not be made to work or plough on hard surfaces since predisposes to hoof injury. If they must work they should be shod.
- Bullocks should be trained for work at early ages and should not be brought to full work until they are 3 years of age.
- Check and remove pack clay between the claws regularly. Some times stones also enter between the inter-digital skins that predisposes to inter-digital colibacillosis. Stabling area thus should be clean and dry. If wet, the animal will easily be susceptible to physical damages and infections such as mud fever and dermatophillosis.
- Weight estimation should be done correctly for proper dosing, feeding and for determination of draft capability of animals to enable match with the proper implement.
- Castration of working bulls is important because it avoids undesired behavior. In most tropical countries castration is done late about four years of age. This is important for a bull to attain its secondary sexual characters such as heavy short neck, powerful shoulder, stronger musculature, well developed hump sot hat the bull easily fit with the harness [2].
- Oxen should get appropriate feeding regimen according to the amount of work performed (Table 3).

Camels all over the world are neither well managed nor get proper allowance for their nutritional requirements and well being [9]. Modem management of Camels is not well established.

Camels should be trained well and castrated when important. At two years of age they are introduced to the discipline of control by head or nose peg made of wood, bone or very occasionally metal. This is passed through the nose below and towards the extremity of the nasal bones. At first calves merely carry the attachments, but later they are increasingly handled and trained. As soon as head control has been established the young camel is induced to sit and stand at command. The word of command is continually repeated until the young camel kneels in natural position preliminary to subsiding on its hocks and finally to its breast pad. Young camel are then loaded with an empty saddle and later ever increasing loads are mounted on the saddle. Camel are not usually brought in to full work until are six years of age and they may to continue to work until they are 20 years old. All camels under good management should b e retired from work for a definite period each year. This is usually during the rains when the conditions for work are hardiest and there are the best opportunities for browsing and grazing [1].

Camels are castrated to obtain large but docile pack camels. For using them as pack animal they should be castrated at 7-9 years. By this time the hump is not more developed to the same proportion after castration, which would be cumbersome for saddling and loading. Surgical castration is the common method. Castration makes males the best workers. The work of castrated males will not be interrupted by rutting period, because during rutting the working camel usefulness is greatly diminished. It loses appetite, lack body vigor and is exhibitionist, irritable, intolerant of rivals and rebellious of discipline [9].

Proper Feeding Strategies of Draught Animals: Major research components crucial to the formulation of feeding strategies for draught animals, are evaluation of the availability and the nutritive value of existing feed resources, the utilization of the feeds by animals, i.e. how much of the feed can be consumed and how efficiently these feeds are converted in to useful energy and finally the determination of nutrient requirements of draft animals. Until the mid 1980 research on nutrient requirements for working cattle received less attention than that on other classes of farm livestock. This was because of the difficulties associated with the determination of their energy expenditure. Fortunately, during the last decade a great deal of research has been geared towards the elucidation of some fundamental aspects of the nutrition of draft animals (Table 2). The adaptation of portable gas analyzers to measure oxygen consumption by draft animals and the design of instrumentation to measure work performance contributed to the accumulation of a body of knowledge that can form the basis of sound predictions of the work performance and the nutrient requirements of the draught animals [2, 11].

The proper nutrition of draught animals depends up on the amount of labour performed i.e. the heavier the work, the greater should be the amount of easily digestible carbohydrates in the ration. The most obvious extra requirement for draught animals is for energy. This extra energy can have different values according to the use to which the absorbed nutrient energy is put. Since there is no reason to believe that the maintenance requirements of draught cattle differ from those of cattle kept for other purposes, the rationing of such animals becomes simply a question of determining the extra nutrients needed for work [12].

In the absence of direct measurement of oxygen consumption, the extra energy used to perform different activities can be estimated using the factorial method. This method integrates a addictively the energy cost of walking, caring and pulling loads. The energy cost of pulling is fairly constant when expressed in relation to tractive effort and distance. Therefore, this can be accurately predicted if work output is known. Energy cost of walking, which can account for 5 0% of more of the total energy expended for work is more difficult to predict because it is dependent on ground surface and needs to be determined directly [13].

