

PROCESS-BASED SIMULATION OF GROWTH AND RE-GROWTH OF PERENNIAL PLANTS WITH THE DAISY MODEL

Knowledge that
benefits society



FIELD CROPS AND PARAMETERIZATION



***grass/clover**, 3-4 cuts yr⁻¹, 0 kg N ha⁻¹; (stub 10 [cm]), 90% harvest
(Roncossek, 2013)



***festulolium**, 3-4 cuts yr⁻¹, 400-500 kg N ha⁻¹; "*Ryegrass*"; (stub 3 [cm]), 95% harvest
photosynthesis= Jiao et al. (2016 a,b); **devel.**= educated guess (60% plant flowered, in the field maybe 20%); **harvest**= (DSmax 1.50); (cut_delay (x₁ y₁) (x₂ y₂)..)



***miscanthus**, 1 cut yr⁻¹ (autumn), 50-150 kg N ha⁻¹; (stub 10 [cm]), 95% harvest
"default"; **photosynthesis**= Jiao et al. (2016 a,b); **root N uptake** (one-time change);
devel.= educated guess (flowering 15.10-15.11); **harvest**= (DSmax 2.00); (DSnew 0.43)

FIELD CROPS AND PARAMETERIZATION



slight calibration on F_m and Q_{eff}



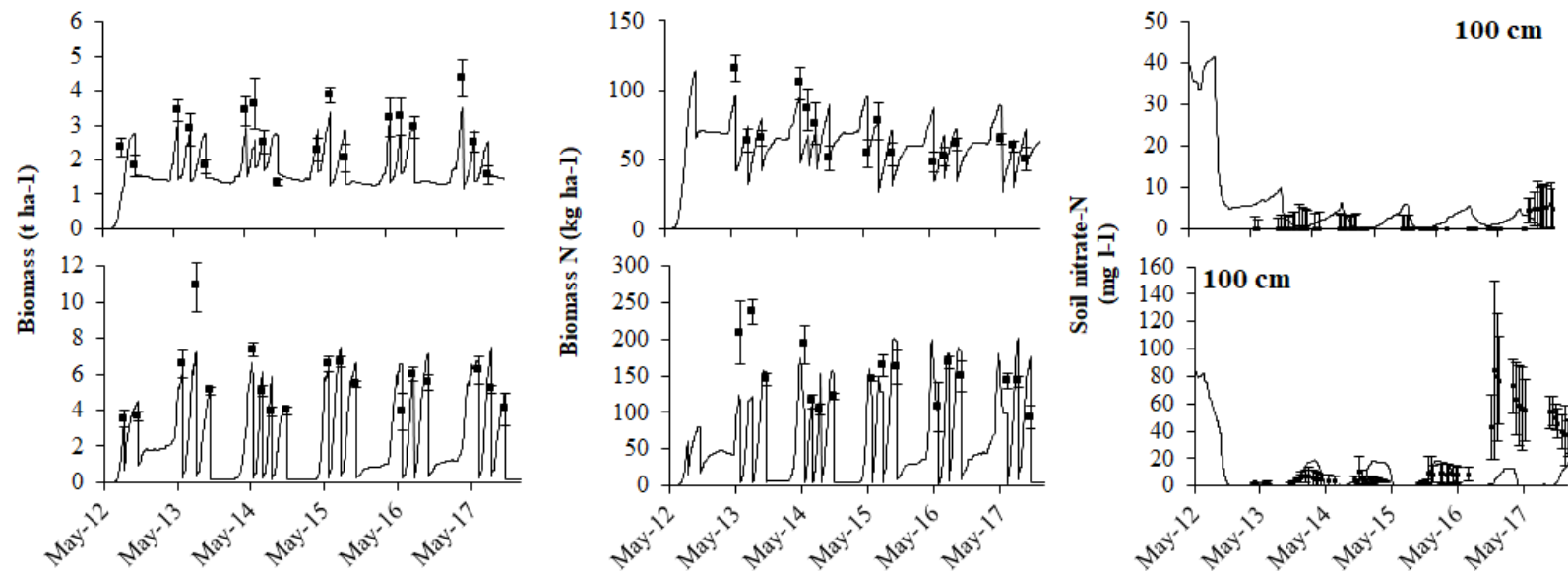
The University Park campus

RESULTS

	NSME	RMSE	RMSE	R2	Dev.
Plant t DM/ha			annual		
Grass/clover	0.2	0.7 (1.3-4.3)	0.7 (4-11)	0.21	0.1
Festulolium	0.9	1.5 (3.5-11)	3.0 (7-23)	0.36	0.45
Miscanthus	0.9	-	3.5 (3-21)	0.78	-1.5
Plant kg N/ha			annual		
Grass/clover	-0.3	22 (48-116)	45 (160-318)	0.2	11.6
Festulolium	0.81	56 (92-236)	100 (377-590)	0.1	-6.2
Miscanthus	0.84	-	10 (48-141)	0.61	0.21

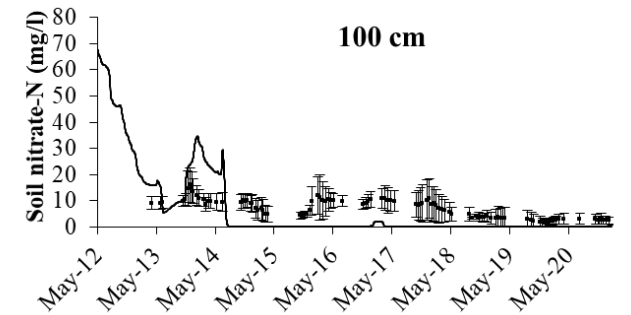
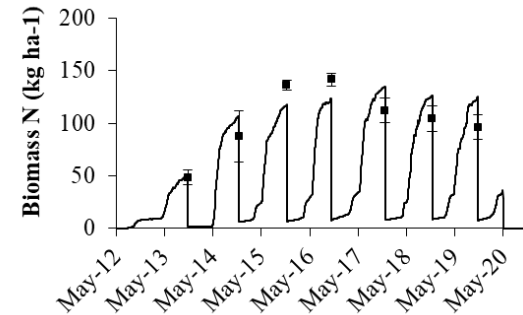
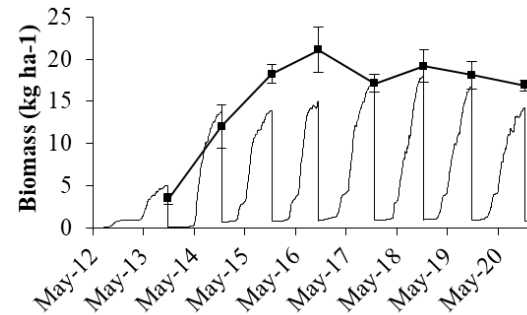
RESULTS AND DISCUSSION

- ***Grass/clover** - fairly acceptable statistics - grass and clover already parameterized
