# Release Notes – Overseer version 6.5.1 (Crop model changes)

## Contents



## Introduction

The update of the Overseer model to version 6.5.1 represents a complete update of the crop sub-model.

This update aimed to resolve known issues with the crop model that were previously identified by users, Overseer Limited and those highlighted by the 2021 model review. This includes resolving the difficulty associated with acquiring and reviewing information required to incorporate crops into the Overseer model. Following the recommendations of (Brown, 2022), the crop model was updated to incorporate the following:

- Updated crop coefficients table, including updated definitions of a crop (coefficients) that more directly correlate to real-world plant growth.
- Model update:
    - Use of new crop coefficients.
    - Scaled plant growth based on thermal time, rather than crop-specific national averages.
    - Additional calculations for field loss and dressing loss.
    - Addition of four new crops
- UI update:
    - New user input fields (field loss, harvest/end event date).

- Updated crop selection pathway.

## Advantages/benefits

Due to the large scope of the changes made with this update, there are a raft of advantages and benefits with this release, which are listed as follows:

- Field loss and (where appropriate) dressing loss are now accounted for in the model.
- No longer need to select a crop variant based on end use and/or time of planting (e.g., “oats summer” and “oats autumn” are now just “oats”).
- All current crops were reviewed and updated, with an additional 4 crops added to the model (described further below).
- Resolved historical “prior land use” bug (described further below).
- Updated crop definitions and coefficients table, making it easier for Overseer to review current or incorporate new crops in the future.
- Review and removal of the “End N uptake” function (Why was the 'End N uptake' function removed?)

## Overall impact

Before releasing model updates to OverseerFM, this update was assessed, with all changes being co-developed and agreed with by subject matter expert, Hamish Brown.

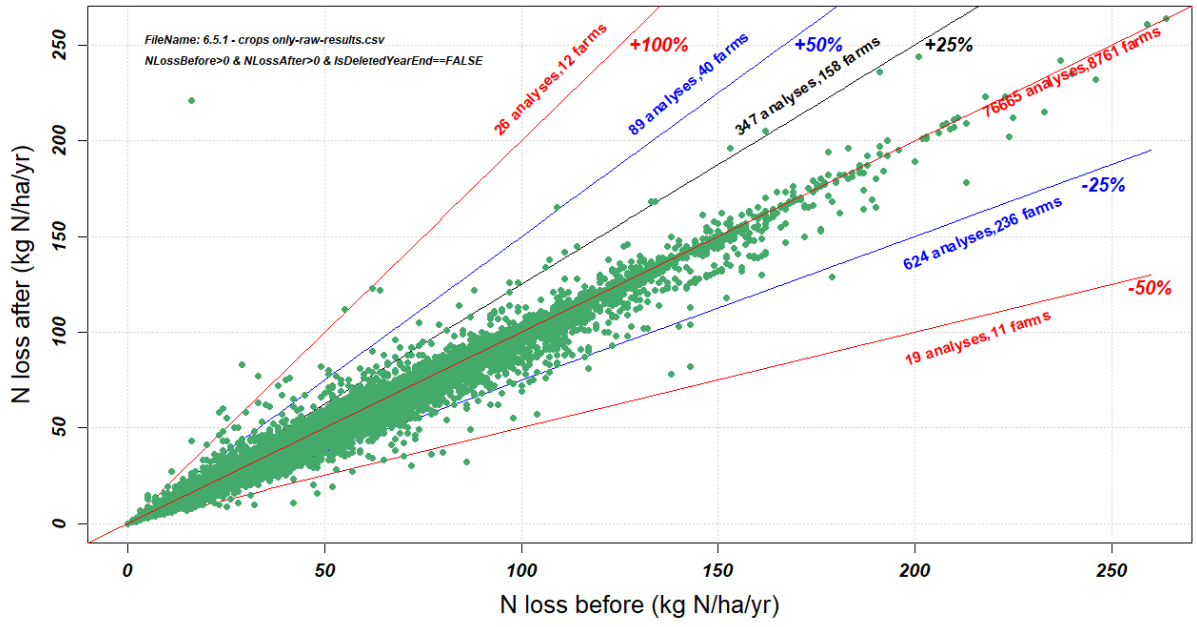
The impact on modelled results for the change is determined using year end analyses for each farm account in OverseerFM. The Impact on analyses being able to generate a result is as follows:

