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Operation Patterns of Mowing Grassland - Fauna Protection and Costs

Fauna safeguarding operation patterns can contribute to the protection of young game and birds. For fauna saving operation patterns, as well as for the usual bed mowing, distances travelled, percentage of turning time, field capacities, operation costs and working widths were ascertained for different plot sizes as well as for an exemplary farm. With the respective patterns, effective measures for fauna protection can be realised without additional costs

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Literature

Literature references can be called up under LT 03308 via internet http://www.landwirtschaftsverlag.com/landtech/local/literatur.htm.

Several times a year mechanised grassland harvesting leads to injury and death of a large number of animals. The selection of operation working patterns for mowing effects a number of opportunities to escape for young game and birds. While trying to evade the approaching mower, the animals hesitate to leavethe shelter of the vegetation. Current working patterns cut off the escape routes of the animals, if they leave the uncut vegetation surrounded by sections already mown and thus without contact to the adjacent fields. This is the case for conventional mowing patterns that subdivide the field into several plots (*Fig. 1*) and for mowing in spirals from the field periphery to the centre. These working patterns are the most common in practice.

Fauna protecting working patterns facilitate the animals escape as the uncut vegetation is connected with the field edges and the animals can be expelled from the field within the cover of the standing plants [2, 9, 10]. Among these working patterns are the methods of mowing in stripes from the inside outwards or from one field side to the other as well as mowing in spirals from the field centre to the periphery (*Fig. 2*).

Depending on the working patterns covered distances, turning time percentages and therefore field capacity, required labour time and process costs change. These parameters shall be determined for different field sizes and working widths as well as for a model farm.

Approach

Initially the distances travelled for the working patterns regarded were calculated [6]. Calculations were carried out for field sizes of 2 - 100 ha assuming a rectangular shape and a length:width ratio of 2:1. Three tractor-mower-combinations with working widths of 2.70 m, 4.90 m and 7.70 m are considered. Field capacities and operation costs for the different working patterns are referred to as the standard time ST, according to the working time structure of the Association for Technology and Structures in Agriculture (KTBL) [5]. Field capacities can be obtained from the covered distances in relation to working and driving speeds. Process costs are calculated based on guide values [8].

The model farm regarded is situated in the North of Brandenburg. An area of approximately 120 ha is mown for each cut. A standard tractor with an engine power of 101 kW and a front-rear-combination of two disc mowers with an actual working width of 5,80 m is used for mowing. The grassland spreads over 27 fields lying in close proximity to each other and most having a generally rectangular shape. At sizes of 1.4 - 27 ha 85 % of the fields are smaller than 15 ha. A favourable length-width-ratio can be found mainly for the smaller fields. The grassland fields are mown in conventional patterns with plot widths of 50 m.

Results and discussion

As expected, effective field capacities increase for all working patterns with rising field size and working width. The rise of field capacity is particularly important in the range of smaller fields with sizes up to 10 ha, while increases that can be noticed from a field size of 25 ha or more are generally insignificant. These results correspond to the

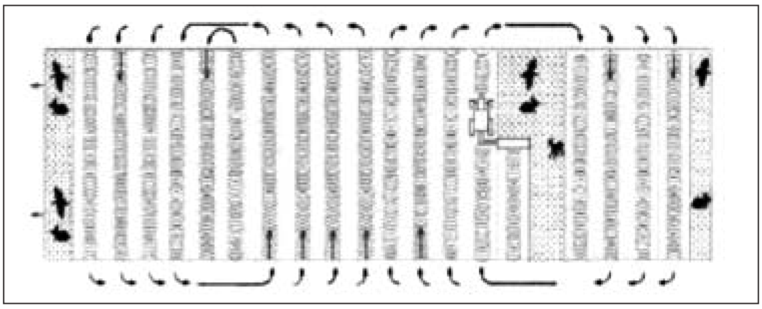
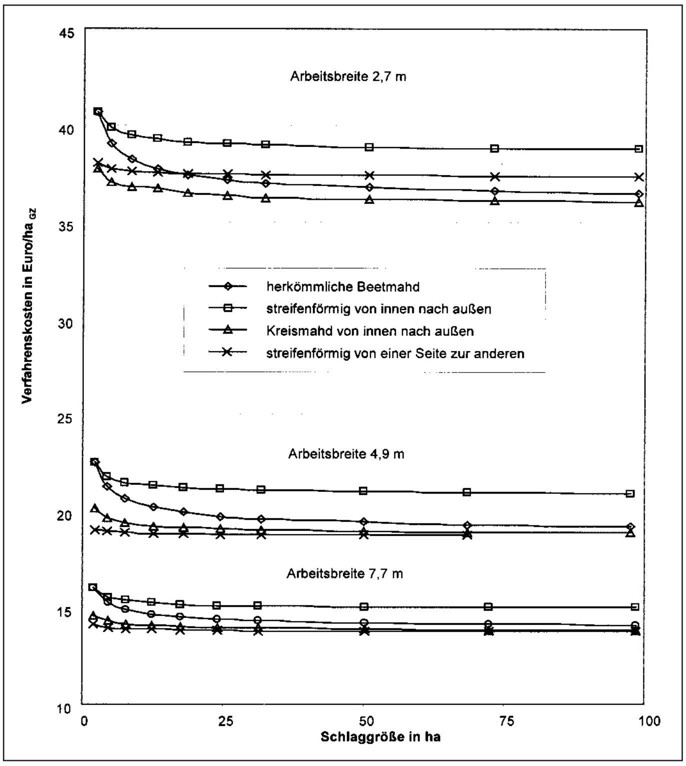


Fig. 1: Standard operation pattern for mowing grassland

data of other authors [1, 3, 4].

