Getting Value from In-field Feeding Systems: Nutrient Loading Calculator

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Key Points

- This is an Excel-based calculator that does not require additional software to operate on your computer.
- The calculator was designed to estimate nutrient loading from bale grazing, rolled out or processed feed deposited on the ground.
- By knowing the amount of nutrients being imported onto a site, a producer can better manage the feeding system and the animals to take advantage of those nutrients as well as reduce nutrient loss to the environment.

The nutrient loading calculator (NLC) was designed to help livestock producers plan and manage in-field winter feeding systems and to get the most value from their chosen feeding system. This Excel-based calculator estimates the amount of nutrients (nitrogen, phosphorus, potassium, and sulphur) being added to the landscape by winter feeding systems, such as bale grazing, that import feed onto a site. It was designed to help producers manage wintering sites and animal density to minimize the environmental impacts of the feeding system, quantify the benefit of the winter feeding system, assist with site selection, and subsequent site and crop management.

This calculator was developed by Agriculture and Agri-Food Canada in consultation with technical experts from provincial agriculture departments in Alberta, Saskatchewan, and Manitoba.

A significant portion (70 to 90%) of the nutrients brought onto a site to feed a herd are left behind on the land as manure and un-eaten feed. Excessive nutrient additions can negatively impact the growth and quality of subsequent crops and increase the risk of nutrient loss to the environment. This tool was created to quantify the potential nutrient impacts of a given winter feeding system. Built into the calculator are several threshold warnings that notify the user if livestock density, feed density, or nutrient loading are extremely high. By knowing the amount of nutrients being imported onto a site, a producer can better manage the feeding system and the animals to take advantage of those nutrients as well as reduce excessive nutrient loading and loss to the environment. The calculator can be used to help determine the amount of nutrients that the feeding system is leaving behind. This allows the producer to plan spring operations to take advantage of those nutrients.

The calculator can be used to run ‘what if’ scenarios comparing various winter feeding systems and feeds. It can also be used to determine the amount of feed required to meet the needs of an identified number of animals for a designated number of feeding days. It gives the producer the ability to plan and lay out a bale grazing site by providing bale spacing distances. The program will supply the number of bales required to be fed per day or the number of feed wagon loads needed per day to feed the size of herd being managed.

The user inputs into the program include the number of animals being fed, the size of animals, the size of the feeding area, and the anticipated number of feeding days. Up to three different feeds can be used in the calculator at one site. The user can select, from drop-down menus, the feed types being used. The program contains book-value protein and nutrient content for a wide selection of feed options. These are

the same book values used in the 'Cowbytes' software. The user can input their own feed analysis information if they have it. This information will then over-ride the book values for all calculations. Based on the nutrient content of the feed, the amount of feed being fed and the size of the feeding site, the program estimates the amount of nitrogen, phosphorus, potassium, and sulphur being deposited at the site.

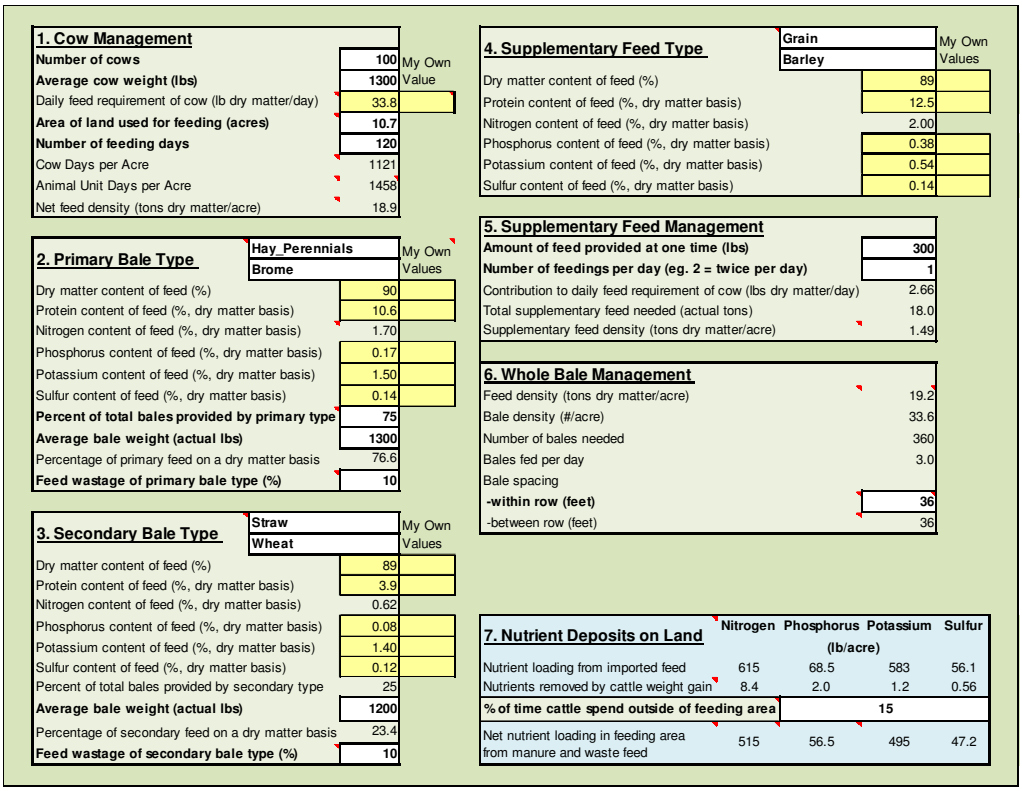
The calculator assumes that all nutrients, with the exception of nutrients removed as livestock weight gain, calf development, or milk production, are deposited on the landscape in the form of manure, urine, and waste feed. The calculator does not estimate how the nutrients are deposited across the feeding site. Distribution is a function of the size of the site and the amount of time animals spend at the shelter/bedding areas, watering sites, and other land outside the feeding area.

