Nitrogen Risk Scorecard Calculations

The Fonterra Nitrogen Risk Scorecard is a farm data driven series of calculations that provides for an objective consideration of the likely scale of manageable nitrogen risk that exists on a farm through a single farming year. This 'Calculations' document provides the input data requirements, and the calculations applied to each data point, to generate the risk ratings that are reported to the farmer.

This Calculation Documentation provides written reference for each of the calculations that are contained within the Nitrogen Risk Scorecard engine.

Metric	Data points required	Calculation or Equation
Effective farm area (Ha)	1. Total farm area 2. Total non-effective areas	*Total farm area – non effective blocks*

Purchased nitrogen (N) surplus Kg/Ha	3. Total N fertiliser applied kg/ha
	4. Imported supplements kg/ha
	    a. Total tonnes imported by type
	    b. N content of each supplement type
	5. Total Production (milk, meat and supplementary feed exported off farm)
	6. Amount of N contained in productive outputs
		$N^{fertiliser} + N^{supplement} - N^{production}$
		
		/ effective farm area
		
		= Purchased Nitrogen Surplus Kg/Ha

Total energy requirements on farm (MJME)	7. Stock on farm
	    a. Monthly stock numbers,
	    b. Age and breed
	8. Energy requirements per animal
	    a. Maintenance
	    b. Pregnancy
	    c. Production
		Breeding Stock example
		
		Maintenance energy requirement per animal+ energy for productive output + pregnancy requirements x number of animals

Dry matter eaten (KgDM/Ha)	9. Total dry matter (DM) from imported supplements	*Sum Kg DM from each supplementary feed consumed.*
	10. Total DM from crops	*Crop area x Crop yield x % of the crop eaten by animals x percentage crop fed this season*

Metric	Data points required	Calculation or Equation
Dry matter eaten (KgDM/Ha)	11. Total DM from pasture a. calculated based on the amount of energy required to maintain the animal, + production, and pregnancy demands.	**Total DM from pasture[1]** $(lactation + daily\ maintenance + pregnancy - (imported\ feed\ x.8) - (fodder\ crops\ x.8))/10.5$
Stocking rate	12. Monthly stock numbers	**Dairy example** $Highest\ monthly\ cow\ numbers\ /\ effective\ farm\ (ha)$
Wintering off May - Aug	13. Monthly stock numbers a. Wintering off May – Aug is the percentage difference in monthly cow numbers between <u>April</u> and each of the winter months (May – Aug). Therefore, reporting a reduction in number of animals on farm over winter from the month prior to winter	$April\ monthly\ cow\ numbers - May\ monthly\ cows)\ /\ April\ monthly\ cows$ $(April\ monthly\ cow\ numbers - June\ monthly\ cows)\ /\ April\ monthly\ cows$ $(April\ monthly\ cow\ numbers - July\ monthly\ cows)\ /\ April\ monthly\ cows$ $(April\ monthly\ cow\ numbers - Aug\ monthly\ cows)\ /\ April\ monthly\ cows$
Wintering practices *(percentage of winter period animals spend on either crops, structures or pasture)*	14. Number of animals on farm 15. Number of animals on off-pasture facilities or crops over winter months. 16. Number of hours animals spend on structures or crops	**Time on crops =** $Number\ of\ cows\ on\ crops\ x\ hours\ on\ crop$ $x\ number\ of\ days\ on\ crop\ /$ $number\ of\ cows\ on\ farm\ x\ total\ winter\ hours\ (2952)$
		Time on structures = $No\ of\ cows\ on\ structures\ (May - Aug)\ x\ hours\ on\ structures\ ((May - Aug))/\ (No\ of\ cows\ on\ farm\ x\ total\ hours\ May - Aug\ (2952))$
		Time on pasture = $Total\ hours\ (May - Aug\ of\ 2952)$ $- total\ hours\ on\ structures\ (May - Aug) - total\ hours\ on\ crops\ (May - Aug)$

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[1] Estimated grazed pasture intake is expressed in MJME, this is divided by 10.5MJME/kg DM to obtain KgDM per farm. For all crops & supplementary feed consumed a utilisation factor of 80% has been applied.

Metric	Data points required	Calculation or Equation
Total N fertiliser applications	17. Effective farm area 18. Total fertiliser applied 19. Percentage of N in commercial fertiliser products	*Total tonnes of all N fertiliser product(s) x N content of product(s)/ effective farm area*
N fertiliser conversion efficiency	20. Total tonnes of N applied 21. Total production achieved (milk solids, meat, wool, velvet, crops etc)	*Total tonnes of all N fertiliser product(s) x N content of product(s) / total N in productive outputs*
N fertiliser highest application rate Kg N/Ha	22. All fertiliser applications	*Select the highest application rate from all applications*
Feed budget	23. Data to indicate that a feed budget is used to plan N fertiliser use	
Total N imported from feed (Kg/Ha)	24. All imported supplementary feed fed to animals within the season 25. N content of supplements	*Total tonnes of DM from imported supplement x N content of each feed type / effective farm area*
Average N content (%) of imported supplement		*Total Kgs of N imported from supplement / total Kgs of imported supplement x 100*
Conversion efficiency of N from imported supplementary feed to productive output[2]	26. Total Kg of production 27. Total N from imported feed	*Total Kg milk solids/ total Kg N from imported supplement*
Cropping & cultivation	28. Total area cultivated 29. Cultivation method	*Total area cultivated (conventionally)/ effective farm area* *Total area cultivated (minimum tillage)/ effective farm area* *Total area cultivated (direct drilled)/ effective farm area*

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[2] In this case it calculates the conversion efficiency to Kg milk solids. This could equally be changed to other singular productive outputs or to total farm outputs.

Metric	Data points required	Calculation or Equation
Season of harvest	30. Crop harvest date	*If crop's harvest date falls in April, May, June, July, August or September the farm will fall in the Winter Harvest category, otherwise considered as Summer Harvest*
Timing of fertiliser application	Timing of fertiliser applications to crops	*N fertiliser was applied to crops during the high-risk months of May, June, July and August = 'Yes' then High Risk*
Effluent irrigation area *(thresholds being considered against ;4ha/100 cows without structures, or 7ha/100 cows with structures)*	31. Off pasture facilities 32. Effluent block size 33. Peak cows	*Peak cows/ disposal area*
Effluent discharge method & application depth	34. Effluent discharge method 35. Maximum application depth of irrigation	*Methods in order from lowest risk are: Discharge to land, Discharge to land (non-optimal storage), Discharge to land and water, Discharge to water*
Freshwater irrigation method, (proportion of each method as a % of the total irrigation area)	36. Total irrigated area 37. Irrigation method(s) 38. Irrigation area per method	*Irrigation method 1(ha) / total irrigation area = The % of irrigation area allocated to method 1. This is repeated for each irrigation method to determine the percentage of each irrigation method on farm* *Risk is then attributed on a pro rata basis by irrigation method*
Scheduling irrigation	39. Questions: How do you decide when to start and stop irrigating? 40. Answers: (a) When water is available or water budget or (b) Soil moisture meters, or (c) visual assessment	*Risk is attributed on a pro rata basis to each scheduling option based on the % of the total irrigated area the method covers*

Metric	Data points required	Calculation or Equation
Application Method	41. Question: How do you decide how much water to apply? 42. Answers: (a) Irrigation is applied at a fixed depth and return period (b) adjusted to achieve deficit irrigation (c) Variable rate irrigation	*Risk is attributed on a pro rata basis to each application method based on the % of the total irrigated area the method covers*