‘Grassland Compass’: a practical tool to improve grass production and grass utilization at Dutch dairy farms

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Abstract

Dutch dairy farms feel an increasing need to improve grassland production and grass utilization while at the same time reducing the environmental impact because of sustainability goals, legislation on manure management and recent intended policies. The net dry matter yields of grasslands range from 8 to 19 t DM ha^{-1} y^{-1}. This is caused by the variation in farm management which implies that there is room for improvement. However, for farmers it is often unclear which actions need to be taken, in which field, and in which part of the management (soil, sward, manuring, grazing, silage making, conservation). There are a number of farm decision support tools to improve the grassland management. However, a tool that provides a practical overview of all the strengths and weaknesses of grassland management on a particular farm has been lacking. The ‘Grassland Compass’ project developed a practical tool for both farmer and advisor with the aim to improve grass production and utilization at individual farm level. The project is an initiative of Dutch Universities of Applied Sciences in collaboration with feed industries, advisory services and dairy farmers. In spring 2018, during six weeks prior to the first cut, a prototype of ‘Grassland Compass’ was evaluated on 33 Dutch dairy farms. Results suggest that ‘Grassland Compass’ provides useful suggestions for improvements in grassland production and grass utilization.

Keywords: grassland production, grassland utilization, decision support tool, KPI

Introduction

For Dutch dairy farming, it becomes increasingly important to optimize the available farm resources. Sustainability goals in the dairy chain, legislation on manure management and new policies increase the need to optimize available resources. Dry matter yields of grasslands can differ more than 10 t DM ha^{-1} y^{-1} in the Netherlands, with averages ranging from 8 to 19 t DM ha^{-1} y^{-1} (Aarts *et al*., 2005; Van Eekeren *et al*., 2010). These differences in yield can only partly be ascribed to differences in soil type and growth conditions. They are mainly attributed to differences in the management of the dairy farmer, such as differences in land use or in input of nutrients (Aarts *et al*., 2005). This implies that there is a potential for improvement of grassland production. Existing farm tools, e.g. ‘Kringloopwijzer’ (Annual Nutrient Cycling Assessment; Aarts *et al*., 2015), provide quantitative performance data on grassland production, grass utilization and nutrient cycling on farm level but do not provide an overview of the strengths and weaknesses in the grassland production chain. A consortium of Dutch Universities of Applied Sciences, feed companies, advisory services and dairy farmers has therefore developed Graslandkompas (‘Grassland Compass’ (GC)). The aim of the GC-project was to develop a tool for farmer and advisor to get insight in the strengths and weaknesses of the grass production and utilization chain. The design of this tool should stimulate dairy farmers to carry out actual measures to improve the grassland production. This study aims to test the on-farm functionality of the GC ('proof of principle') by testing it on Dutch dairy farms.

Materials and methods

GC has a layered approach. Six 'areas of influence' ('wind directions') were identified that affect the process of grass production and grass utilization: soil, sward, manuring, grazing, silage making, conservation. Soil and sward relate to production factors, while the other wind directions relate to activities. Each wind direction consists of a number of key performance indicators (KPI). A KPI consists of a set of performance indicators (PI). PIs should meet three criteria: i) they must be related with grassland production and/or utilization; ii) the outcome can be influenced by the farmer; and iii) they should be available or easy to determine during an on-farm test. Expert judgement was used to score the possible outcome of each PI. A PI was scored from 1 (poor) to 5 (good). KPIs were calculated as the weighted average of PIs (1-5 with intervals of 0.5). The wind directions were calculated as the weighted average of the KPIs. The arithmetic mean of the six wind directions led to the final GC score. Each wind direction consists of 3 to 6 KPIs. A KPI consists of 1 up to 15 PIs. GC was tested on 33 dairy farms in the Netherlands during a six-week period prior to the first cut in April-May 2018. Project partners nominated farmers who were interested in grassland management for testing GC on their farms. The common Dutch soil types sand, clay and peat were represented with 14, 16, and 3 farms, respectively. Both the dairy farmer and advisor were asked to do a pre-test evaluation of the wind directions of GC, i.e. they were asked for their expectations of the score for each wind direction. Data collection was done through i) retrieval of data from existing resources (e.g. soil or silage analyses results or results from Kringloopwijzer (Aarts *et al.*, 2015); ii) an interview with the farmer; and iii) field measurements (e.g. visual evaluation of soil structure and sward quality). The results of GC were discussed with the farmer and compared with the pre-test evaluation. A difference of 1 or more between the pre-test evaluation and the GC-result was considered to be relevant.

