FARMAX Dairy improvements

March-May 2025

Background

The animal model within FARMAX Dairy is called MOOSIM (Bryant et al. 2008). Using a combination of empirical and mechanistic components, it simulates all the major physiological processes happening within a dairy cow – maintenance of tissues, pregnancy, growth, deposition/mobilisation of body (fat) reserves and, of course, mammary cell/tissue growth and milk production. As a standalone model the objective of MOOSIM is to calculate (output) milk production, liveweight change and the feed intake (DM) required to achieve that production. It needs information on the age, breed, liveweight, body condition and genetic merit of the animals being modelled, the climate they experience, the quality and quality of pasture allowance (aboveground kgDM offered / cow) and supplementary feed quality and allowance (kgDM /cow offered per day).

MOOSIM is embedded in FARMAX Dairy. The FARMAX user interface allows the farmer to specify the required animal attributes and the quantity and quality of supplementary feed offered per day to cows. FARMAX then iteratively solves the MOOSIM model with different pasture allowances until it determines the appropriate pasture allowance that delivers a pasture intake that meets the nutritional needs of the cows. It solves this algorithm for each day of the period modelled.

Recognised Issues

For NZ dairy farming systems based on a diet mostly comprised of grazed pasture, the measured levels of milk production and body condition agree well with those modelled by FARMAX. However, some farmers and consultants have observed that under very intensive farming systems with high production and high levels of dry matter intake that:

- the model hasn't been able to simulate as much milk as measured in the vat
- the intake solver hasn't stabilised and vastly over-estimated pasture intake levels

Farmers/consultants have also noted that, compared to what is measured on farm, the model tends to partition in late lactation more toward body condition score (BCS) than milk production.

Action to remedy

We have made changes to the MOOSIM model and how it interacts with FARMAX to address the above issues. In doing so it was important that we retained the ability for MOOSIM to accurately represent the processes occurring within the dairy cow, while giving the user a better ability to reflect the reality occurring on their farm. We have also made other changes that improve the user experience making it easy to adjust and update milk production actuals and body condition score (BCS). The following outlines the changes made:

1. Pasture inputs - Target vs Actual

The MOOSIM model which underlies FARMAX Dairy is largely driven by user inputs related to supplementary feed supply and pasture allowance (allowance is defined as the total aboveground biomass potentially available for grazing per cow per day). But feed supply can also be an output of MOOSIM because it determines the pasture feed required from knowing the energy cost of maintenance, liveweight change, pregnancy and lactation.

In MOOSIM V1, we iteratively manipulated the model, until feed required was equal to the feed supplied. In high feeding or late season cases where the lactation component of the model was not able to produce enough milk, the extra energy was channelled into BCS. This is why BCS sometimes increased beyond what is typically observed in reality.

In MOOSIM V2, we have made these input and output feed supply aspects of MOOSIM explicitly obvious to the user by providing two pasture offered rows (Figure 1).

The first row – ***Pasture (target)*** - is the *input* value which drives MOOSIM. This row is editable.

The second row – ***Pasture (actual)*** is calculated (i.e. is a model *output*) from the energy cost associated with milk production and BCS outputs. This row is not editable. It will normally be less than or equal to the target value. It is these pasture values which drive the reported demand and intake, and which are used by the pasture model to compute predicted pasture cover.

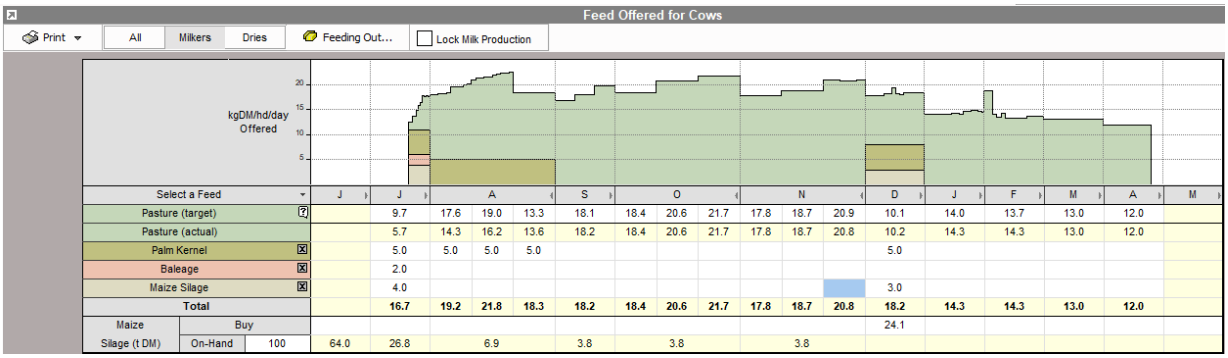


Figure 1 Feed Offered section of the Performance screen for a cow herd

The two pasture intake values will often be equal but separating the input and output pasture offered gives you transparency and freedom to tune the model. They will differ if you either:

- manipulate modelled Milk production (Figure 2) or BCS (Figure 4) using the new scaling factors (explained below), or
- override modelled per day per cow MS by directly entering values into *Model MS* row of the *Production* table (Figure 2), or
- enter milk actual totals in the *Milk Actuals* form and calibrate the model (Figure 3), or
- switch to OAD milking (*Pasture (actual)* will be reduced).

