On-Farm Verification of Improved Donkey Drawn Carts

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Abstract
Metallic wheeled and pneumatic tired animal drawn carts modified by Bahir Dar Agricultural Mechanization Research Center were evaluated under farmer management condition. Medium sized and strong donkeys that are house fed and/or grazing were used for the test purpose With estimated cost of 1005 ETB and load capacity of 2-4qts under gravel, farm and slightly sloppy fields for a distance 5-10kms, the pneumatic wheel donkey drawn cart is preferred than the metallic wheel type. It is estimated to generate additional income of about 2400 ETB annually. The cart is also found advantageous over the use of a single packed donkey and locally used cart on different soil types and seasons of operation. It is also comparatively advantageous over personal carriage and donkeys back transport, which can manage to carry not more than 7-10kgs and 25kgs, respectively, for the specified distance in the locality. It is thus recommended to popularize this cart but with some modifications on the paddle, support frame, length and width of beams, axle and longitudinal planks.

Introduction

Donkeys are most widely used as pack animals in different parts of the country. They provide pack services, carrying different commodities weighing 60–100 kg up to a distance of 15-20 km for duration of 4–5 hours. Observations undertaken along the main roads to and from Addis Ababa revealed that the use of donkeys is directly related to the distance covered. On the Gojjam and Dessie roads goods are transported by donkeys than by people while on the Ambo Road more people carry goods than donkeys (Feseha et al. 2008). In Amhara Region, especially in the rural areas, in-land travel involves transport of goods and is mainly done by pack animals, or humans using head and/or back carrying. Though donkeys are used for transporting of loads, they are rarely used for carting in the region (Geta, 2008). Lack of appropriate sized cart, along with other problems made donkeys little used in carting.

There are, however, some localities, especially in the rift-valley parts of the country, which are using donkeys for driving small carts. Locally made, metallic wheeled donkey drawn carts have been utilized in these areas for long. Melkassa (Nazerat) based Agricultural Mechanization Research system (AIRIC) has tested these models under dirt track field conditions and developed improved designs. These improved cart models were brought to Amhara region and distributed in East Gojjam areas through the extension package. But farmers have pointed out different design problems on these carts. Based on such

comments and test results, further improvement has been made by Bahir Dar Agricultural Mechanization Research Center (BAMRC) on these models for making them suited for local conditions. Comparative test was conducted on this modified cart models on flat areas of the region, on gravel and farm roads, and they have been found performing best compared to the AIRIC models (Wolelaw, 2006). These improved models, however, were not demonstrated for farmers and their performance was not measured under farmer's management condition. Thus, this improved design, with pneumatic and steel wheels, was given to farmers to verify performances and suitability under the specific local condition and create awareness among farmers and important data has been taken.

Material and Methods

Demonstrations were held in Metema and Enemay woredas. Twelve modified carts, out of which six are pneumatic and the rest metal wheeled, were produced and one pair (one cart from each) was given to neighboring farmers to comparatively evaluate their advantage. The carts were tried on dry and wet conditions in flat and farm roads. The carrying capacity and distance covered in the demonstration was considered after a service of one and half year. Donkeys that are house fed/grazed were used for the demonstration. Group discussions were held to gather opinion of beneficiaries.

Result and Discussion

Local transport

In the demonstration areas people use personal carriage and packed donkey to transport their small loads. Local made donkey drawn cart, named *karu*, which is produced in Sudan, is also used in Metema area. As farmers disclosed, a person can carry a weight of 7-10 kgs while a donkey is capable of transporting up to 25 kgs for a distance of 5-10kms. Karu cart, whose platform or loading unit is lowered from the pulling beams, has a similar carrying capacity to that of the modified pneumatic cart which, however, depends on donkey's physical condition and the status and compaction of the road.

Figure1. Karu cart as used for different purposes

According to farmers saying, the cost of transporting goods (to specified distance) by pack donkey is about 4 ETB per trip, while Karu carts, whose a purchasing price was about 2600 ETB, and which is heavy, require monthly maintenance cost of about 75ETB (users in Metema) demands more payment for longer distances. Whether rented or used by the owner, however, a Karu cart earns similar amount as to that of the pneumatic type improved donkey drawn cart.

