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The proportion of transport and transport costs in grassland farming in the middle-German uplands

Grassland farming in the conditions of the middle-German uplands is characterised by inefficient farm infrastructure which leads to higher costs. Large steading-field distances also mean that problems of transporting low yields in forage harvesting over long distances in a relatively short time have to be overcome. From 10 to 30% of the total required working time requirement is spent in transport. Especially where transport distances are long, increasing the load per journey leads to a reduction in working time. Only a 100% utilisation of new machines, which is hardly possible on an individual farm, led to lower working costs in comparison with the use of second hand machines in farm-specific utilisation. Because of this application of machinery sharing between farms is the medium of choice.

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Keywords

Grassland management, farm-field-distances, mechanisation, field-sizes, transport, operation costs

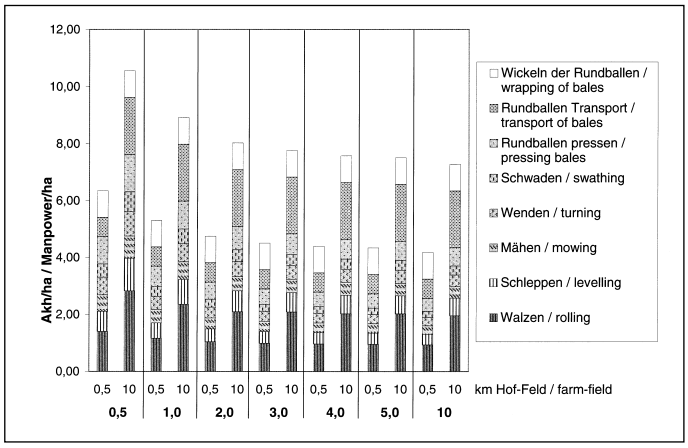

Fig. 1: Labourrequirement (MPh/ha) for wilted silage at different field sizes and farm-field distances

The part-project "Technique, equipment and plant/farm building systems for grassland farming with livestock in peripheral regions" of the special research sector (SFB) 299 was presented in LANDTECHNIK 3/2000. There, the costs involved in all important procedural operations in grassland farming were presented using the example of silage production with self-loading wagon in association with field size, steading field distance as well as machinery utilisation and mechanisation form.

Reflecting the greater proportion of pastureland in the peripheral region "Lahn-Dill", the farms in the investigation specialise in forage production with silage and hay for livestock enterprises. This poses the problem that at harvest very large amounts of forage have to be transported in a relatively short time. The aim was to calculate the costs of transporting round bale silage from field to steading in an investigated farm in Lahn-Dill-Bergland as proportions of total costs.

The methods for calculating the farm specific working time requirements and the procedure costs, as well as the carrying-out of model calculations for the different field sizes and field-steading distances were described in the above mentioned edition and will not be repeated here.

Investigated farm

The grassland farm involved ran suckler cows with inwintering and summer grazing and covered 91.7 ha and, for the region, enjoyed favourable conditions. The larger fields (average size 6 ha) nearer the steading were used for grazing. The average size of the meadows was 2 ha and of the forage fields 1.6 ha. The meadows were 3.5 km from the steading and the forage fields 1.7 km.

The following machinery was used on the farm for grassland work: Trac-tractor 111 to 130 kW; 4-wheel drive tractor 60 to 74 kW; rear wheel drive tractor 49 to 55 kW; wheeled loader 1 m^3, 7 t, 56 kW; grass roller 2 m, grass train 5 m, front-mounted rotary mower 2.80 m, rear-mounted rotary mower 2.80 m, rotary swath turner 4.50 m, rotary tedder 6.30 m, round baler 1.20 m, wrapper for big bales up to 400 kg, double-axle 2-sided tipper permitted load 8.0 t (52 dt), low loader 12 t, round bale grips for front loader, fully hydraulic 1.5 t front loader for 60 kW.

Total required working time

Shown in figure 1 are the required working times in man hours/ha in association with increasing field size for field steading distances in each case of 0.5 km and 10 km for all parts of the procedure of round bale silage production including pasture husbandry.

With a field-steading distance of 0.5 km the total working time requirements in association with field sizes was between 6.4 and 4.2 man hours/ha. With 10 km these were between 10.6 and 7.3 man hours/ha. With the

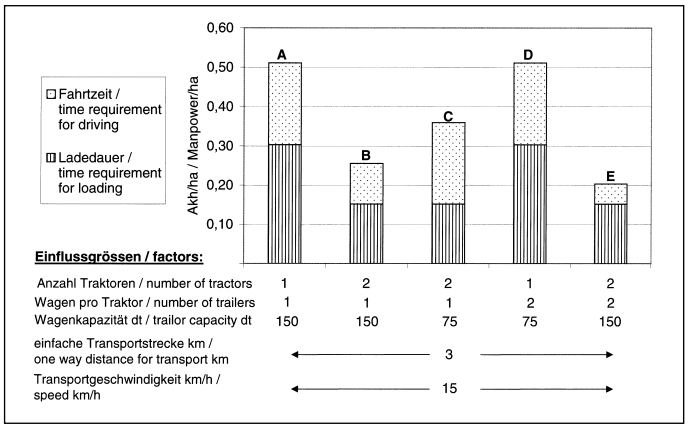

Fig. 2: Time for travelling and loading (MPh/ha) for transport of round baled silage 78 dt/ha depending on different factors