Average draft forces required for pulling a cart with light (300kg), medium (600kg) and heavy (900kg) loads are 360,480 and 550N, respectively. Average draft forces required to plough sandy soils at an average depth of 15cm is 970N. A similar value can be assumed for direct riding of unploughed sandy soils using a mould board plough. Oxen can readily sustain draft force equivalent to 11kgf/100kg their live weight while working, hence oxen weighing at least 150 to 250kg, depending on load, are needed to pull carts in pairs. Farmers are already using young animals for carting in a progressive training process in many farming systems. However, heavier teams are needed for ploughing and ridging. Pairs of oxen weighing about 400kg each are required if sandy soils are to be ploughed and ridged without undue stress on the oxen. The stress is usually from lack of energy for ploughing [8].

The determinants of feeding strategies for draft oxen in semi-arid areas include the availability and feeding value of feed resources, the type and duration of work animals perform the climatic environment and farmers' objectives. Scarcity and low quality of feeds available during the long dry season are the main constraints facing farmers keeping draft oxen in semi arid areas. A high level of supplementation with a good quality of food is required to maintain an animal's live weight and to support a certain level of production. The reduction of losses of live weight during the dry season using low opportunity cost feed and to maintain state of reasonable live weight can be achieved through improved the availability of feeds during the dry season and maximizing the intake and digestibility of such feed [2].

The first action to be taken in this process is to improve conservation of feed resources that are abundant during the rainy season and early dry season. The second action to be taken is to improve the rumen environment so that oxen can better digest the roughage consumed. Smallholder farmers in Asia, but limited in sub-Saharan Africa, have successfully used urea treatment of straw. Fertilizer grade urea is readily available and is not expensive. Block licks containing non-protein nitrogen (NPN) and other nutrients may have the advantage of being consumed at a lower rate and therefore secure a constant supply of nitrogen to rumen microorganisms throughout the day. Legume hays and tree folders may play a crucial role in improving utilization in draft oxen as these feeds supply rumen degradable nitrogen and rumen escape nutrients. They can therefore improve roughage intake. Mineral supplementation using home made mixtures should be encouraged on-farm [2, 6].

During the cropping season options for feeding draft oxen should take in to account the state of body reserves, the duration and intensity of work and the timing of off take of the anima. The energy cost of walking was higher for the animal working on already ploughed soil. In farming systems where cows are used for cropping, they could be teamed up with males so that the female would walk on the unploughed soil. This could minimize the energy requirements for work in draught cows [14].

Energy Requirements for Work: Energy is the most obvious nutrient required in extra amounts in draught animals. The energy used by a working animal in the field cannot be determined directly. However, the amount and type of work along with the live weight of the animal, enables to estimate the energy used for work. The information necessary to make these estimates can be summarized as.

Energy used for work = Energy for working + Energy for carrying loads + Energy for pulling loads + Energy for working uphill.

This formula may be expressed qualitatively as $E = AFM + BFL + W/c + 9.81HM/_D$ Where; E = extra energy used for work (Kj).

A = Energy used to move 1kg of body weight 1m horizontally (J)
F = Distance traveled (km)
M = Live weight (kg)
B = Energy used to move 1kg of applied load 1m horizontally (J).
L = Load carried (kg).
W = Work done whilst pulling loads (km).
H = Distance moved vertically upwards (km).
C = Efficiency of doing mechanical work (work done/energy used).
D = Efficiency of raising body weight (work done raising body weight/energy used) [7].

The operator, the task being undertaken, the length of the working day, weather and health state of the animal will influence distance traveled during work. These all in turn determine the extra daily energy requirement. Animals working hard for short periods may require less energy than those working steadily for longer periods. For example an animal pulling a loaded cart can have a higher energy requirement than one ploughing, although the later travels greater distance in a working day. The energy costs of walking, pulling and carrying have been determined for most of the animals used for work. Energy costs of pulling and carrying do not change with changes in the surface over which the animal works, however the energy cost of walking does change. It can increase four-fold when an animal walks on soft or water logged ground, compared with when it walks on hard ground. Similarly when ploughing, the animal walking in the furrow can expend up to 20% more energy than the animal walking on the undisturbed, unploughed land. These factors need to be taken in to consideration when thinking about daily energy requirements for a particular animal or task Estimates of daily energy requirements for work vary, but when expressed as a multiple of maintenance, the extra energy used for work in a day is relatively low. Even under conditions of good feeding and management, working ruminants rarely expend more than about 1.8 times maintenance in a working day [8, 10].