Steel wheeled carts

Though the steel wheel cart is assumed to be of paramount importance to farmers under conditions of gravel and farm roads, its performance was seen to be highly un-satisfactory. The heaviness of the wheels made it difficult to be easily drawn by the animals. It also gets deep to the ground where ever there is crack and unable to pass any obstacle under the prevailing conditions.

Figure 2. Steel wheeled donkey drawn cart

The wheel was not strongly fixed to the axle, createing undulating movement in farm road conditions. It also has high rolling resistance as it is seen heavier to move. Breakage and detachment of some parts has been observed frequent requiring frequent maintenance increasing overall usage costs. Moreover, its movement creates strain and discomfort to the donkey. Due to its greater maintenance cost, higher discomfort for the donkey and difficulty to be easily drawn in different field conditions, farmers has shown little interest in using this cart and was left out immediately. Thus it bears no acceptance under the current status.

Pneumatic wheel

Figure3. show the lower part of the pneumatic wheeled donkey drawn cart. The purchasing price of this cart was1005ETB.Used for transportation in town and trips on marketing days, held once in a week; a pneumatic tire cart earns about 200 Birr per month. After a year and half service, the cart was found having a carrying capacity of 2-4qts for a distance of 5-10kms. Medium and strong donkeys that are house fed and/or grazing were used for the trial.

Figure3. Pneumatic wheeled donkey drawn cart

Table1. Partial budget analyses of different transport systems

1. Partial budget of pneumatic tired verses packed donkey transport

Additional costs	Additional benefits
Dp =90 ETB	GP=2400 ETB
Mp= 27ETB	
Lp=720 ETB	
Reduced returns	**Reduced costs**
Pk=192 ETB	-
(A)Additional costs and reduced returns=1029.00	(B) Additional benefits and reduced costs=2400.00

Net benefit=B-A=2400-1029=1371.00

2. Partial budget of pneumatic verses local karu cart

Additional costs	Additional benefits
Dp =90 ETB	Gp=2400 ETB
Mp=27 ETB	
Lp=720 ETB	
Reduced returns	**Reduced costs**
Gk=2400ETB	Dk=234 ETB
	Mk=900 ETB
	Lk=720 ETB
(A) Additional costs and reduced returns= 3237.00	(B) Additional benefits and reduced costs=4254.00

Net benefit=B-A=4254.00-3237.00=1017.00

It is found preferable even to locally used cart, Karu, as its weight is relatively simple. It is comfortable for the transportation of fruits, vegetables and packed soft drinks along with the normal transport of sacked loads. Low purchasing price along with less maintenance requirement makes it more preferable than the locally used ones. However, some users especially those at Metema suggested that the platform should be lowered in similar manner to that of the Karu type, It was also observed that since the wheels used were small in size, they were easily obstructed by small stones, tree roots, and simple rugged surfaces. Besides their short and narrow beams create sliding of load to the back of the cart and create discomfort to the animals. The cart also lacks supporting side boards creating load instability and problem to tighten the load. Moreover the pad was not sufficient to avoid strain on the animals. The average economic benefit received from pneumatic wheeled cart is higher than that of Karu and the most locally used packed donkey transport. Thus with intended modifications, pneumatic donkey carts can serve good for rural load transport.

Conclusion and Recommendation

Regardless of the relative advantage, it is important to consider the suggestions made and introduce modifications to fully and widely utilize the implement. Hence

- Change the size of the pneumatic wheel to larger one (like 7.5*1.6 inches) to avoid surface obstruction and increasing load capacity
- The width of the cart at the front, which was 36cm during the test, should be increased to 50cm.
- Construct the frame of the bed 30cm far from the rear side of the two beams
- The length of pulling beam should be about 3meters ; 1meter at the back and 2meters in front from the center of the shaft
- Padding material should be smooth to avoid strain on animals
- The bracket should be positioned in such a way that it reduces pull back or hanging of the donkey, especially at inclined roads, and decreases vertical load on the animal
- Popularization and demonstration should be continued after improvement

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