Stics Performance Evaluation Report : Miscanthus

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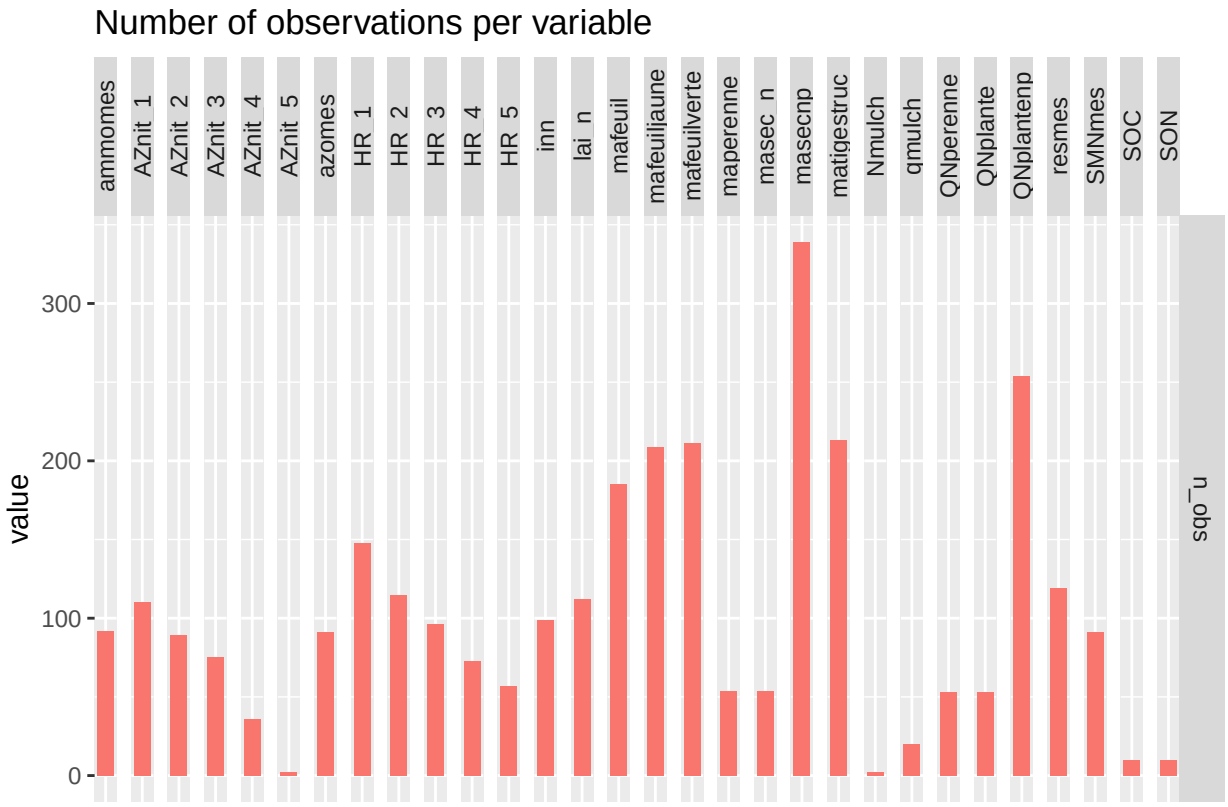
STICS version: V10.0.0

IdeSTICS version: r1956

Number of USMs: 122

Number of cultivars: 1

Cultivars names: Giganteus



The umber of observations used for model evaluation varies between variables.