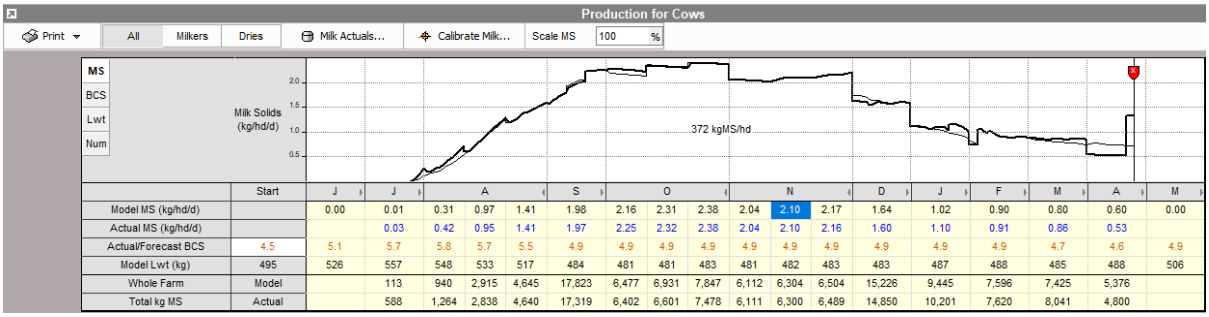


Figure 2 Milk solids component of the Production section of the Performance screen

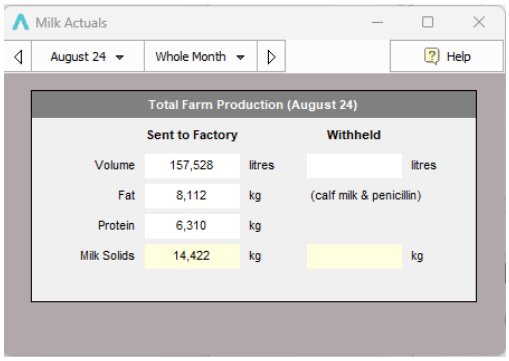


Figure 3 Milk Actual input screen

In summary

Think of ***Pasture (target)*** as the maximum amount of pasture the farmer *targets* to offer, from which the cows (normally) eat some or all of it and ***Pasture (actual)*** is the amount calculated *as actually* offered given the production and/or BCS specified. Both pasture rows are *offered amounts* meaning they include utilisation waste.

2. Total DM offered

The *Total* row at the bottom of the feed input table (Figure 1), now displays the total **offered** of all feeds. This is the total of the *Pasture (actual)* and all the supplementary feeds offered. Previously, the *Total* row displayed the total DM **utilised** (down the throat of the cow), and if users wanted to know the total offered, they had to manually add back in utilisation losses.

3. Scaling Milk Solids (MS) and Body Condition Score (BCS)

There have been enhancements made to scale milk production and body condition score quickly and easily. It allows users to adjust milk production and BCS independently. If users believe their animals partition proportionally more to milk than BCS, then they can either upscale the MS and/or downscale the BCS. These changes flow back to the *Pasture (actual)* offered row in the above *Feed Offered* table, because scaling MS and BCS will also change the demand for energy.

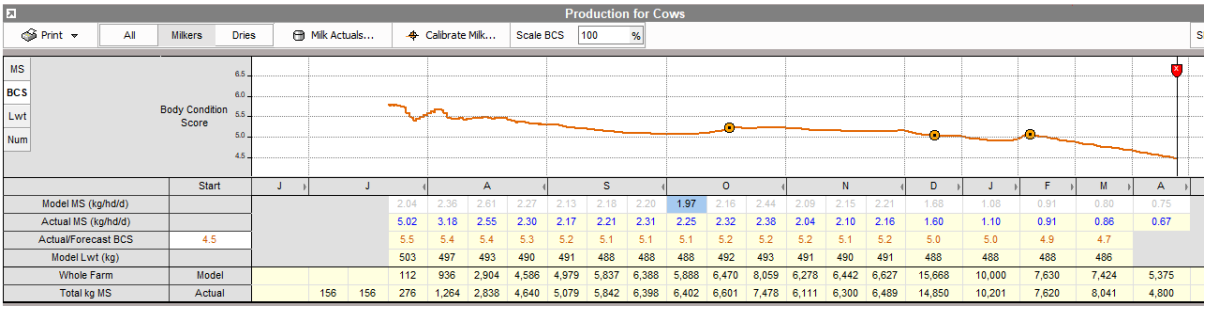


Figure 4 Body Condition Score component of the Production section of the Performance screen

4. Overriding BCS

It is now easy to add, adjust or delete BCS measurements directly on the BCS graph. Just right click on the graph where you want to add a measurement (in terms of date and BCS level), and then select *BCS* (Figure 5). You can also change BCS by dragging a BCS point.

