Horse Bunching of Whole Trees from Thinnings on Flat and Sloping Terrain

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ABSTRACT

Productivity of horse bunching of whole trees from early thinnings was assessed by means of time studies, using a hand-held micro computer. Productivity which varied from 2.8 to 8.8 steres/hour was found to be dependent upon loadsize and terrain conditions (A stere = cubic metre of loose chips). Suggestions are made for improvements.

BACKGROUND

Project Group CPC7 of the International Energy Agency (Felling and bunching of small trees on gentle terrain using small scale equipment) showed interest in the bunching of whole trees from thinnings by horse. As one of the overall objectives of CPC7 was mutual co-operation and exchange of information among its nine member countries, a small study of horse bunching of whole trees was undertaken by representatives of two countries vis P. Kofman (Skovteknisk Institut, Denmark) and H. Phillips (FWS Ireland).

INTRODUCTION

Chipping of whole trees from forest thinnings has become increasingly popular in the heath districts of Denmark. The chips are used for energy purposes eg. heating. Stands are first row thinned to afford access to a tractor-mounted chipper which travels though-out the stand. However in Eastern Jutland, and on some of the islands, as in many parts of Ireland, it is not possible to row thin for various reasons, including windthrow etc. In such areas trees for chipping have first to be concentrated at roadside or strip-road. Skidding by horse is one possible way to achieving this. The method has been studied previously for flat terrain condition (Dekking 1984). This current study embraces both flat and sloping terrain using the same horse and driver.

STAND DESCRIPTION

Two stands of Norway Spruce (Picia abies) in Silkeborg Forest, were chosen for the study (Table 1). One was on flat terrain while the other was on sloping terrain. The trees had been felled by chainsaw and manually bunched in May of the previous year.

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Table 1: Stand Data

Stand Number	Silkeborg 84e	Silkeborg 283/284
Tree Species	Norway Spruce	Norway Spruce
Age	25	23
Stems/ha - before thin	6,370	4,400
Stems/ha — after thin	3,300	2,270
DBH(cm) of thinning	4.6	4.7
Height(m) before thin	6.8	10.0
Slop (%)	0	25
	(Silkeborg 84e = Flat Terrain)	

The thinning in stand 84e was heavy and was in contrast with stand 283/284 which received a moderate thinning from below.

In the stand on flat terrain the trees had been manually bunched into piles of between five to eight trees; while on the sloping terrain piles were only three to four trees. In both stands the trees were bunched between the rows (Fig1) in alternate rows. The rows were brashed to allow easy access for the horse.

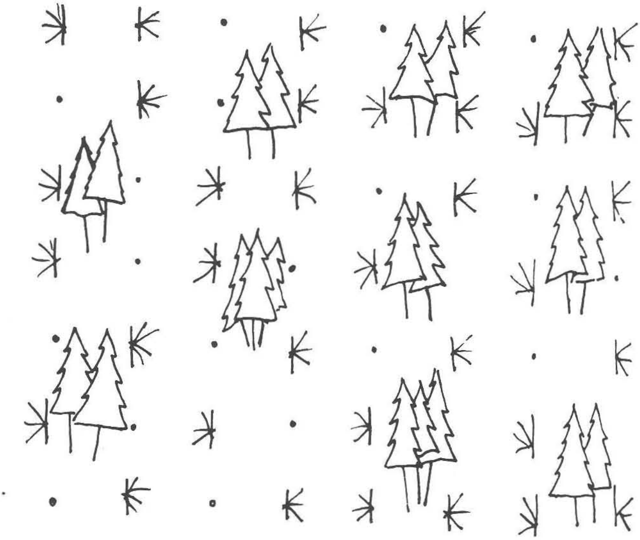


Fig 1. Felling Pattern.

Method of Working

The horse was driven into the stand and steered to the bunch/pile to be extracted. The horse was turned, the load chokered using a singly choker chain and the horse then driven to roadside. At roadside the horse and load had to be turned though 90°, positioned and the load unchokered.