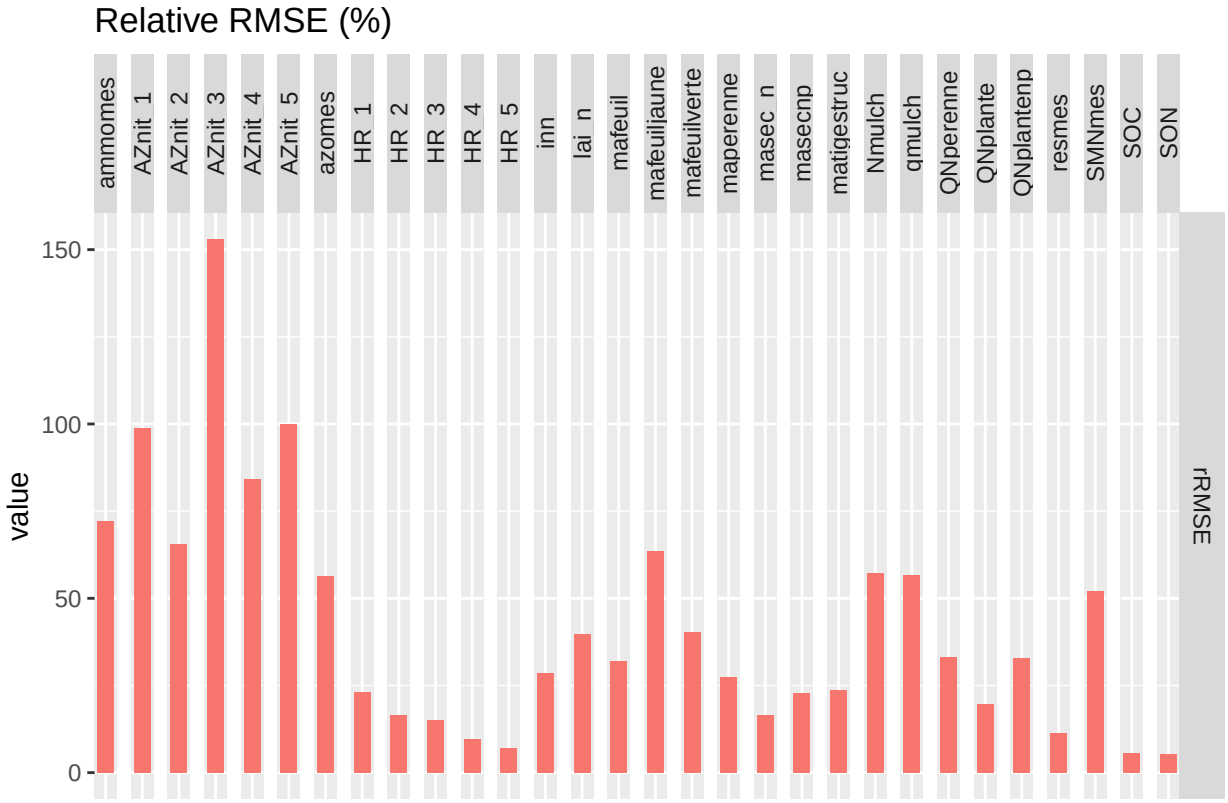
Concerning plant variables, we have numerous observations for non-perennial organs biomass (LAI = lai_n, green leaves = mafeuilverte, dead leaves = mafeuiljaune, stems = matigestruc) and N content (for non-perennial biomass = QNplantenp) with around 100 to 300 observed data. We have less measurements for perennial organ biomass (maperenne) and N content (QNperenne) with around 50 observations, but enough for model evaluation.

