Estimating your emissions intensity for oaten hay using the G-GAF calculator

Queensland produces around 1.1 million tonnes of hay annually, with about 48% originating on the Darling Downs. The remainder of production is spread across the state, with substantial volumes produced in the Wide Bay, Central Queensland and Ipswich areas (MLA 2023).

Though hay production has many commonalities with cereal production, the harvesting of hay rather than grain means there are some important differences in greenhouse gas emissions. The calculation of emissions for oaten hay production using the Cropping GHG Accounting Framework V11.1 (G-GAF, PICCC 2025) is demonstrated here using the following three steps.

Step 1. On the Data input page, in the 'Average grain yield' box on row 7, enter average tonnes of hay per hectare (number of bales x weight of bales in kg ÷ 1000 ÷ area sown in ha). For example 25,000 bales x 100 kg ÷ 1000 ÷ 500 ha = 5 tonnes per ha.

Enter your farm data	Farm Name
Choose your region in Australia	Qld
Farm cropping details	Oats
Production System	Non-Irrigated Crop
Please answer this question - Does your crop get enough rainfall or irrigation to drain through the soil profile, i.e. typically above 600mm	No
Average grain yield	5.00
Area sown	500

This will adjust the emissions intensity to be for tonnes of hay.

Step 2. Go to the 'Crop Residues' tab at the bottom of the page.

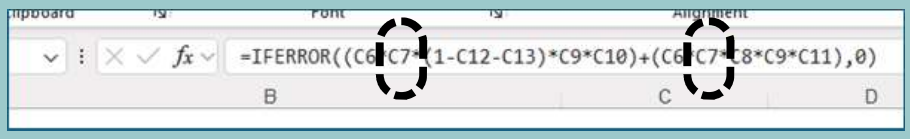
Data input - crops | Data input - vegetation | Fertiliser | Leaching and runoff | Crop Residues | tmospheric

Change the figure in 'Table A5.5.9.3 Crop Residues – proportion burnt/removed', row 91 'Queensland', column C 'Fraction Burnt' from 0.06 to 0. Then, in the same table change row 91 'Queensland', column D 'Fraction Removed' from 0.04 to 0.8.

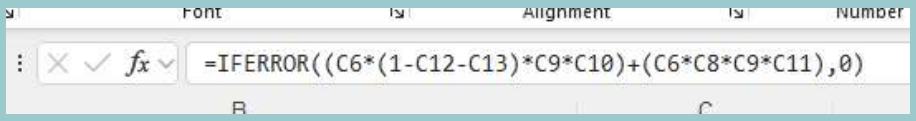
Table A5.5.9.3 Crop Residues - proportion burnt/removed		
State	Fraction Burnt	Fraction Removed
NSW	0.220	0.05
Vic	0.21	0.07
Qld	0	0.8
SA		

This reduces emissions attributable to 'N_2O – Crop Residues', since much of the crop residue is being removed. If your property is in another state, change accordingly.

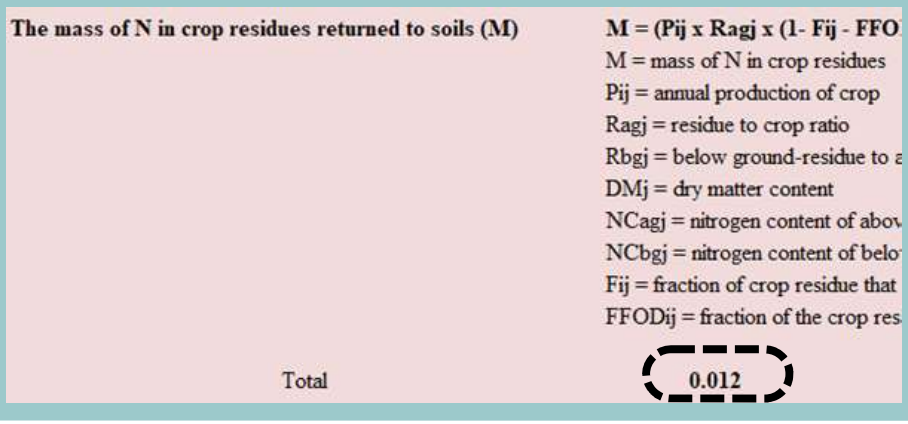
Step 3. Click on to the cell in row 28 under the appropriate column (in this example for Oats column C). The formula for 'The mass of N in crop residues returned to soil M' will appear in the formula box.



Delete both mentions of '*C7' from the formula.



The model then will use your total hay yield from the paddock as the above ground biomass rather than calculating the amount of stubble based on grain yield.
In the example above, 'The mass of N in crop residues returned to soils (M)' is 0.012.



How do the emissions compare between oaten hay and an equivalent grain crop?

The main difference in emissions between a hay and grain crop, given the same management and equivalent yields (using the 1.42 residue to crop ratio in the model as an estimate of yield of grain vs yield of hay) is that the grain crop leaves much more residue in the paddock to produce nitrous oxide compared with the hay. In the above example, nitrous oxide from crop residues was 25.3 tCO_2e for hay and 46.6 tCO_2e for grain. The emissions intensity was 0.09 tCO2e/t of hay and 0.14 tCO2e/t of grain.

Acknowledgement
Thanks to Dr Aaron Simmons from NSW DPI for input to this work.

References

MLA (Meat and Livestock Australia) (2023) Hay production faces regional variations due to looming dry. https://www.mla.com.au/news-and-events/industry-news/hay-production-faces-regional-variations-due-to-looming-dry/#:~:text=29%2C868.16,Gold%20Coast accessed 27 August 2025

Lopez M.B., Ekonomou A., Eckard R.J., Kotz P. (2025) 'A Greenhouse Accounting Framework for crop production (G-GAF) based on the Australian National Greenhouse Gas Inventory methodology'. Updated March 2025 http://www.piccc.org.au/resources/Tools

The Farm Business Resilience Program is jointly funded through the Australian Government's Future Drought Fund and the Queensland Government's Drought and Climate Adaptation Program

Australian Government | Future Drought Fund | Drought and Climate Adaptation Program | Queensland Government