The working animal with the highest energy requirement for work is the large draught horse, which because of its size, has a high draught capacity and can therefore work for longer periods of time in a day than a smaller animal. Donkeys seem to work effectively for only 2-4 hours at a time in crop production activities. Draught animals generally lose weight during the working season unless additional supplementary feed is given. Millet, sorghum, maize and rice are the staple crops grown in rain fed agriculture in the sub-Saharan Africa. Providing such supplement feeds for a short or a long period before ploughing was equally beneficial. Concentrate feed is the ideal supplement to feed with the bulky staple diets of working animals, being a high- density source of energy and easily consumed by the animal before and after work [1].

Energy Requirement of Working Cattle: Actually the extra requirement for energy varies depending on the type, level and duration of work as well as on the prevailing working condition and such as soil, climate, harnesses and implements used. Working cattle require 130-170% of their maintenance energy requirement for work. That means 1.3-1.70 times more energy than the maintenance energy need [15]. Estimates of the energy requirements of working cattle are summarized in Table 2 and 3.

Energy Requirement For/Working Equidae: In Horses energy requirement depends on depends on intensity and duration of work, environmental temperature and the size of the load that the horse is carrying. In donkeys, the maintenance energy requirement is almost the same as ponies and small horse breeds.

Table 2: Energy requirement of cattle for maintenance and percentage extra energy requirement for work

	Body weight in Kg			
Energy Requirement	200	300	400	500
Cattle				
Maintenance (MJME/day)	27	37	46	54
Extra energy requirement above maintenance %				
2 hrs work	18	20	22	23
4 hrs work	37	41	44	47
8 hrs work	74	82	88	94

Source: Bamualim and Kartiarso [11].

Table 3: Feeding standards for bullocks

	Normal work		Heavy work	
Live weight (kg)	DCP (kg)	TDN (kg)	DCP (kg)	TDN (kg)
200	0.24	2.0	0.25	2.7
300	0.33	3.1	0.42	4.0
400	0.45	4.0	0.57	4.8
500	0.56	4.9	0.71	6.4

Source: Singh and Moore [16]

Table 4: The estimated maintenance and work energy requirement in camels

Maintenance	Energy required in (MJME/day)
500kg breed male	54
400kg breed female	45
Word	
1 hour Work of 500kg draught or pack transport	8.2

Source: Wilson [10]

The energy for work depends on similar factors as that of horses and also on the nature of the ground. Energy requirement of mules is not well done and is given roughly as daily feed allowances. It is estimated that a medium size mule on medium work should get 2.7-5.4 kg of energy concentrate per day and 4.5-7kg roughage per day.

Energy Requirement for Working Camels: Compared to other animals for maintenance, they have higher energy need (Table 4). This is due to t he fact that camels spent much energy and time in search of feed and water which is considered as part of its maintenance energy [13].

Requirements for Proteins, Minerals and Vitamins: There seem to be no extra requirement in working animals over and above those contained in the extra feed needed to supply the extra energy needed. Exercise seems to have little effect on urinary nitrogen excretion in man or sheep but no work appears to have been done on draught animals. If a working animal is not to loose weight, it must consume more energy giving foods and this will almost certainly involve consumption of enough extra proteins since most energy feeds have certain amount of protein or NPN. In the case of an underfed animal, the release of body reserves to meet the animal's need for energy will also involve the release of sufficient extra proteins. Therefore, there seem to be no need of supplementing proteins for draft animals except in cases of injury and heavy work where proteins are required for tissue repair and replacement of mobilized tissue proteins for energy, respectively [7].

Except for salt, the requirements for most minerals is not significantly affected due to work. Working animals loose much salt a long with sweat particularly when working in very hot climates. Thus, extra salt is required to replace that lost in sweat. There is no significant increase in vitamin requirements in response to work. However, during heavy work requirements for vitamin B-complex may increase due to their role in energy metabolism. Such increases usually does not necessitate for dietary supplement as these vitamins could be synthesized by the microorganisms residing in rumen and colon [7, 15].

Health Management of Draught Animals

Health Problems Associated with Work: Like all other animals, draught animals suffer from common health problems of livestock. However, in addition to these problems, they also suffer from specific health constraints associated with work [13]. These include; yoke galls, back sores, horn injuries, loosening of patella, hoof injuries and cancer. Factors that predispose draught animals to these specific health problems include first made to work for long periods in their life, the frictional force between the harness and animal will be exaggerated if inexperienced animal is used for work due to unsteady traction, excessive pressure exerted by the weight of the load for long periods on the hump or on the back, inadequate padding under the harness, excess and unbalanced load on the back of animals, working on hard and stony ground surfaces and beating by inexperienced operator and working with a single harness for different animals [8].