- Total number of tested analyses: 93, 740
- With a N loss result (before): 81312
- With a N loss result (after): 77301
- Loss of result: 4264 (4.5%)

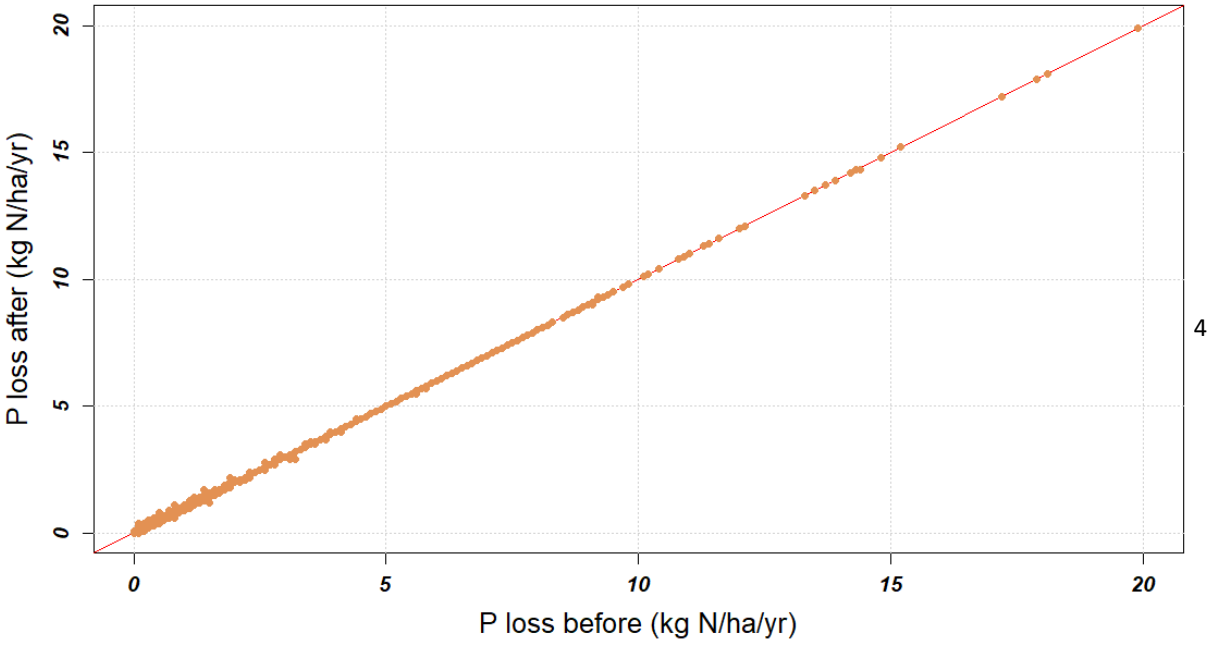
Reason for loss of results: 95% are due a feeding error, discussed further below.

The following graphs show the combined impact of model release 6.5.1 on N, P and GHG results. We have used the complete database of 93, 740 analyses within OverseerFM.