- ***Festulolium** - calibrated with "*Ryegrass*"; difficulty to simulate re-growth (*"Ryegrass"* developed to be grown in association with other crops - clover in particular)



RESULTS AND DISCUSSION

***Miscanthus** - default plant module parameterized and calibrated; not able to simulate inter-annual pattern; need for dedicated experiments.



DISCUSSION

*modelling re-growth after defoliation

// phenology_std.C

“Only increase DS if assimilate production covers leaf respiration.”

// production.C (assimilate production)

remobilization of assimilate from root?

- *ShldResC*: number [**<fraction>**]
Parameter (default 0)
Capacity of shielded reserves (fraction of stem DM).
- *ReMobilDS*: number (dimensionless)
Parameter (default 1.2)
Remobilization, Initial DS.
- *ReMobilRt*: number [**d⁻¹**]
Parameter (default 0.1)
Remobilization, release rate.
- *IntDSRelRtRes*: number (dimensionless)
Parameter (default 0.8)
Initial DS for the release of root reserves.
- *EndDSRelRtRes*: number (dimensionless)
Parameter (default 0.8)
End DS for the release of root reserves.
- *RelRateRtRes*: number [**d⁻¹**]
Parameter (default 0.05)
Release rate of root reserves.

SUM-UP AND OUTLOOK

- *Simulation accuracy depended on perennial plant. Assisted auto-calibration?
- *Support agricultural policy for cultivation of perennial grasses in Denmark

Thanks for attention!



Microcosms and
climate chambers



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PLANT DEVELOPMENT