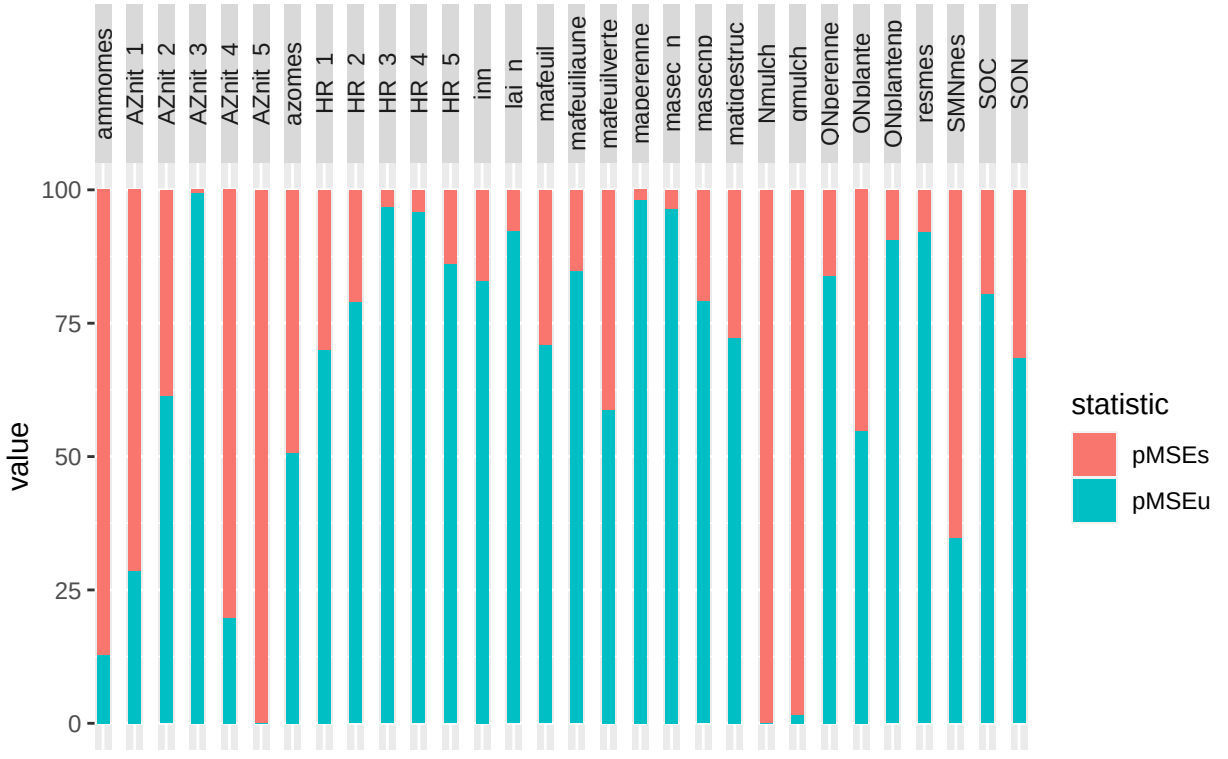
Concerning soil variables, we have also numerous observations for soil nitrate content and gravimetric soil water content in different soil layers (AZnit and HR respectively), nitrate and ammonium and soil mineral nitrogen and water content in the soil profile (azomes, ammomes, SMNmes and resmes respectively). We also have some measurements of mulch biomass (qmulch) and its N content (Nmulch) and a few data for soil organic carbon (SOC) and nitrogen (SON) stocks.

Evolution of performances with respect to previous versions

Miscanthus was not parameterized for previous versions of STICS.

Global analysis





The relative root mean square error (RMSE) is the highest for soil nitrate content in the different soil layers (between 60 and 150%) but is lower when integrated over the soil profile (azomes, Relative RMSE around 50%). Relative RMSE for soil water content is lower than 25%.

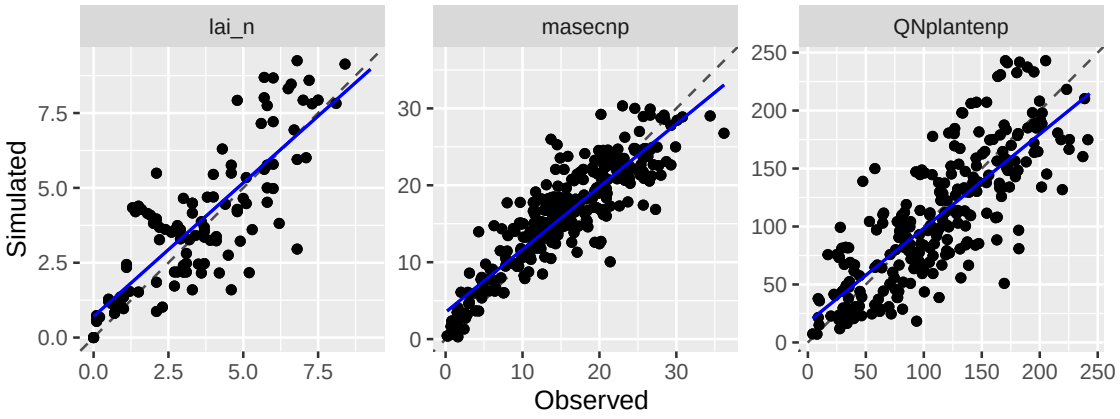
rRMSE varies between less than 25% and 60% for plant variables. The simulations are fairly good for aboveground biomass (rRMSE around 25%).

