Pastur'Plan: a dynamic tool to support grazing management decision making in a rotational grazing system

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Abstract

Efficient grazing management requires anticipation and flexibility and would be greatly facilitated by the development of dynamic tools with the capability to simulate different scenarios based on regular measurement of grass supply on the farm. Pastur'Plan, built on a spreadsheet within a partnership between INRA and a livestock management advisory association (Orne Conseil Elevage), combines two complementary concepts. The first is inspired by the Grass Wedge method adapted to French grazing conditions to highlight the distribution and coherence of grass supply on the paddocks on a farm and the requirements for grass based on the grazing rules and objectives. The second concept allows us to describe the evolution of the balance between grass growth and demand according to various grazing simulations on a paddock-by-paddock basis. This paper describes the hypothesis and calculations implemented, and subsequently the simulation method used and the illustrations dedicated to help support decision-making by grazing managers.

Keywords: grazing management, dynamic tools, dairy cows, grass wedge

Introduction

Feeding dairy cows at grazing is of interest as a means to provide a low-cost and well-balanced diet. In continental Europe, however, the contribution of grazed grass in the total annual diet of dairy cows is declining. Various different reasons such as small accessible areas for grazing, grass growth sensitivity to climate and the difficulties to manage grazing systems efficiently are often mentioned in surveys of farmers. In contrast to indoor feeding, feed supply and quality in grazing systems is more variable and grazing management requires frequent adjustment to ensure consistency between animal requirements and grass growth. The art of grazing is to anticipate variations and imbalances between grass supply and demand and to implement essential adjustments promptly to manage the dynamic grazing system efficiently. Many methods and tools have been developed in the recent past to help farmers and advisers to implement grazing systems more efficiently. Such tools are often based on a weekly measurement of grass availability and the projection of the change in grass availability in the immediate future based on predicted grass growth and demand. One such tool used in France, named Herb'aVenir (Defrance *et al.*, 2005), is based on the calculation of grazing days ahead. Similarly, another tool proposed in New Zealand and Ireland is the grass wedge method (Dillon and Kennedy, 2009) based on a graphic comparison of the actual and ideal grass supply profiles on a paddock-by-paddock basis. In both cases, these tools are static, and do not give the farmer an anticipated grazing plan. Consequently, such tools require expertise of the farmer to analyse the grass supply profile and make the right decisions. The objective of this paper is to describe Pastur'Plan, a new decision support tool based on the grass wedge concept adaptation and on the possibility of dynamic simulations of anticipated future grazing outcomes.

Concepts and calculation methods implemented in Pastur'Plan

The grass wedge concept (Dillon and Kennedy, 2009) compares the actual biomass of each paddock drawn on a histogram graph with an ideal line joining two points corresponding to the pre- and post-grazing biomass. The lowest point corresponds to the post-grazing biomass objective. The highest point

is the target pre-grazing grass yield (kg dry matter (DM) ha^{-1}) calculated as the product of the stocking rate (cows ha^{-1}) by the grass demand (kg DM cow^{-1} day^{-1}) by the rotation length (days) plus the target residual grass yield (kg DM ha^{-1}). In fact, mathematically, the line between these two points is straight only if the paddock area and grass growth potential is identical for every paddock and this is frequently not the case. In Pastur'Plan, to be more universal, we have chosen to draw a breaking line (Figure 1) where each point is the ideal height at which each paddock should be, taking account of (1) the pre- and post-grazing heights defined by the farmer, (2) the area of each paddock, (3) the predicted grazing duration of the previous paddocks and (4) the future grass growth during the simulated period.

To propose a predicted grazing calendar and to facilitate the evaluation of different scenarios of grazing management, Pastur'Plan calculates the grazing days available and duration of grazing for each paddock according to animal requirements and the grass offered. Animal demand depends on the herd size, the grass-intake capacity of the individual animal (nine categories are proposed depending on the type of animal) and the level of forage or concentrate supplementation. As a consequence of the substitution rate law (Faverdin *et al.*, 2010), we have considered a grass intake decrease of 1 kg and 0.5 kg of DM for each 1 kg of forage or concentrate intake, respectively. The grass provided is calculated daily, paddock-by-paddock, and also by cow according to an annual standard grass growth curve which is modifiable and updatable by the user according to local grass growth measurements.

Among the most original aspects of Pastur'Plan is the capability to test different options (levels of supplementation, excess grass ensiling, changing weather conditions, etc.) and to simulate the consequences in terms of likely future grazing outcomes. For each paddock chosen by the user as the next paddock to graze, Pastur'Plan calculates the paddock grazing duration and applies grass growth curves to all other paddocks of the platform. The calculations are done at a half-day scale. For each half day, Pastur'Plan calculates the total grass intake according to the animal demand, changes the biomass consumed into grass height used (with a modifiable sward density grid included in the software) and calculates the residual grass height. If the residual grass height calculated exceeds the post-grazing height objective, the herd stays in the paddock for another half day and Pastur'Plan simulates a new grazing sequence. At the end of each grazing, a summary table is created with a new grazing profile taking into account the new state of the grazing platform to facilitate analysis by the user.

