APSIM Next Generation to Model Red Clover Under Nordic Climate

Mukhtar Ahmed, David Parsons, Julien Morel, Kumar Uttam, Boel Sandström, Marcos Lanna, Johanna Wallsten

APSIM Next Generation to Model Red Clover Under Nordic Climate

Ahmed Mukhtar[1] (mukhtar.ahmed@slu.se), Parsons David[1], Morel Julien[1], Kumar Uttam[1], Sandström Boel[1], Lanna Marcos[2], Wallsten Johanna[1]

[1] *Agricultural Research forNorthern Sweden, Swedish University of Agric Scinces, Umeå, Sweden*; [2] *Plant Production Ecology, Swedish University of Agric Scinces, Uppsala, Sweden*

Introduction

Cool climate and shorter growing season are the main feature of northern part of Sweden. These features poses a serious challenges to have crops which can survive under low thermal units, and grow well at higher latitudes with longer day length and higher radiation use efficiency. Red clover (*Tri-folium pratense* L.) is an important deep rooted perennial forage legume crop famous for its high protein feed (Marshall *et al.*, 2017) and high rate of biological nitrogen fixation. Red clover is a native of Sweden and have been cultivated in Sweden from at least 200 years. Management practices, study sites and climatic conditions have significant impact on the quantity and quality of forage. Climate change in the form of increased CO_2 concentration and temperature and changes in rainfall patterns have quite significant differential influences on crop yield and product quality. The effect of mangements, genotypes and environments on red clover in northern Sweden could be studied by the use of crop model such as Agricultural Production Systems sIMulator (APSIM) next generation. This model have not been tested and calibrated for northern part of the world. Therfore, the purpose of this study is to calibrate and evalaute APSIM next geneartion for red clover crop production under nordic conditions and to see how this model can capture effect of radiation use effeciency on drymatter production of red clover crop.

Materials and Methods

Data regarding crop, soil and weather for four study sites i.e. Röbäcksdalen (63◦8**1**'N, 20◦2**4**' E), Öjebyn (65° 34'° N, 21° 39' E), Lännäs (63°1**1**' N, 17°**74**' E) and Ås (63◦24'N, 14◦56**'**E) were collected from Nordic field trail System (NFTS). One red clover cultivar i.e Torun (4n) drymatter data was considered only (Table 1) to calibrate the model. Afterwards, four year (2015-2018) simulation was conducted in which first year was cosnidered as establishment year while in the next three years, defoliation command was initiated to have three cuts in each year.

Results and Discussion

Above dry matter accumulation by APSIM next generation was simulated in close agreements with observed data but variation was higher during establishment year where it was under simulated as initially default cultivar coefficients were used. However, if we modify leaf radiation use efficiency (RUE) parameter then increase in dry matter was observed. Therefore, in order to get accurate estimation from APSIM next generation it is important to focus on parameters which can capture effect of higher RUE in northern part of Sweden. Similarly, to improve model performance at higher latitude light extinction coefficient was also changed but still it has been observed that proper phenotypic data should be made available to implement APSIM next generation with true spirit at ground scale.

Conclusions

Field scale data is required to calibrate the APSIM next generation at higher latitudes of Nordic regions so that it can effectively capture the effect of higher radiation use efficiency. Our results can help to see the performance of APSIM next generation at higher latitudes and help to improve the model performance on ground scale.

.../...

Table 1. Sowing and harvesting date of Red Clover during 2015-2018 at four sites

Years	2015-18			
	Sowing	Harvests		
		H1	H2	H3
Establishment Year (Y1)	21/05/2015	21-06-2015	-	-
2016		21-06-2016	10/8/2016	10/9/2016
2017		21-07-2017	10/7/2017	28/8/2017
2018		17-06-2018	26/07/2018	5/9/2018

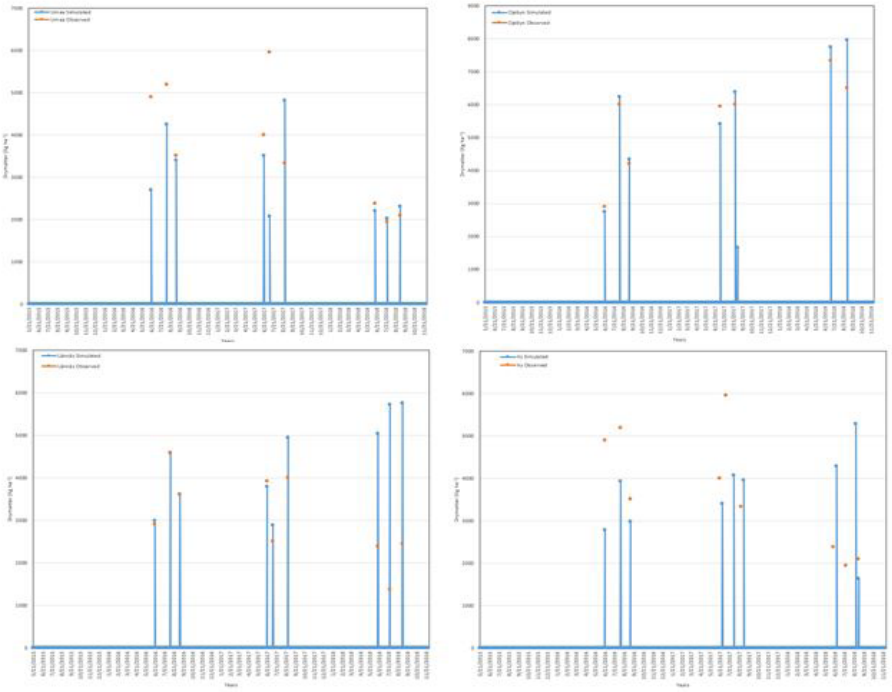

Figure 1. Red Clover Drymatter accumulation at four different study sites

Keywords: APSIM Next Generation, Red Clover, Nordic Climate, radiation use efficiency, Drymatter.

References:

1. Marshall, A.H., Collins, R.P., Vale, J., Lowe, M., 2017. Improved persistence of red clover (Trifolium pratense L.) increases the protein supplied by red clover/grass swards grown over four harvest years. European Journal of Agronomy 89, 38-45.