# Modeling grassland with CATIMO - focus on the second cut

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## Introduction

- Up to 50 % of the annual dry matter (DM) yield of forage grasses comes from the second cut in Nordic countries and Canada. Therefore, including the summer regrowth in forage grass growth models is important.
- The nutritive value of the second cut differs markedly from that of the first cut.[1]
- Few models have attempted to simulate regrowth (LINGRA[2,3], STICS[4,], Hurley Pasture Model[5], CROPGRO[6]) and its nutritive value.
- This poster presents new updates to CATIMO (Canadian Timothy Model[7,8]) to simulate grass regrowth and its nutritive value (Jing et al.[9, 10]).

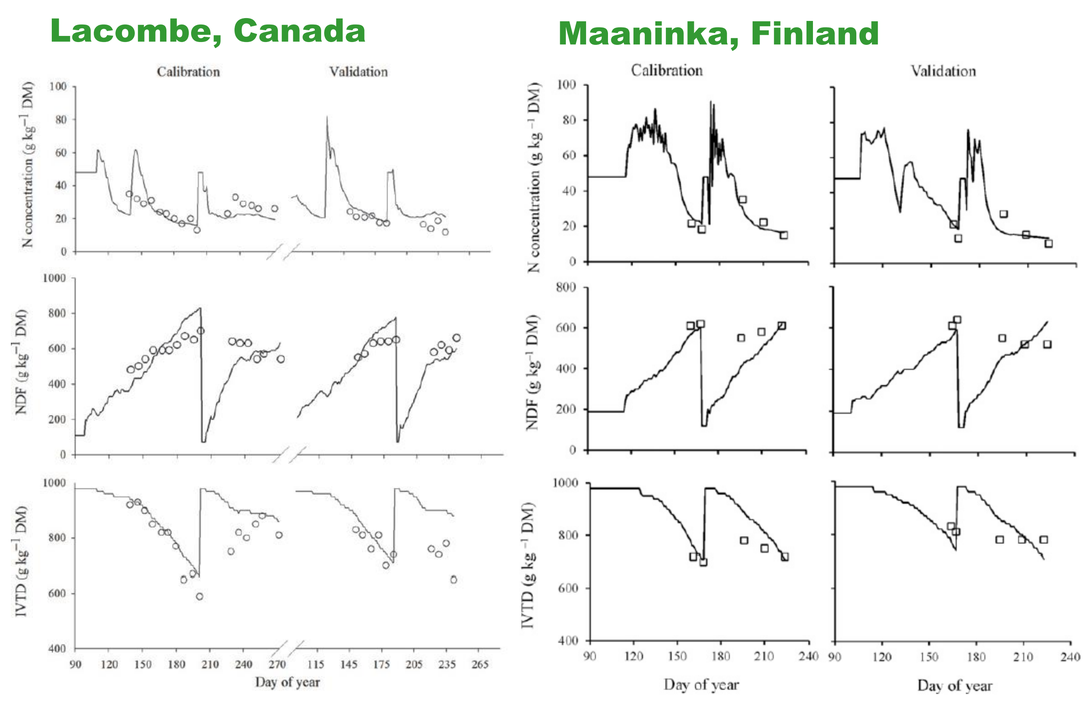



Fig 1. Simulated (lines) and measured (symbols) values of N concentration, neutral detergent fiber (NDF) concentration, and in vitro true digestibility of dry matter (IVTD) at Lacombe (Canada) and Maaninka (Finland).

Table 1. Statistical evaluation of the model's performance.

| Crop attribute | Primary growth | | | | Regrowth | | | |
|---|---|---|---|---|---|---|---|---|
| | N | EF | RMSE | NRMSE(%) | N | EF | RMSE | NRMSE(%) |
| *Calibration set* | | | | | | | | |
| Leaf area index | 19 | 0.35 | 1.2 | 25 | 22 | 0.40 | 1.8 | 44 |
| Forage DM yield (g DM $m^{-2}$) | 35 | 0.79 | 64 | 15 | 26 | 0.87 | 54 | 26 |
| N concentration (g $kg^{-1}$ DM) | 35 | 0.61 | 3.4 | 17 | 26 | 0.08 | 4.3 | 19 |
| NDF (g $kg^{-1}$ DM) | 35 | -0.01 | 52.3 | 9 | 26 | -0.32 | 65.8 | 12 |
| dNDF (g $kg^{-1}$ NDF) | 25 | 0.64 | 50.9 | 7 | 17 | 0.66 | 35.0 | 5 |
| *Validation set* | | | | | | | | |
| Leaf area index | 29 | 0.69 | 1.5 | 37 | 44 | 0.26 | 1.2 | 42 |
| Forage DM yield (g DM $m^{-2}$) | 33 | 0.75 | 79 | 21 | 24 | 0.86 | 55 | 27 |
| N concentration (g $kg^{-1}$ DM) | 33 | 0.46 | 3.4 | 16 | 24 | -0.23 | 4.4 | 24 |
| NDF (g $kg^{-1}$ DM) | 33 | -0.05 | 62.8 | 11 | 24 | -0.35 | 65.7 | 12 |
| dNDF (g $kg^{-1}$ NDF) | 25 | 0.53 | 35.8 | 5 | 17 | -0.81 | 57.9 | 8 |

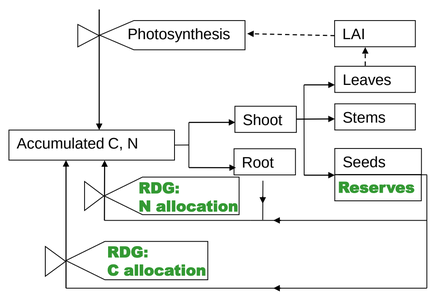
N: number of data pairs; EF: model simulation efficiency; RMSE: root mean square error; NRMSE: normalized root mean square error between simulated and measured values; dNDF: in vitro digestibility of the NDF.

## New regrowth modules

CATIMO is a model specifically developed to simulate the growth and nutritive value of the primary growth of timothy *(Phleum pratense* L.). [7,8]

### Reserve-dependent growth module (RDG)[9]

Regrowth of forage grasses is dependent on the storage and remobilization of C and N reserves. Therefore, a new **RDG module** was incorporated into CATIMO.




The performance of the updated model was assessed with data from four field experiments in Norway, Finland, and eastern and western Canada (Jing et al.[9])

### Nutritive value module[10]

CATIMO was updated to simulate N concentration, neutral detergent fiber (NDF) concentration, in vitro digestibility of NDF (dNDF), in vitro true digestibility of dry matter (IVTD) of the summer regrowth. They were simulated as for spring growth but with modifications to leaf-to-weight ratio and daily changes in the NDF and dNDF of leaves and stems.

The updated model was evaluated with data from four independent field experiments in Finland and eastern and western Canada (Jing et al.[10]).

The updated CATIMO is the first forage grass model to simulate the nutritive value of the summer regrowth. Functions of nutritive value from CATIMO were recently integrated into the STICS model with success.[11]

## Conclusions

- Regrowth DM yield was successfully simulated with the reserve-dependent growth module for very contrasted sites, including Norway and Finland (Table 1).
- Simulated leaf area indices under 4.0 matched well the measured values.
- Nutritive value simulation works well with primary growth. The model performance with the summer regrowth varied across experiments (Fig. 1; Table 1).
- The regrowth nutritive value simulation was the most successful in eastern Canada.
- Nutritive value simulations of the summer regrowth can be further improved with better knowledge of factors controlling nutritive value in summer regrowth and experimental measurements of the proportion of leaves and stems and their respective nutritive value.

### References

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