**Comparison of the total N loss before (6.5.0) and after (6.5.1)**




**Comparison of the total P loss before (6.5.0) and after (6.5.1)**

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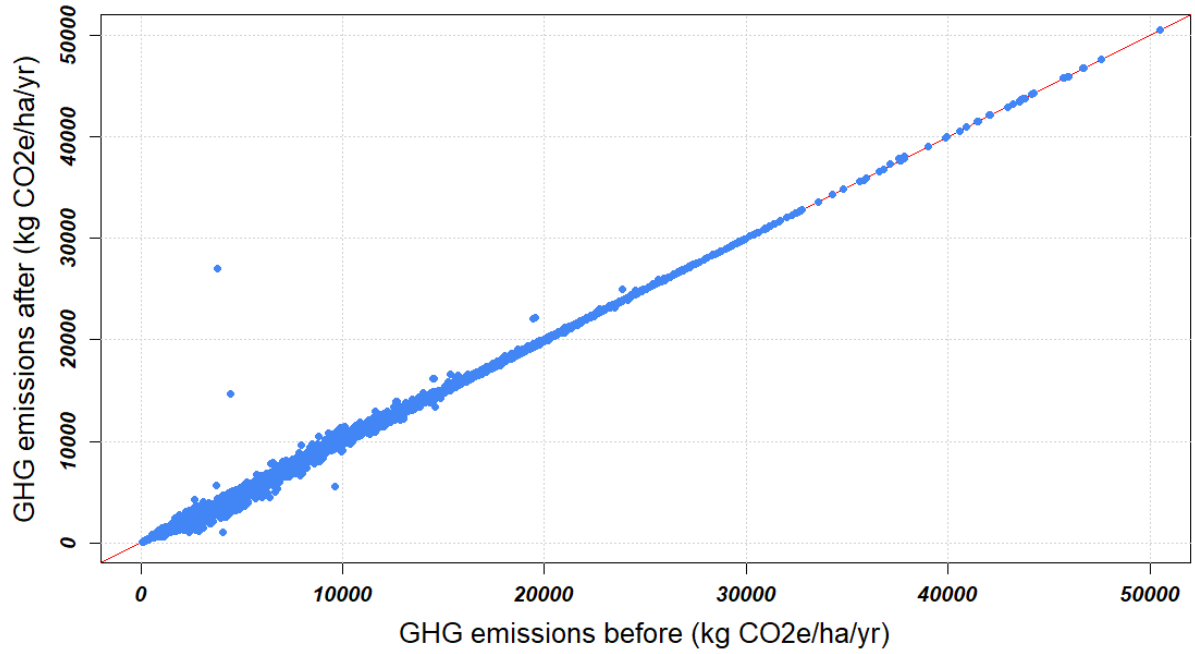
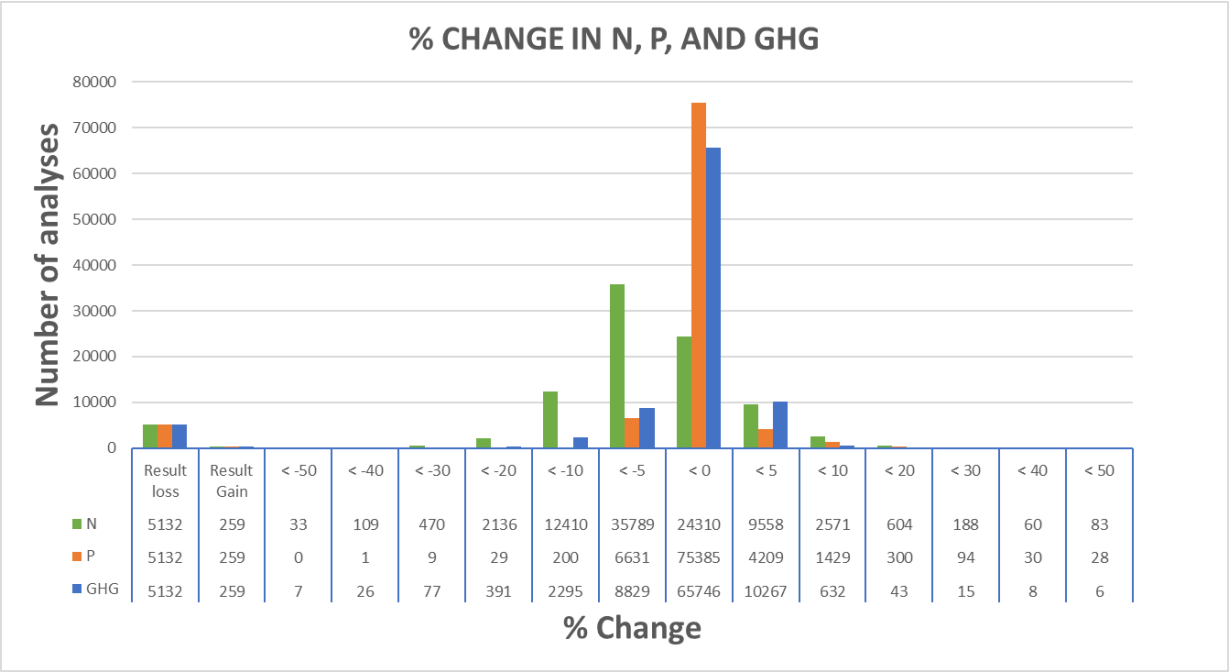
**Comparison of the total GHG loss before (6.5.0) and after (6.5.1)**



**Total kgs/year % change in N, P and GHG**




## What have my results changed?

The update of OverseerFM to version 6.5.1 is a complete update of the crop sub-model. If the analyses in your farm account do not include the use of this sub-model, your results should stay the same. Our analysis of the OverseerFM database shows that over 10,000 farm accounts in OverseerFM use the crop sub-model, while around 4000 farm accounts do not.