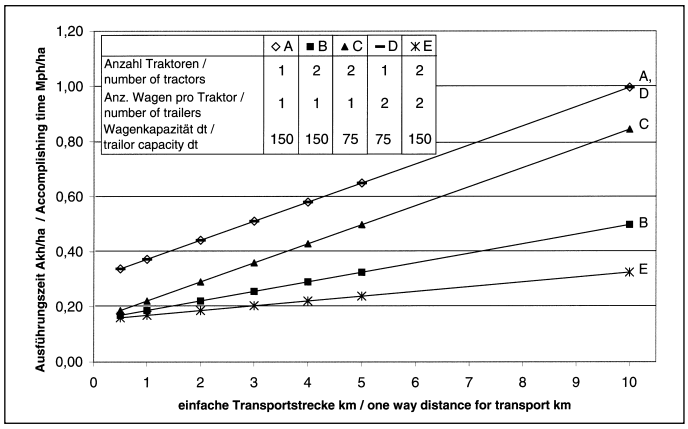

Fig. 3: Execution time for transporting (MPh/ha) for transport of round baled silage 78 dt/ha at different farm field distances

0.5 km distance a reduction of 34% in working time requirements could be achieved through increasing the field size, with 10 km this action led to savings of 31%.

On average, 35% of total working time was devoted to pasture husbandry measures of which 25% went for the rolling alone. Because of the high work requirement, only 3 ha on the farm were rolled.

Transport

10% of working time was used in transport where the field steading distance was 0.5 km and field size was 0.5 ha. With 10 km distance and with the same field size, the percentage share of working time in transport was almost doubled to 19%. With increasing field size, the working time requirements for jobs from rolling through to round baling were reduced. At the same time, the percentage proportion of working time requirements for transport and bale wrapping increased.

The working time requirement for field to steading transport of the round bales comprised mounting time, driving time steading to field/field to steading (according to field size), bale loading and transport times. The sum of driving time and transport equalled operational time.

Figure 2 shows a calculation example in the comparison of driving time and length of loading time assuming different trailer capacities as well as numbers of tractors and trailers (A-E). Assumption A for the presented investigation farm featured a load of 25 bales per transport unit. The representation shows that the time taken for loading was influenced by the number of tractors used in the operation and the driving time of the trailers used. Doubling the number of tractors and trailers led to a halving of the transport and loading times.

With increasing field-steading distance (= one-way transport distance) the reducing influence on working time requirement of larger trailer capacity was increased (*fig. 3*). Assumption A, the application of one tractor with a 15 t capacity trailer has the same importance as assumption D. In this case, with the increase in field-steading distance from 0.5 km to 10 km a three-times multiplication of the operational time was to be expected. With assumption E one can assume only a doubling of this. Thus, with a field-steading distance of 10 km the major importance of increasing load per journey can be seen. According to [1], increasing transport speed is also interesting where the distances are over 15 to 20 km.

Costs

Costs in round bale silage production assuming the new purchase of machinery and 100% exploitation of it, are presented in *figure 4* as an extension of the working requirements (fig. 1) times a payment rate of 25 DM/man hour and the mechanisation costs.

With an 0.5 ha field 0.5 km from the steading the costs were around 720 DM/ha and, at 10 km distance, almost 1000 DM/ha with a yield of 2.46 t/ha dm (24,600 MJ ME/ha or 14,760 MJ NEL/ha) [3] for the first cut. The reduction in costs by the increased field size effect led to costs of 580 DM/ha with 10 ha at 0.5 km distance and 784 DM/ha at 10 km.

A comparison of the transport proportion of total costs with the results for the working time requirement (fig. 1) showed that in this case the proportion for the transport is 8 to 20% greater as in the case of the operational costs.

Where the 100% exploited own-mechanisation is replaced through machine sharing between farms, additional costs of from 99 to 140 DM/ha can be expected which can be set against the savings in working time.

The current situation on the farm (used-value machinery, exploitation 39%) when compared with machine sharing between farms indicates, however, that, in addition to releasing of labour capacity, the latter offers a saving effect of 48 to 119 DM/ha.

Literature

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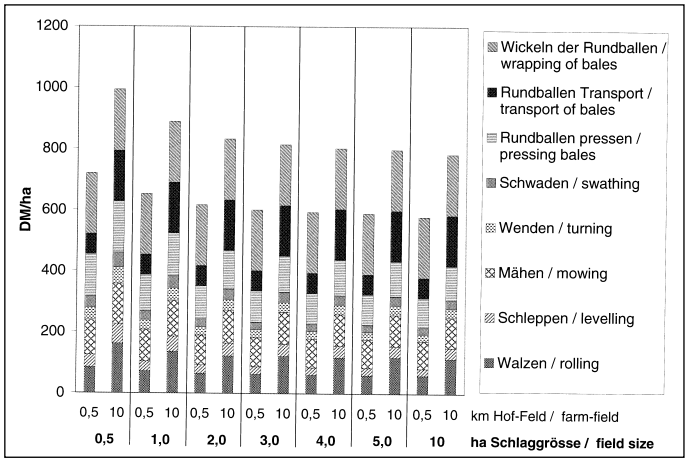

Fig. 4: Process costs in DM/ha for baled silage for different operations (new machines, capacity utilisation 100%)