With regard to field capacities, the ranking of the working patterns is as follows at all working widths and field sizes: Highest field capacities are reached by mowing in stripes from one field side to the other, followed by mowing in spirals from the field centre to the periphery where field capacities are only slightly lower. These two fauna protecting working patterns allow higher field capacities than conventional mowing in plots. The field capacities are lowest at mowing in stripes from the field inside outwards. The differences to the other working patterns are especially high for large fields, since a great deal of time is needed for turning.

Fig. 3: Operation costs with different patterns, plot sizes and working width

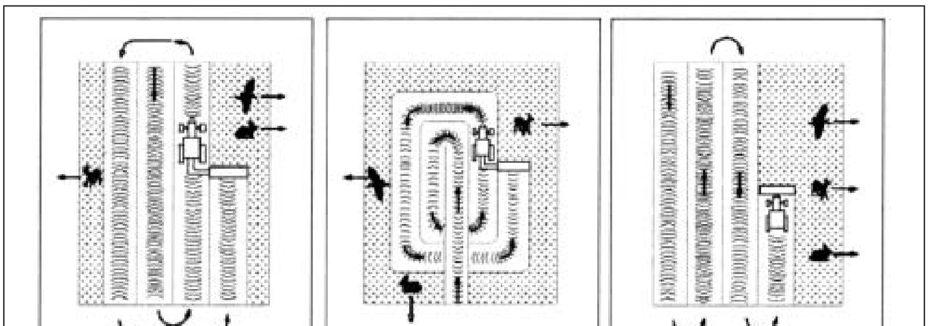


Process costs are inverse to field capacities and decrease with rising field sizes and working widths (*Fig. 3*). They are lowest when mowing in stripes from one field side to the other followed by mowing in spirals from the field centre to the periphery. Highest operation process costs occur, when mowing in stripes from the field inside outwards. One exception in the ranking of the working patterns arises at the working width of 2.70 m as different mowing machines are needed. In contrast to the other working patterns mowing in stripes from one field side to the other requires a front mower. Since the purchase prices are higher than for rear mowers, machine costs increase. Operation costs for mowing in spirals from the field centre to the periphery and at field sizes over 25 ha also for conventional mowing in plots are lower than for mowing from one field side to the other.

In the model farm regarded, field capacities of the working patterns mostly have a uniform order for the single fields as well as for the whole farm [7]. They are highest for mowing in stripes from one field side to the other and for mowing in spirals from the field centre to the periphery both working patterns reaching 2,6 ha/hST for the whole farm. Conventional mowing in plots results in 2,3 ha/hST. When mowing in stripes from the field inside outwards field capacities with 1,9 ha/h_{ST} again are lowest.

While mowing in stripes from one field side to the other leads to higher field capacities than mowing in spirals for rectangular fields with a uniform length-width-ratio of 2:1 there is no difference between the two working patterns at the model farm. Referring to the total grassland area of the farm, the medium length:width ratio is lower than 2:1, causing higher turning time percentages when mowing in stripes and thus reducing field capacities.

Regarding process costs the working patterns show the opposite order of the field capacities. At 31 €/ha_{ST} process costs are lowest when mowing in spirals from the field centre to the periphery or in stripes from one field side to the other. Conventional mowing in plots, however, leads to process costs of 33 €/ha_{ST}. Thus using the two fauna protecting working patterns can reduce process costs by 6 %. Only mowing in stripes from the field inside outwards increases process costs. At 38 €/ha_{ST} they are 18 % higher than for conventional mowing in plots.



2a mowing in stripes from the inside outwards *2b mowing in spirals from the field centre to the periphery* *2c mowing in stripes from one field side to the other*

Fig. 2: Fauna-protective operation pattern of mowing grassland

One difficulty when mowing in spirals from the centre to the periphery consists in finding the field centre. However, drivers familiar with the fields should be able to manage this. In the future, positioning systems in combination with electronic field maps on the tractor might give further support. A second problem can arise from residual plots remaining at the field edges where the fields are irregularly shaped. To limit additional passes across the field as far as is possible, it is recommended to mow the residual plots straightaway when reaching them during the round course.

Mowing in stripes from one field side to the other is only possible using front mowers or pivoted trailed mowers.

Conclusions

Fauna protecting working patterns are part of a complex of measures for the protection of grassland fauna during mowing. Field capacities increase and operation costs decline by mowing in stripes from one field side to the other or in spirals from the field centre to the periphery whereas mowing broad fields in stripes from the inside outwards leads to a remarkable increase of process costs.