Note: this update does not impact the pasture model.

Farm accounts which use the crops sub-model may see a change in their farm results following this update. As such, a description of the model changes and the possible reasons for a change in farm results are outlined below. This work does not update how pasture or pasture crops are modelled.

### Harvest or end of the crop date

The most significant upgrade made to the crop model in this update is how the curves for biomass accumulation, canopy cover, and root depth are calculated. Before this upgrade (up to version 6.5.0), these curves were static and reflected a national average. With this upgrade, these curves are now scaled between user specified planting and harvest/final event dates, allowing for more realistic predictions and accurate farm descriptions. However, users must now specify the harvest or final date.

If your OverseerFM analyses currently have crops that don't have a specified harvest/final event date, we have estimated this harvest/final event entry and the associated date for you. While Overseer has done its best to estimate this new information based on all the old information already provided, this new information may not be right for your farm.

To ensure the change in your results is appropriate, please look at your blocks and update the specified harvest or final event reason and/or dates as needed.

### Prior land use

When entering information for crop blocks, users select how the land was used prior to the described 2-year rotation. Previously (version 6.5.0), there was a bug in how the selection of 'grain crop' or '(vegetable) crop' options impacted the N leaching estimates for some users. This update indirectly fixes this bug, which, for some users, will cause a change in their results.

Please note: Entering prior land use information then leaving the 2-year rotation largely undefined leads to significant uncertainties in the modelling of nutrient dynamics and is therefore considered an inappropriate use of OverseerFM. The "prior land use" option informs the "land use" before the start of the 2-year rotation, to learn more see "Characteristics of crops" Technical Manual Chapter (TMC), section 2.4.

### Biomass accumulation

As previously mentioned, this upgrade changes how the model uses the biomass accumulation curve, which is now scaled between planting and the newly required harvest/final event dates.

The model hypothesises that the curve of N uptake is identical to the curve of biomass accumulation. Thus, the proportion of N absorbed each month is the same as that of the biomass accumulated each month.

Previously (version 6.5.0 and prior), these curves were static and independent of harvest/final event dates. With this update, biomass accumulation (and thus the total N uptake) is now scaled between planting and the newly required harvest/final dates, meaning the monthly proportion of N absorbed is more appropriately distributed over the growing period of the crop.

This indirect change in how crop N update is calculated may lead to a change in your current OverseerFM results. Reviewing and updating the harvest/final event date values, as necessary, on all your blocks will ensure these new results best reflect the farm system.

### Harvest index calculation

A significant upgrade to the crop model is an update to the information describing the characteristics of crops. New coefficients now correlate more directly to observable properties of a crop. This means these new coefficients can now be more easily assessed by farmers and scientific experts.

The harvest index (HI – proportion of harvestable yield of a crop to the total yield), which depends in some cases on the crop yield, is now calculated and restricted in a range defined by the new crop coefficients *typical HI* and the *expected HI range*. This restriction may cause a change in your OverseerFM results when the input crop yield is outside typical yield range.

### Removal of "seasonal" variations of crops

As previously mentioned, the crop model has been updated to improve how crop curves are calculated (see section 1.1) and how crops are described (see section 1.4 above). Together, these updates now allow for the seasonal variation in crop growth to be accounted for within a single definition of a crop. This means that selecting the appropriate seasonal variation of a crop is no longer needed in OverseerFM, simplifying the crop selection process. For example, when selecting Cauliflower, there is no longer a need to select Cauliflower (winter/spring) or Cauliflower (summer) depending on when you're growing the crop, now users can simply select Cauliflower and provide the additional information as per normal.

## Crop coefficient updates

As part of this work, scientists have also reviewed and updated the crop coefficients for all crops currently in OverseerFM. While many have remained unchanged, some coefficients for certain crops have been updated, based on extensive data/literature analysis by scientists and by review from local crop experts.

The most significant changes in the crop coefficients are the following:

- Our experts significantly increased the maximum root depths of greens and green manures, which generally results in a decrease in total nitrogen loss.
- The total amount of N fixed (N fixation) by leguminous crops (beans, lentils, and peas) has been reduced according to the opinion of our experts, which generally translates into a reduction in GHG emissions.
- N content has decreased, feed utilisation has increased, and HI has upgraded for fodder beet (discussed further below).
- HI has upgraded for kale.
- The coefficients for HI, moisture, and N contents have been significantly changed for all beans, and also for cauliflower (winter/spring) and cabbage (winter/spring) crops when converted to cauliflower and cabbage (respectively).