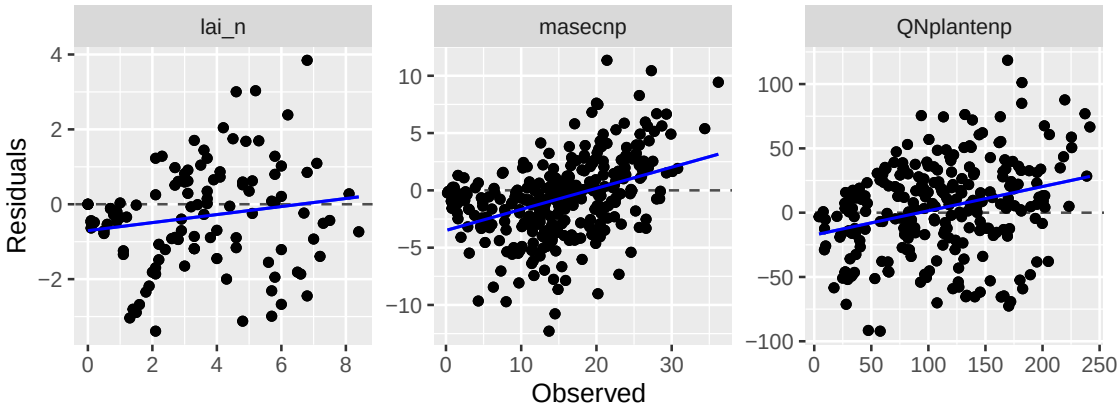
The relative RMSE for SOC and SON is low but the model tended to under-estimate SOC and SON and it was only observed in one site. The simulation of mulch decomposition and SOC and SON dynamics still needs improvements (and a broader evaluation).

Growth dynamic

	lai_n	masecnp	QNplantenp
n_obs	112.00	339.00	254.00
mean_obs	3.56	14.99	111.18
mean_sim	3.88	15.73	107.59
CV_obs	59.70	50.39	51.09
CV_sim	60.21	43.76	53.74
RMSE	1.42	3.44	36.62
rRMSE	0.40	0.23	0.33
pMSEs	0.08	0.21	0.09
pMSEu	0.92	0.79	0.91
EF	0.55	0.79	0.58
Bias	0.32	0.74	-3.59

LAI as well as non-perennial organs biomass and N content dynamic is well simulated by the model. Mean of simulations and observations are similar. The rRMSE varies between 23 and 40% and the model efficiency between 0.55 and 0.79.