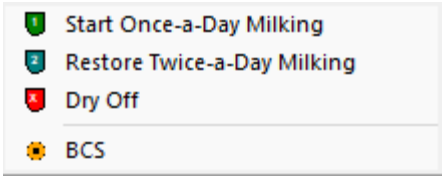


Figure 5 Right click on the Production section graph of the Performance screen to open is input selector

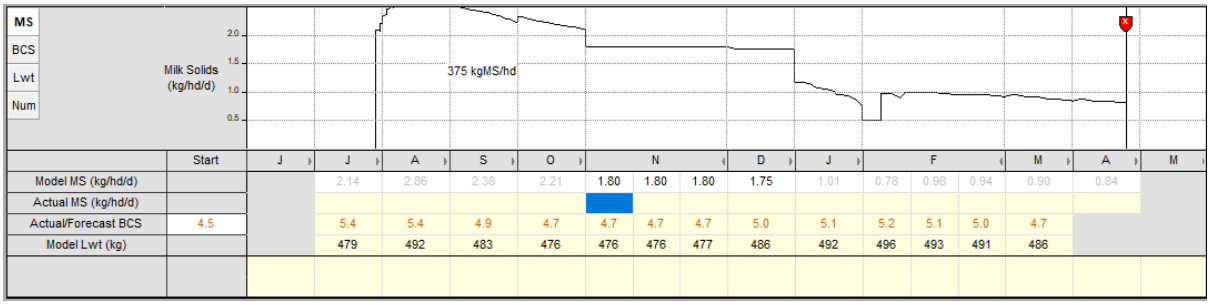
5. Smoothing applied to BCS curve

Another change implemented is the modelling between BCS measurements. Previously, the model jumped up (or down) to the measured value on the day of the measurement. It created a "saw-tooth" effect to the graph. In reality, we know BCS doesn't abruptly change from one day to the next. Therefore, the model now gradually ramps (or down) to the next BCS measurement, creating a much smoother (and realistic) change in BCS.

6. Overriding Milk

As well as scaling the milk production for the whole season, user can also directly enter observed MS per cow into the *Model MS (kg/hd/day)* row of the *Production* table (Figure 6). Modelled values are displayed in grey text until they are overwritten with actuals – then the text becomes black. The values can be inputted monthly or at 10-daily time steps. Deleting out the inputted value a cell restores the modelled value.

Note: if you are struggling to get the modelled milk production to respond to changes in feeding, check to see if there are manually entered override values in this table.



	Start	J	J	A	S	O	N			D	J	F		M	A	M
Model MS (kg/hd/d)			2.14	2.86	2.38	2.21	1.80	1.80	1.80	1.75	1.01	0.78	0.98	0.94	0.90	0.84
Actual MS (kg/hd/d)																
Actual/Forecast BCS	4.5		5.4	5.4	4.9	4.7	4.7	4.7	4.7	5.0	5.1	5.2	5.1	5.0	4.7	
Model Lwt (kg)			479	492	483	476	476	476	477	486	492	496	493	491	486	

Figure 6 Milk solid production table

7. The choice is yours

It is up to the user if they want to use these changes or not. Use *Model Settings* in the Dairy Enterprise *Properties* screen to select either standard MOOSIM or the version with these changes implemented (MOOSIM V2) (Figure 7). **Existing** files will use whatever MOOSIM version was specified and saved; **new** files will be set to MOOSIM V2 by default.

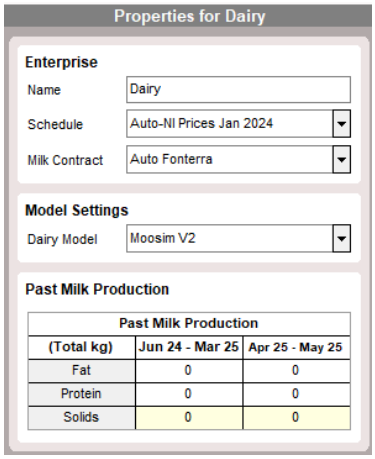


Figure 7 Where to select MOOSIM v1 or MOOSIM v2

References

Bryant J., Lopez-Villalobos N., Holmes C., Pryce J., Rossi J., and Macdonald K., 2008. Development and evaluation of a pastoral simulation model that predicts dairy cattle performance based on animal genotype and environmental sensitivity information. Agricultural Systems 97, 13-25.