During the study attempts were made to attach more than one bunch behind the horse. This failed as it proved impossible to skid one load into another. The bottom load was continually shoved aside due to the light weight of the trees. In some instances the horse driver manually dragged trees from one bunch to another in order to increase his loadsize.

In the stand on sloping terrain some additional manual bunching was done prior to the time study to increase the range of load sizes.

Horse and Equipment

The horse studied was a large draught animal weighing around 900kg. and well experienced in forest work. The harnessing and chokering equipment are show in Fig 2. One point to note is the use of the chest strap, as opposed to the neck collar which is traditional in Ireland.

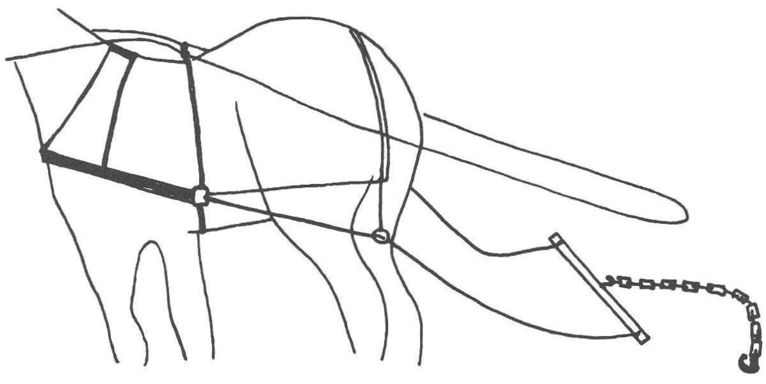


Fig 2. Harness and chokering equipment.

For this type of work, especially on steep and sloping terrain a smaller horse eg. Fjord or Irish Draught would probably have been more suitable and performed better. The loads were never so heavy that the horse had to use great power but it had to carry its own considerable weight uphill all the time. Also the size of the horse proved a disadvantage in manouvering in such close conditions.

TIME STUDY TECHNIQUE

In the field a small hand-held Husky micro computer was used to record time study observations and ancillary data — loadsize, distance etc. The Husky was pre-programmed using a software package developed by the Skovteknisk Institut. This package consists of a time study module for recording element times and a data collection module. The programme permits the recording of up to ten time elements, data imput and correction, also simple "in the field" data analysis and file handling.

The extraction cycle was broken down into four basic elements:

1. Travel idle
2. Load
3. Travel Loaded
4. Unload.

While these elements proved sufficient for the study in question, it was felt that in future studies, travel idle and travel loaded should be divided to include separate elements for time in the wood and time on the road.

No rating was carried out on the observed times. This absence of rating is standard practice in the Nordic countries (NSR 1978), unlike in Ireland where rating is standard practice.

Two time studies were taken, one on flat terrain and one on steep terrain. This latter study was divided into two parts (Steep 1 and Steep 2). In Steep 1 the presentation of the pile as found on the site was accepted. In Steep 2 some additional manual bunching was done prior to the study to increase the average loadsize and to increase the range of loadsizes to discover what affect loadize had on overall cycle times.

An allowance of 50 per cent was added to the observed times to cover rest and contingencies. Details of the studies are given in Table 2.

RESULTS

For analysis purposes the data relating to distance were adjusted to a base of 20m to enable direct comparison to be made between studies. Simple linear regression revealed a strong correlation

Table 2: Time Study details (allowances included)

Study No.	Stand No.	Terrain	No. Obs.	Trees/ Load	Steres/ Load	*Steres/ Hour	Cycle Time (min.)
1	84e	Flat	40	6.2	0.335	6.04	3.28
2a	283/284	Steep	21	4.0	0.216	3.69	3.46
2b	283/284	Steep	31	6.1	0.329	4.91	3.93

*Note — All distances adjusted to a standard 20m.

between total cycle time and the number of trees per load for both flat and steep terrain (Fig 3). This relationship can be explained by the fact that loading time was strongly related to the number of trees per load ($R^2 = 0.80$). As was expected, unload times were found to be independent of loadsize.