Management practices to prevent or reduce health problems associated with work include: short initial working periods until the animal develops resistance and avoid use of too young animals for work particularly bulls, keep the skin clean that makes contact with the harnesses, the harness should have broad and smooth bearing surfaces, the skin should be greased when animals are made to working during rain, draught animals should be shod if they are made to work on hard surfaces, proper wound management (Rest and prevent complication) and avoid use of same harness for different draught animals [13].

General Health Care of Draught Animals: Routine health care is required for draught animals similar to those animals kept for other forms of production to prevent stress and subsequent loss of health so as to ensure that an animal can carryout timely work. The major health problems of working cattle are; CBPP, Cowpox, Anthrax, Black leg, Lumpy Skin Disease (LSD), Hemorrhagic Septicemia, Trypanosomosis, Babesiosis, Cawdriosis (heart water), Helimenthosis, Exoparasitis and Gastrointestinal disturbance of nutritional origin. Major diseases of working equidae include; African horse Sickness, Anthrax, Tetanus, Strangles, Helimenthosis, Exoparasites, Gastrointestinal disturbance of nutritional origin and Trypanosomosis and those of working camels are; Camel pox, Camel Papillomatosis, Trypanosomosis, Hemorrhagic Septicemia, Anthrax, Exoparasites and Helimenthosis [17].

Control and preventive measures of common health problems of draught animals can be done through Vaccination, use of prophylactic drugs, strategic deworming and routine application of acaricides and treatment of individual cases [16].

Improving Harnessing System: The efficient utilization of animal- drawn implements depends on the effective deployment of the animals' strength and muscular energy. Such deployment is inevitably influenced by the harnessing system. Poor harnessing• results in a reduction in animal-implement performance through needless energy losses [4]. A good harness should be the one easy to attach and remove simple and cheap (usually made locally). Harness should be adjustable; it should help but not hinder the control of animals as must be compatible with the hitching system used. A poor harness is one that injuries t he animal and/or hinders natural movement, breathing or blood circulation. To improve poor harnessing, it is better to modify existing equipment rather than promote radical change [12].

Avoidable skin wounds are a source of continuing frustration for those concerned with donkey health and welfare. There is often a sense of despair that donkey users fail to make a cause and effect link between protruding pieces of wood or metal and a wound on the donkey. Many groups are sought to produce improved harnessing but their cost and complexity has almost always lead to their rejection by donkey users. Legislation has also failed in several countries to improve the standards of harnessing. Happily there are examples (e.g. Northern Province, South Africa) where breast-band harnesses that cause fewer saddle sores have been produced at lower cost than those normally available for sale in markets [12, 18].

Work on improving carts is most likely to be successful where modifications to existing designs are attempted rather than the introduction of a markedly different design. Attention work on improving carts is most likely to be successful where modifications to existing designs are attempted rather than the introduction of a markedly different design. Attention to simple braking systems on existing designs could markedly reduce the number of injuries donkeys suffer in hilly areas [12, 19]. Awareness and the need for attitude change remain the key issues in making improvements in harnessing and hitching. Education as encouragement centered on the adoption of improved measures remains the way forward.

Improving the Genetic Potential of the Existing Livestock for Draught Purpose: Local breeds have and irreplaceable characteristics that cannot be found in any "exotic" breed such as full adaptation to local environmental, parasitical and sanitary situation. Their drawback is usually the low level of performance. The main routes for improvement genetic quality are the use of crossbreeding with semen of improved breeds and improvement of local breeds through selection and breeding [19]. The most important feature of improvement of animal performance through genetics is once a good genetic potential is achieved, it is used as a resource for several generations. Unlike genetic improvement, other improvement strategies such as improvements through management, health care, feeding and harnessing systems all need continuous input [20, 21].

Some of the strategies to improve the genetic potential of cattle for draught power output are:

- Selection and breeding of large sized as well as better performing indigenous cattle. Size is an important trait in draft animals since it is a function of draught capability. However, this strategy requires longer period.
- Cross-breeding. This is process of crossing exotic European breeds with the zebu.

This is being used in Ethiopia to improve milk production. It can also be used in cattle for improvements of draught power because the cross bred offspring are known for their higher draught capability than zebu. However, cross-breeds are less heat tolerant and hence people complain that these breeds are not acceptable. But performance than zebu. Moreover, F_1 Crossbreeds appear to be less susceptible to yoke injuries than zebu cattle [15, 21].

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