The coefficients of some common crops have changed substantially (e,g, fodder beet), as such, further details as to how and why are provided below. Table 1 lists the 20 most used crops for each farm type, where the Overseer analysis has at least one cropping/fodder block in Overseer.

| **All farm types (with at least a cr** | | **Dairy farms** | | **Mixed farms** | | **NonDairy farms** | | **CropAndHorticulture** | |
|---|---|---|---|---|---|---|---|---|---|
| 76554 analyses (8783 farms) | | 45735 analyses (5008 farms) | | 24900 analyses (3431 farms) | | 4349 analyses (1370 farms) | | 1570 analyses (302 farms) | |
| Pasture | 87.7% | Pasture | 90.2% | Pasture | 82.8% | Pasture | 100% | Pasture | 58.3% |
| Fodder_Kale | 37.9% | Fodder_FodderBeets | 35.1% | Fodder_Kale | 58.2% | Fodder_Kale | 47.3% | Grain_WheatFeed | 48.4% |
| Fodder_FodderBeets | 29.6% | Fodder_Kale | 26.9% | Forages_Oats | 39.1% | Fodder_Rape | 25.6% | PastureSeed_Ryegrass | 44.5% |
| Fodder_Rape | 22.3% | Forages_Maize | 23.1% | Fodder_Rape | 36.4% | Fodder_Swedes | 19.7% | VegRoot_Potato | 34.8% |
| Forages_Oats | 22.0% | Fodder_TurnipsBulb | 20.9% | Grain_Barley | 36.0% | Fodder_FodderBeets | 15.4% | Grain_Barley | 33.2% |
| Forages_Maize | 18.6% | Fodder_Rape | 14.9% | Grain_WheatFeed | 31.3% | Forages_Oats | 9.9% | VegLegumes_PeasGreen | 21.1% |
| Fodder_TurnipsBulb | 14.6% | Forages_Oats | 13.9% | PastureSeed_Ryegrass | 26.6% | Fodder_TurnipsLeafy | 8.0% | VegRoot_OnionsBrown | 19.7% |
| AnnualRyegrass | 14.3% | Fodder_Swedes | 9.8% | AnnualRyegrass | 25.6% | Fodder_TurnipsBulb | 5.9% | Forages_Oats | 19.0% |
| Grain_Barley | 13.5% | AnnualRyegrass | 8.9% | Fodder_FodderBeets | 23.6% | AnnualRyegrass | 4.8% | AnnualRyegrass | 18.7% |
| Grain_WheatFeed | 11.6% | Fodder_TurnipsLeafy | 8.2% | VegLegumes_PeasGreen | 15.9% | Forages_Maize | 4.3% | Grain_WheatBreed | 18.3% |
| Fodder_Swedes | 11.1% | Forages_Barley | 3.7% | VegRoot_Potato | 15.1% | Forages_RyeCorn | 3.2% | Forages_Maize | 18.2% |
| PastureSeed_Ryegrass | 9.8% | Forages_Triticale | 1.8% | PastureSeed_CloverWhite | 15.0% | Forages_Barley | 2.4% | PastureSeed_CloverWhite | 17.1% |
| Fodder_TurnipsLeafy | 7.1% | Grain_Barley | 1.8% | Grain_WheatBreed | 14.3% | Forages_Triticale | 0.5% | VegRoot_Carrots | 12.9% |
| VegRoot_Potato | 5.8% | Grain_WheatFeed | 0.8% | Grain_Peas | 13.0% | Forages_Wheat | 0.0% | Grain_Peas | 12.7% |
| VegLegumes_PeasGreen | 5.7% | Grain_WheatBreed | 0.3% | Forages_Maize | 12.9% | | | Fodder_Kale | 11.7% |
| PastureSeed_CloverWhite | 5.3% | VegRoot_Potato | 0.3% | Fodder_Swedes | 12.8% | | | VegFruit_Squash | 10.8% |
| Grain_WheatBreed | 5.2% | PastureSeed_Ryegrass | 0.3% | Forages_Barley | 8.2% | | | VegGreen_BroccoliHeadOnly | 9.3% |
| Forages_Barley | 5.1% | Forages_RyeCorn | 0.3% | Forages_RyeCorn | 6.6% | | | VegGreen_Cauliflower | 8.9% |
| Grain_Peas | 4.6% | Grain_Maize | 0.3% | Fodder_TurnipsBulb | 5.5% | | | VegGreen_Spinach | 8.3% |
| Forages_RyeCorn | 2.6% | VegLegumes_PeasGreen | 0.2% | Fodder_TurnipsLeafy | 5.5% | | | VegGreen_LettuceIceberg | 8.2% |