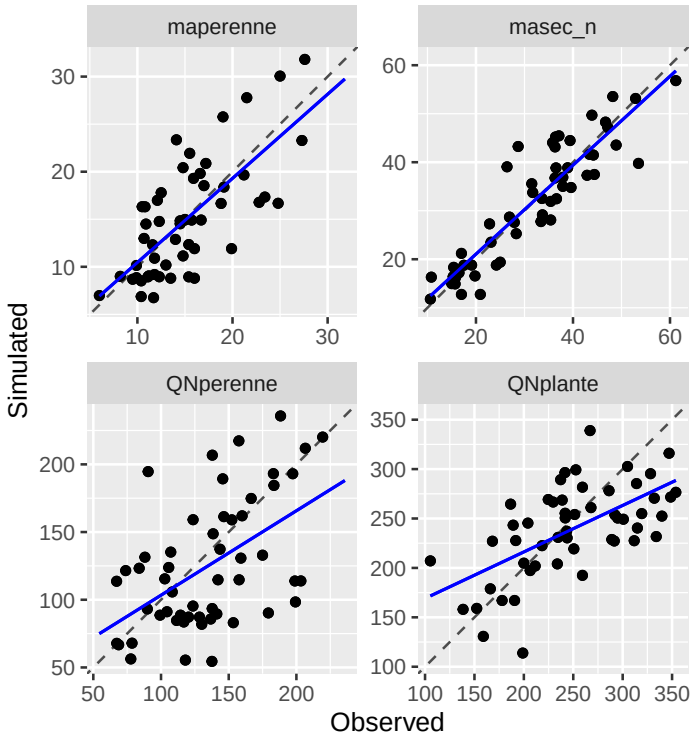


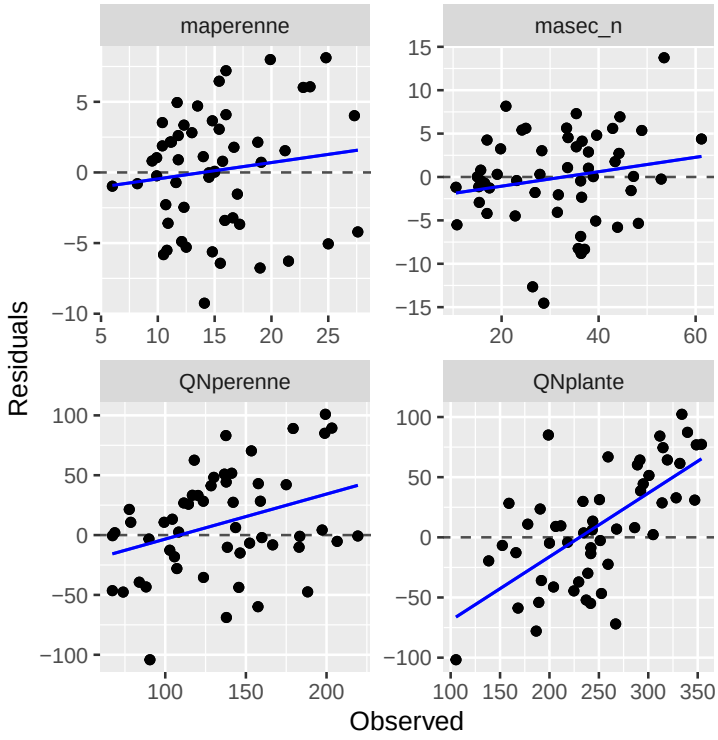

lai_n
masecnp
QNplantenp
Residuals
Observed
4
2
0
−2
0
2
4
6
8
10
5
0
−5
−10
0
10
20
30
100
50
0
−50
−100
0
50
100
150
200
250

Biomass and Nitrogen Partitioning

	masec_n	maperenne	QNplante	QNperenne
n_obs	54.00	54.00	53.00	53.00
mean_obs	31.86	15.12	248.81	134.87
mean_sim	31.93	14.99	239.14	125.10
CV_obs	38.14	32.02	24.16	29.92
CV_sim	38.52	39.81	19.35	38.57
RMSE	5.26	4.16	49.02	44.54
rRMSE	0.17	0.27	0.20	0.33
pMSEs	0.04	0.02	0.45	0.16
pMSEu	0.96	0.98	0.55	0.84
EF	0.81	0.25	0.32	-0.24
Bias	0.07	-0.14	-9.67	-9.77

We show here the results of the model evaluation concerning its ability to simulate biomass and nitrogen accumulation in the whole crop (masec_n = maperenne + masecnp and QNplante = QNperenne + QNplantenp) or in perennial organs (maperenne and QNperenne). The model performance is acceptable, considering the large measurement uncertainty for perennial organs. Moreover, most of the discrepancy between simulations and observations is due to few simulations during drought years. An improvement of the model for simulation of the effect of water stress on biomass and N partitioning is still needed to improve the simulations.