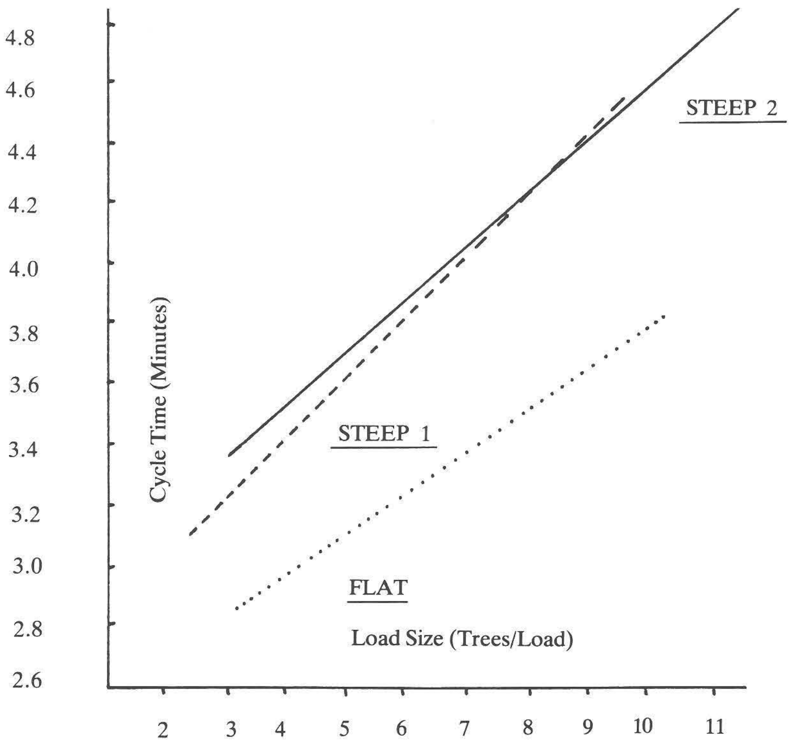


Fig 3. Cycle Time v Loadsize

A significant difference for cycle time versus loadsize was found between the flat and steep terrain (Fig 3). This can be explained by two factors: firstly the increased time level taken to travel unloaded uphill and secondly the additional time taken to choker the loads on the more different steep terrain.

Output in steres was greater for the flat terrain and averaged 6.04 steres/hour. On the steep terrain (all data) output averaged 4.58 steres/hour, a reduction of some 24 per cent. The critical factor apart from ground conditions affecting output is loadsize (Fig 4). The additional manual bunching for the second time study on the steep terrain resulted in an increase in productivity of some 33 per cent. Loadsize reflects the felling and bunching patter undertaken in the stand and is to a large extent controllable at time of felling.

It is interesting to note the range of output on flat terrain compares very favourably with previous studies (Dekking 1984).

SUGGESTIONS FOR IMPROVEMENT

In general terms improvement can be effected in two ways — by increasing productivity and by reducing costs. In this instance both can be done.