How to use Pastur'Plan

Pastur'Plan has been developed on Microsoft Excel and allows the possibility to simulate grass supply change for 42 days or up to 28 paddocks ahead. As often with grazing decision support tools, the Pastur'Plan user starts by inputting the farm structure components (paddocks, herds, feeding supplementation, grazing conditions). Subsequently, paddock heights from each paddock measured with a platemeter are recorded. The actual grass supply profile (Figure 1) and an associated table display the current actual grass supply including the relationship between grass supply and demand. Then the user selects the grazing paddock order and has access, sheet by sheet, to the evolution of the grazing situation. The user can change assumptions and create alternative simulations to evaluate the consequences of alternative management decisions. Finally, the farmer has access to a forecast grazing calendar with some illustrations to help interpret the future grazing simulation. The user can compare the pre- and post-grazing height objective with what is likely to happen, based on the chosen management decisions to reflect the coherence (or not) of the paddock-by-paddock grazing management. The figure of the dynamic evolution of grass demand and growth expressed per cow (not illustrated) permits the user to evaluate the adequacy of the actual stocking rate and supplemental feeding practices on future grass availability. Finally, Figure 2 describes the evolution of grass availability per animal, translated into grazing days ahead. This highlights the likely evolution of grazing in the near future and permits the grazing manager

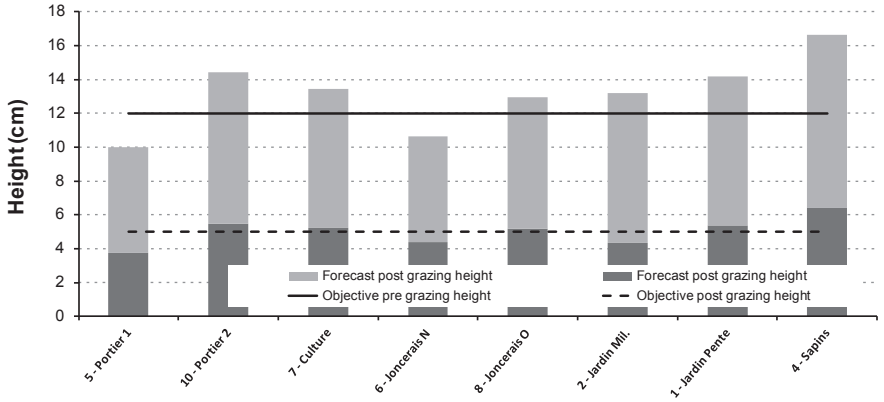

Figure 1. Example of grazing profile in Pastur'Plan.

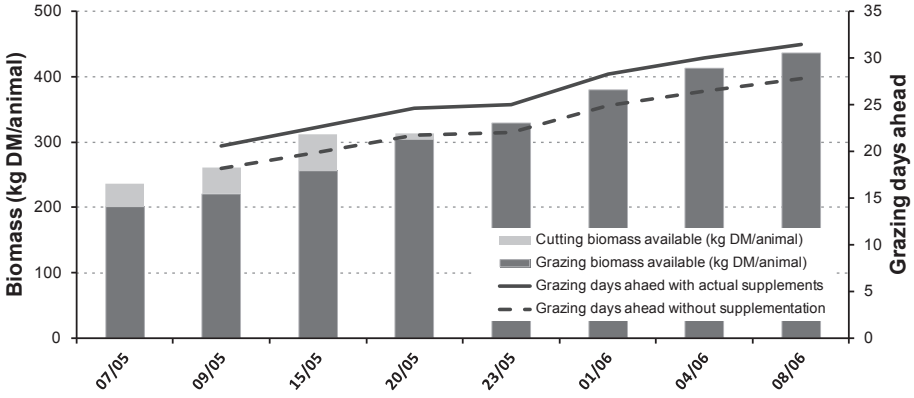

Figure 2. Evolution of grass available and grazing days ahead.

to examine alternative options with advisors and other colleagues before finally deciding on the best grazing plan for the next period.

Conclusions

Developed in association with an advisory company and based on practical grazing management concepts, Pastur'Plan will facilitate anticipation and decision making for advisers and grazing managers. This tool should provide more confidence in grazing systems and improve the efficiency of the dairy production systems based on better grass utilisation.

References

Defrance P., Delaby L. and Seuret J.M. (2005) Herb'aVenir, a simple decision support tool for grazing management. *Rencontres Recherches Ruminants* 12, 80.

Dillon P. and Kennedy J. (2009) Grazing notebook. Teagasc and Irish Farmer Journal, Ireland; 56 p. Available at: http://tinyurl.com/m9dzaw6.

Faverdin P., Delagarde R., Delaby L. and Meschy F. (2010) Alimentation des vaches laitières. In: Alimentation des bovins, ovins et caprins. INRA, Quae, Paris, Paris, pp. 23-58.