Results and discussion

The average milk production of the farms was registered (9,200 kg cow^{-1} y^{-1}) and is consistent with the Dutch average. 55% of the participating farmers had a BSc-education level. 52% of the farmers had an age ranging between 20 and 39. Most farms had a GC above average (above '3') (Table 1). The KPI 'drainage' in the wind direction 'soil' often received the maximum score (28 out of 33 farms). Low scores in 'manuring' were mainly due to N surpluses and/or P_2O_5 surpluses. Low scores in 'silage making' were attributed to the PIs 'drying period', 'cutting height' and 'chop length'.

Table 1. Number of farms for each calculated mean score of GC and per wind direction (-)

Item	calculated mean score								
	1	1.5	2	2.5	3	3.5	4	4.5	5
Grassland compass					3	16	14		
Wind direction									
Soil					1	4	7	19	2
Sward				1	10	10	11	1	
Manuring			1	5	10	11	4	2	
Grazing*					4	9	16	2	
Silage making			3	6	6	10	6	2	
Conservation			1	3	17	10	2		

* two farms did not apply grazing

The wind directions ‘soil’ and ‘grazing’ have been assessed lower in the pre-test evaluation than the GC-result (Table 2). Farmers and advisors felt that they did not have enough knowledge regarding these two wind directions. ‘Silage making’ was assessed higher than the GC-result. Correlation between the GC result and farmer and advisor results was poor; $r^2 < 0.11$.

Table 2. Difference in scores between GC and assessors per wind direction, both for GC higher than assessors and lower than assessors (number of farms per assessor or combination of both assessors).

Wind direction	GC higher than assessor			GC lower than assessor		
	Farmer	Advisor	Farmer and advisor	Farmer	Advisor	Farmer and advisor
Soil	10	5	4	0	0	0
Sward	2	0	0	1	1	0
Manuring	3	2	1	4	5	3
Grazing	5	2	2	0	0	0
Silage making	0	0	0	11	7	4
Conservation	1	3	1	4	4	3

Some PIs were found to be subjective; further validation is therefore necessary. Some PIs showed seasonality, e.g. the PI rooting depth, which tends to be lower early in the growing season (Deru *et al*., 2010). It is further recommended to always use GC in the same season when monitoring developments. Use of GC in spring is therefore recommended. The on-farm test of GC proved to be an excellent instrument to initiate discussions between farmer and advisor on improvements of grassland production and utilization, since the measures are farm specific.

Conclusion

The results of this study show that there are differences between the subjective evaluation of grassland production and grass utilization on individual farms as assessed by GC, farmers and advisors. Whether GC is able to provide useful insights into strengths and weaknesses in the grassland production and utilization chain depends on the reliability of the indicators and on the quality of the input data. Nevertheless, GC has shown that it can provide useful suggestions for improvements in grassland production and grass utilization.

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References

Aarts H., Daatselaar C. and Holshof G. (2005) Bemesting en opbrengst van productie grasland in Nederland. Rapport 102 Wageningen-UR Plant Research International, Wageningen, The Netherlands, 34 pp.

Aarts H., De Haan M., Schröder J., Holster H., De Boer J., Reijs J. ... Meerkerk, B. (2015) Quantifying the environmental performance of individual dairy farms - The annual nutrient cycling assessment. *Grassland Science in Europe* 20, 377-380.

Deru J., Van Eekeren N. and De Boer H. (2010) Beworteling van Grasland - een literatuurstudie. Publicatienummer 2010-018 LbV Louis Bolk Instituut, Driebergen, The Netherlands, 63 pp.

Van Eekeren N., De Boer H., Hanegraaf M., Bokhorst J., Nierop D., Bloem J. ... Brussard L. (2010) Ecosystem services in grassland associated with biotic and abiotic soil parameters. *Soil Biology & Biochemistry* 9, 1491-1504.