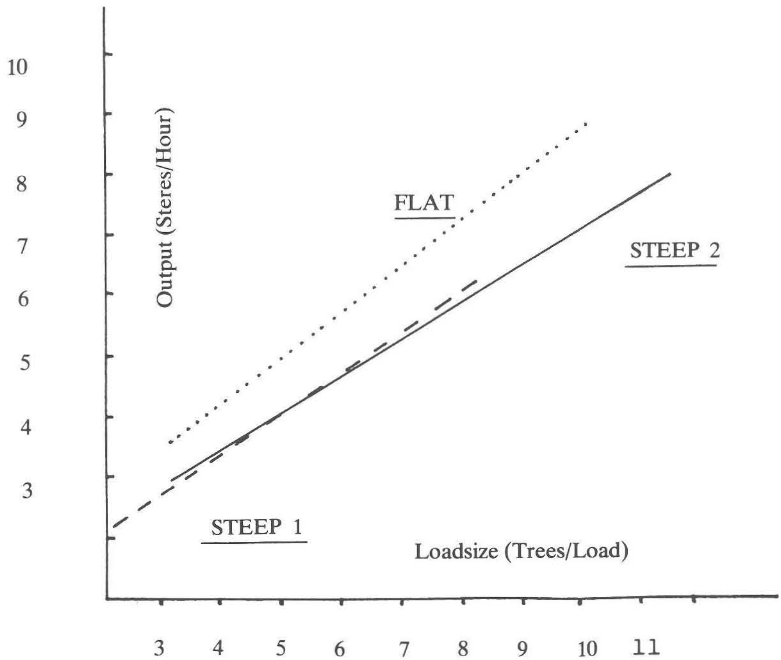


Fig 4. Output as a function of Loadsize

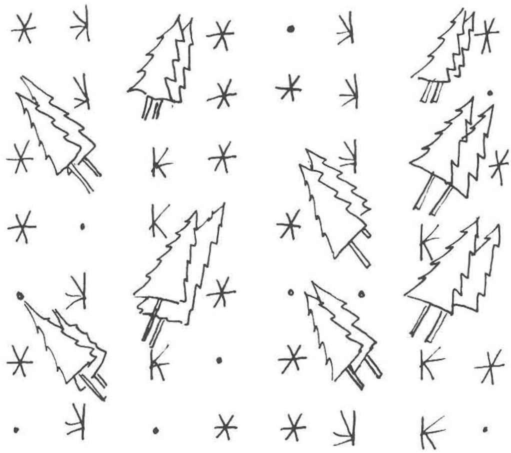
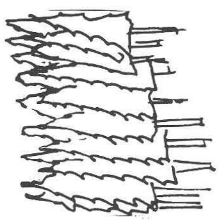


Fig 5. Herringbone Felling Pattern

Present Method



Proposed Method

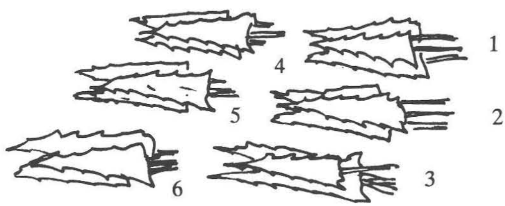


Fig. 6. Unloading at roadside

The productivity of the skidding operation can be increased by increasing the average load size. This in turn can be achieved by changing the felling pattern. At present, every second space between the rows is used for bunching the felled trees and all of the trees along this track have to be brashed. Also as all the bunches lie directly in line it is impossible to load more than one bunch at a time. By adopting a herringbone felling pattern with the butt ends projecting into the rack, loads could be accumulated and loadside increased (Fig 5). This pattern would also permit greater distances between extraction tracks, thus resulting in a 50 per cent decrease in the cost of brashing. Felling costs would change only slightly. Another possible advantage of the herringbone pattern is the likely reduction in damage to the stand.

At roadside a problem arose as regards the area required for unloading (Fig 6). At present with the light loads it was very difficult to place loads alongside one another. With the larger loadsizes for the herringbone pattern which should be compacted during extraction this problem should be over come.

At time of chipping, with the present system of unloading at roadside, the tractor driver is faced with a wall of trees with their butt ends almost in line. If a grapple, full of trees, (they may come from different loads) is pulled towards the chipper many additional trees will follow and end up lying beside the infeed opening leaving a mess which is difficult to clear away. This could be over come if the horse driver could leave the load staggered (Fig 6).

CONCLUSION

Skidding of whole trees from thinnings by horse has potential. Output varied from 2.4 to 8.8 steres per hour and was dependent upon loadsize and ground conditions. Productivity can be increased and costs reduced by adopting a herringbone felling pattern and by changing the pattern of unloading at roadside.

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