*Only farms with cropping/fodder blocks are represented in this table

*Table 1: Top 20 percentage presence of a culture in an analysis.*

## Fodder beet (fodder)

In previous versions of Overseer the proportion of a crop used for animal feed (feed utilisation) was not equivalent to the Harvest Index (HI) for fodder crops, contrary to what was expected ('Characteristics of crops' TMC, section 4.2). Now, HI and feed utilisation are equal for all crops used for animal feed, increasing the feed utilisation of fodder crops from 0.75 to 0.89 at typical yield. Because of this increase in feed utilisation, 5% of all OverseerFM analyses will now be showing an overfeeding error. We recommend reducing the amount (yield) of fodder beet accordingly to resolve this error. Please contact us if you need help making this change.

Additionally, the N contents for fodder beet product has been significantly reduced from 1.8% to 1%. This change will result in a large decrease in total N uptake of this crop, meaning there will be, in some cases, an increase in N available for leaching.

## Total N uptake

Adjustments of Harvest Index coefficients, moisture, and N content of different parts of a plant can cause significant changes in the total N uptake of a plant, and therefore may alter calculations for estimated N leaching.

Below is the list of crops with the biggest decrease and increase in total N uptake. The total N uptake was estimated using the typical yield of the crop. If you'd like more information on how the crop coefficients were updated, please see Brown (2022) publications.

| End use | Group | Name | Total N uptake (kg N/ha) | | Variation (%) |
|---|---|---|---|---|---|
| | | | Old | New | |
| Vegetable | Pulse | Broad beans | 783 | 267 | -66 |
| Vegetable | Pulse | Beans green | 317 | 145 | -54 |
| Vegetable | Green | Cauliflower (winter/spring) | 507 | 263 | -48 |
| Fodder | Bulb | Fodder beets | 393 | 255 | -35 |
| Vegetable | Green | Cabbage (winter/spring) | 342 | 240 | -30 |
| Vegetable | Green | Spinach | 41 | 111 | 168 |
| Manure | Green manure | Oats and rye | 77 | 185 | 140 |
| Vegetable | Green | Broccoli (summer) | 211 | 325 | 54 |
| Fodder | Leafy brassica | Turnips (leafy) | 217 | 313 | 44 |
| Vegetable | Green | Cabbage (summer) | 179 | 240 | 34 |
| Seed | Vegetable, root | Radish (OP) | 212 | 280 | 32 |

*Table 2: List of crops that may show the most significant decrease (top) and increase (bottom) in total nitrogen uptake (kg N/ha).*

## Conclusions

If you are one of the over 10, 000 farm accounts that use the Overseer crop model, your existing OverseerFM analysis results have likely changed.
Part of these changes will be appropriately driven by an update to how crop growth is modelled, an improvement to the description of crops within this updated model (crop coefficients), or a big fix for how prior land use impacts N leaching. However, some of the changes you might see may be due to incorrectly estimated harvest/finish event dates or if assumptions / workarounds were previously used when setting up your farm analysis in OverseerFM, that are now inappropriate due to this update.

The results of many analyses are significantly impacted, either by a change in estimated total N loss (5% of the analyses show a greater variation than ±15%) or by the analysis now showing an overfeeding error (5% of total). To ensure the changes you see in your analyses are appropriate, please review your analyses and do the following:

1. Review and update the harvest/final event dates on all your blocks.
2. Where applicable and appropriate, reduce the amount (yield) of fodder to resolve over-feeding errors.

We realise that this update to the crop model and the resulting variations in results may be significant for some farm accounts. However, the model now more appropriately describes and estimates the impact of how crops are farmed.

Please do not hesitate to contact our helpdesk helpdesk@overseer.org.nz if you need any help updating your farm or contact science@overseer.org.nz if you would like to know more about the science behind this update.

**Reference:**

*Brown H., The Overseer crop model upgrade (August 2022), Plant&Food Research SPTS No. 22789, published on www.overseer.org.nz.*