

4. Crop and animal performance in grass-to-grass resowing

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4.1 Introduction

Maintaining or increasing grassland productivity is one of the key motives for farmers to resow their grasslands. Grassland productivity on farms may decline gradually from year to year or drop suddenly to a lower level. Various causes can be responsible for this decrease, such as unfavourable soil conditions (f.i. compaction), weather damage to the sward (drought or frost) and invasion of undesired plant species. At some point in time, it may be profitable to plough and resow the sward, as in most situations a higher productivity is expected in the years after resowing relative to the years before resowing. The increase in productivity must be substantial, because it should at least compensate for the loss in grassland productivity in the year of resowing, which occurs if the grass sward is ploughed prior to resowing. Figure 1 illustrates the development in grassland productivity, as described above, including the assumption that the 'final' production level after resowing is higher than before (see also section 9.1). It is presented here as an hypothesis that should be tested with experimental data.

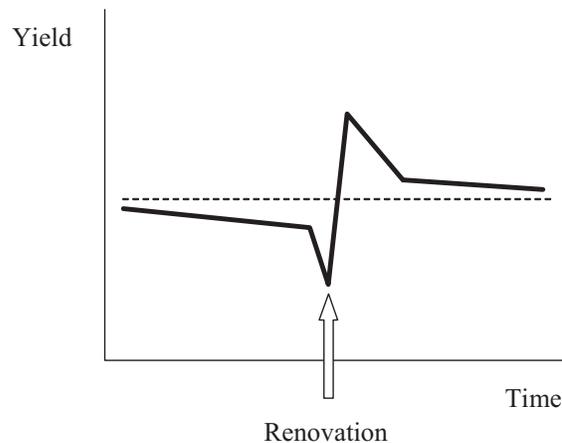


Figure 1. Hypothesised yield development of grassland in time.

In this chapter the hypothesis of Figure 1 is split into three main questions, which can be answered separately:

1. To what extent does the yield decrease with grassland ageing takes place?
2. Does the yield improvement outweigh the yield loss in the year of ploughing?
3. Which yield variable is important for the farmer (grass dry matter, protein, animal intake/production, etc.)?

Data from the Wageningen workshop, as published in Conijn *et al.* (2002), have been used for answering these questions and the results are described in section 4.2.

4.2 Results and discussion

4.2.1 Decreasing yields with increasing age?

The first question for testing the hypothesis of section 4.1 reads:

To what extent does the yield decrease with grassland ageing takes place?

Table 1 contains the results based on the data found in the proceedings of the Wageningen workshop. Yields have been expressed in relative units (%) in order to compare the original data from different countries.

Table 1. *Relative grass yields (%) during subsequent years after resowing.*

Country	DK ¹		B ²		NL/UK ³		IRL ⁴	
	Cut	Grazed	Grass	Gclov	DM	N	4%	15%
Year 0			92	93	80	80		
1	263	110	88	88	125	115	}	}
2	229	107	91	72	103	98	} 135	} 102
3	176	100	92	105	103	98	}	}
4			100	101	103	98	100 ?	
5	100		100	100	103	98		
6								
100 % =	3.8 ⁵	8.1 ⁵	11.3 ⁵	9.8 ⁵	8.4 ⁵	280 ⁶	10.1 ⁵	13.5 ⁵
Sowing	Spring		Autumn		Spring		?	

Note: Year 0 is the year in which the grass is resown (either in autumn or in spring).

¹ Yields of temporary grass swards in subsequent years. Cut: average values for a fertilization level of 300 kg N ha⁻¹ y⁻¹ with/without irrigation; Grazed: values have been estimated based on calculated intake (Soegaard et al., 2002).

² Yields of temporary grass swards of different ages sown in subsequent years. Yields were determined by cutting strips, swards were grazed rotationally. Grass is grass dry matter and Gclov is dry matter of a grass/clover mixture (Nevens et al., 2002).

³ Estimated dry matter (DM) and nitrogen (N) yields of grass swards of different age. Production in year 0 is assumed to be 20% lower and the dry matter production level in year 2 and later is assumed to be 3% higher due to genetic improvements of the newly seeded grass variety (Schils et al., 2002). Data from the UK (Hopkins et al., 1990; 1995) have been used to estimate the values in year 1.

⁴ Yields of old swards compared to reseeded swards, measured by taking three or four cuttings per year. Two situations: old sward containing only 4% and 15% of *Lolium perenne* respectively (Humphreys & Casey, 2002).

⁵ Unit is ton dry matter ha⁻¹ y⁻¹.

⁶ Unit is kg N ha⁻¹ y⁻¹.

Figure 1 gives an illustration of the dry matter data of Table 1.

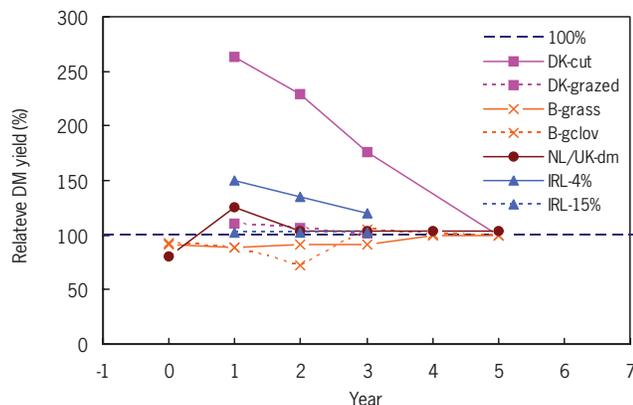


Figure 1. Relative grass dry matter yield as function of number of years after resowing. Based on data from Table 1.