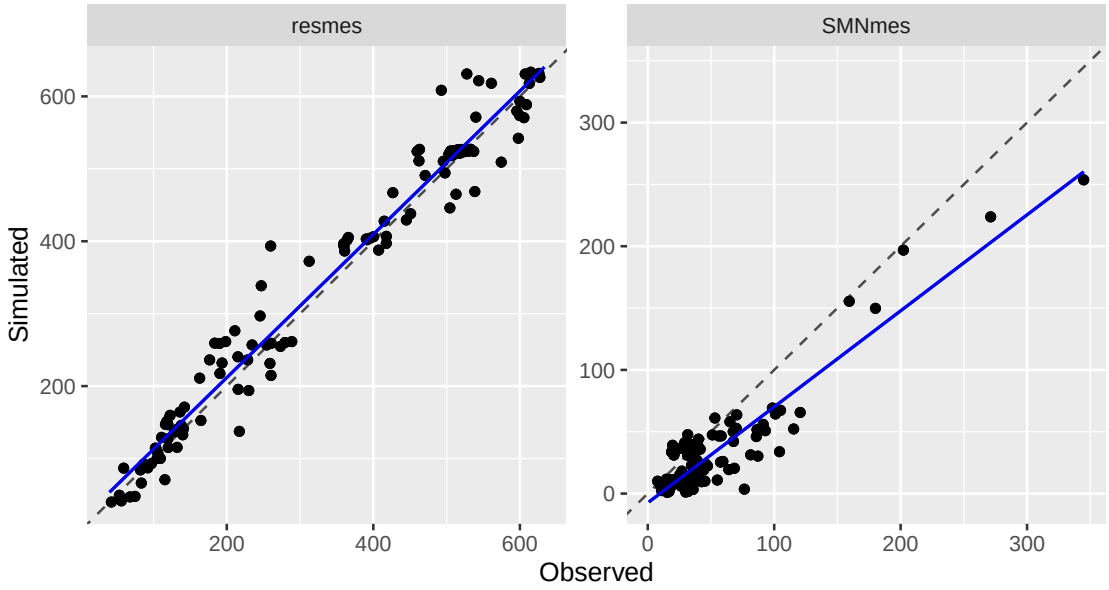


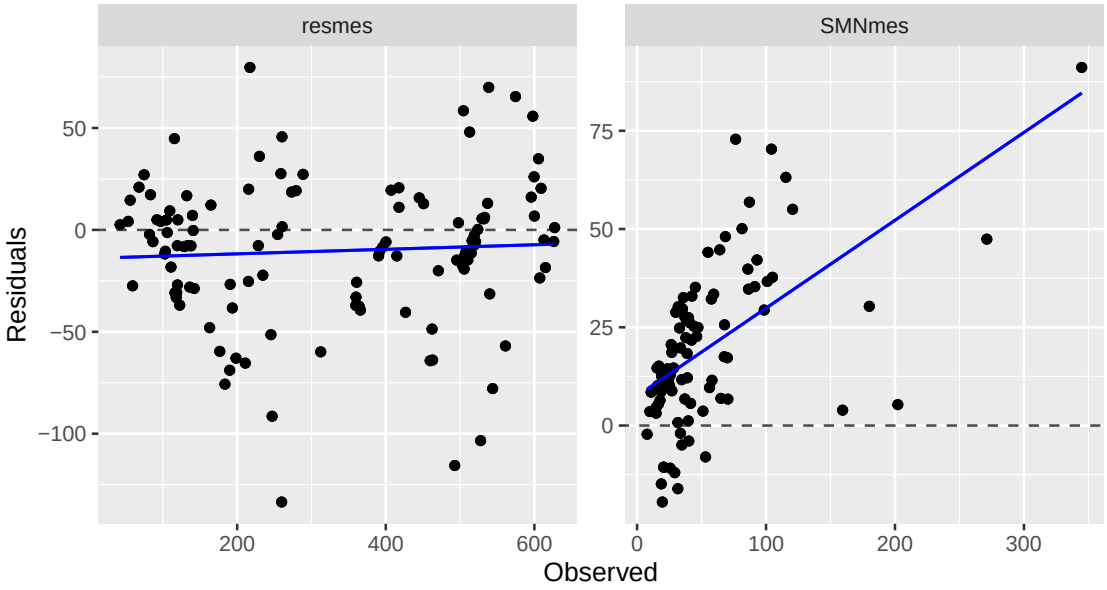

maperenne
masec_n
QNperenne
QNplante
Residuals
Observed
5
0
−5
−10
15
10
−15
20
40
60
100
50
−50
−100
150
200
250
300
350
25

Water and nitrogen soil content

	resmes	SMNmes
n_obs	119.00	91.00
mean_obs	331.62	54.69
mean_sim	341.91	34.95
CV_obs	56.08	96.42
CV_sim	54.79	126.65
RMSE	37.13	28.40
rRMSE	0.11	0.52
pMSEs	0.08	0.65
pMSEu	0.92	0.35
EF	0.96	0.71
Bias	10.28	-19.74

Soil water content in the soil profile (resmes in mm) is well simulated by the model. Simulation of soil mineral nitrogen content is also satisfactory even if the differences between simulated and observed data are higher. In particular, the model is able to simulate the low soil mineral nitrogen content under well established miscanthus crop.




resmes
SMNmes
Residuals
Observed
50
0
−50
−100
75
50
25
0
200
400
600
0
100
200
300

Conclusion

It is important to say here that model evaluation has been done on multiple sites (from England to south of France) with different soil and climate situations and independent data from calibration. Moreover, the simulations were chained from the planting year for at least 3 years and until 20 years, which means that the simulation of a year was automatically initialized with the results of the simulation of the previous year.

The model can be used to simulate biomass production and environmental impacts of miscanthus on the long term even if some improvements of the model is still needed for mulch and soil organic matter dynamics. Of course, if you have complementary data to evaluate the model do not hesitate to contact us!