Only two out of seven datasets show a substantial decline in grassland productivity over the years (DK-cut and IRL-4%). The others do not show any substantial decrease over the years. Some of them even had lower yields for some years shortly after resowing (Belgium data). The slope of the DK-cut data is extremely negative compared to the others and also its production level at 100% is an outlier (after 5 years: 3.7 t ha⁻¹ y⁻¹). This situation clearly does not represent a permanent grassland, but a short-term, fast-degrading ley for which plant species varieties may have been selected that do not seem to persist very well under the prevailing growing conditions in Denmark.

Other relevant data from the Wageningen workshop concerns:

- In Belgium an experiment comparing permanent grassland with three-year temporary leys during 31 years resulted in almost equal feed energy yields from both grassland types at equal fertiliser N input (75.1 GJ NEL ha⁻¹ for permanent and 73.3 GJ NEL ha⁻¹ for temporary grassland (Nevens *et al.*, 2002).
- In northern Germany a proportion of 77% of the grassland fields is older than 10 years and circa 50% is older than 30 years in conventional farming systems (Taube *et al.*, 2002).

The long-term experiment in Belgium does not seem to support the hypothesis of lower yields on old grassland, as the permanent grassland produced even slightly more than the young grassland which had an average age of only 2 years. But this conclusion can be debated because it has been derived from a comparison of grassland fields in a rotation system with grassland fields in a permanent grassland situation. Probably, the amount of soil organic N will be different in the two situations with a higher level in the permanent grassland fields, due to the higher N inputs accumulated over the years. It is likely that in the temporary leys total N availability (from external inputs + soil supply) was lower due to an assumed lower N mineralization correlated with the lower organic N content in the soil. This may have influenced the ley production level. Whatever the case may be, the experiment in Belgium is not just about comparing between old and young grassland, but also between permanent grass and temporary grass interrupted by arable cropping.

The data on grassland age of northern Germany clearly shows that a large proportion of the grassland fields is not renovated frequently and may therefore suggest that the degradation with ageing is not very substantial in this part of Europe. It should be noted however that the intensity of grassland use partly determines the need for renovation, because (i) in some cases intensive use of grassland may be directly responsible for sward degradation and (ii) farms with a high stocking rate generally need a high grass production level which is assumed to be more easily obtained from younger swards. So, the the situation of grassland use in northern Germany may differ from other regions in Europe, such as the Netherlands or Belgium, where grassland renovation is practised more often. Indeed, the intensity of fertiliser use in northern Germany seems moderate as compared to f.i. the Netherlands, as 67% of the grassland fields received less than 221 kg N ha⁻¹ y⁻¹. Unfortunately, the data of grassland age in Taube *et al.*, (2002) could not be related directly to fertiliser intensity, nor could they be compared with corresponding experimental data from other regions in Northwest Europe.

4.2.2 Production increase versus production loss

The second question for testing the hypothesis of section 4.1 reads:

Does the yield improvement outweigh the yield loss in the year of ploughing?

Based on the data from Table 1, it may be concluded that in general the production increase is more or less equal to the production loss if permanent grassland is renovated. The total gain in dry matter production seems therefore negligible and is in some cases even negative (see data from Belgium). The experimental results are surprisingly in view of the frequent grassland renovation practice at dairy farms (f.i. in the Netherlands). A number of reasons may be responsible for this observation and some of them are pointed out below.

- Grassland renovation at farms occurs more often than is needed, maybe partly due to the difficulties in making a realistic cost/benefit analysis in terms of productivity of resewing a single field on a farm.
- In some experiments the new grassland has been compared to old grassland that is still in 'a good shape' and therefore produced as good as the reseeded swards.
- Substantial difference between young and old grassland can only be found in some years, f.i. during dry periods in summer. This might be explained by better rooting characteristics of the young swards which is only beneficial if soil moisture conditions become limiting for the older swards during the growing season. In other years, with good growing conditions, the difference is relatively small and this hampers a clear-cut conclusion from the data.

4.2.3 Which yield variable matters?

The disappointing results when looking at the absence of the assumed dry matter advantage of grassland renovation in combination with the observed practice of frequent resewing at dairy farms, brings up the third question:

Which yield variable is important for the farmer (grass dry matter, protein, animal intake/production, etc.)?

In other words, dry matter yield as determined in many experiments (mostly by cutting: gross production) may not be the right variable to measure when studying the pro's and con's of grassland renovation. In general, two other variables seem more important than gross dry matter production, i.e. (i) net intake by animals and (ii) nutritive value of the grass. In Conijn *et al.*, 2002 the following information could be found on this issue:

- The Netherlands suggested lower grazing losses and thus higher animal intake, but experimental data are lacking to support this.
- Ireland found in general a higher nutritive value and silage quality for *Lolium perenne* compared to other plant species.
- But Belgium determined equal feed energy yields from old and young grassland (see 4.2.1) and
- the United Kingdom reported similar animal production rates after grazing on permanent and reseeded grass swards (Hatch *et al.*, 2002).

So, evidence for these alternative variables being substantially improved by grassland renovation seems conflicting and is therefore not unambiguously supporting the hypothesis.

4.3 Conclusions

Concluding

- The hypothesis can not be accepted due to lack of experimental evidence, based on the data as published in the proceedings of the Wageningen workshop (Conijn *et al.*, 2002).
- However, this may be caused by measuring the wrong variable, i.e. the gross dry matter production. More effort is needed to look at other productivity measures such as animal intake, digestibility, nutritive value and/or animal production.

- In line with the above, efforts should be concentrated more on the whole cycle of fertiliser use – grass production – animal intake – production of milk/meat and animal manure that can be used as fertiliser again, in a farm situation.

4.4 References

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