There are two versions of this calculator: a feed-to-cow version and a cow-to-feed version. The feed-to-cow version asks for feed-management factors first and then cow-management factors. The cow-to-feed version (Figure 1) starts by inputting the cow-management factors first and then the feed-management factors. Both versions will provide the same outputs and information they just approach data input from different angles.

For more information on the Nutrient Loading Calculator go to:
http://www1.agric.gov.ab.ca/$Department/softdown.nsf/main?openform&type=NLC&page=information

Or, go to www.agriculture.alberta.ca – select Decision Making Tools Tab then Livestock and then Nutrient Loading Calculator.

In addition, there is a pdf user manual available for download that walks the user through both versions of the calculator.



1. Cow Management

		My Own Value
Number of cows	100	
Average cow weight (lbs)	1300	
Daily feed requirement of cow (lb dry matter/day)	33.8	
Area of land used for feeding (acres)	10.7	
Number of feeding days	120	
Cow Days per Acre	1121	
Animal Unit Days per Acre	1458	
Net feed density (tons dry matter/acre)	18.9	

2. Primary Bale Type — Hay_Perennials / Brome

		My Own Values
Dry matter content of feed (%)	90	
Protein content of feed (%, dry matter basis)	10.6	
Nitrogen content of feed (%, dry matter basis)	1.70	
Phosphorus content of feed (%, dry matter basis)	0.17	
Potassium content of feed (%, dry matter basis)	1.50	
Sulfur content of feed (%, dry matter basis)	0.14	
Percent of total bales provided by primary type	75	
Average bale weight (actual lbs)	1300	
Percentage of primary feed on a dry matter basis	76.6	
Feed wastage of primary bale type (%)	10	

3. Secondary Bale Type — Straw / Wheat

		My Own Values
Dry matter content of feed (%)	89	
Protein content of feed (%, dry matter basis)	3.9	
Nitrogen content of feed (%, dry matter basis)	0.62	
Phosphorus content of feed (%, dry matter basis)	0.08	
Potassium content of feed (%, dry matter basis)	1.40	
Sulfur content of feed (%, dry matter basis)	0.12	
Percent of total bales provided by secondary type	25	
Average bale weight (actual lbs)	1200	
Percentage of secondary feed on a dry matter basis	23.4	
Feed wastage of secondary bale type (%)	10	

4. Supplementary Feed Type — Grain / Barley

		My Own Values
Dry matter content of feed (%)	89	
Protein content of feed (%, dry matter basis)	12.5	
Nitrogen content of feed (%, dry matter basis)	2.00	
Phosphorus content of feed (%, dry matter basis)	0.38	
Potassium content of feed (%, dry matter basis)	0.54	
Sulfur content of feed (%, dry matter basis)	0.14	

5. Supplementary Feed Management

Amount of feed provided at one time (lbs)	300
Number of feedings per day (eg. 2 = twice per day)	1
Contribution to daily feed requirement of cow (lbs dry matter/day)	2.66
Total supplementary feed needed (actual tons)	18.0
Supplementary feed density (tons dry matter/acre)	1.49

6. Whole Bale Management

Feed density (tons dry matter/acre)	19.2
Bale density (#/acre)	33.6
Number of bales needed	360
Bales fed per day	3.0
Bale spacing	
-within row (feet)	36
-between row (feet)	36

7. Nutrient Deposits on Land

	Nitrogen	Phosphorus	Potassium	Sulfur
	(lb/acre)			
Nutrient loading from imported feed	615	68.5	583	56.1
Nutrients removed by cattle weight gain	8.4	2.0	1.2	0.56
% of time cattle spend outside of feeding area	15			
Net nutrient loading in feeding area from manure and waste feed	515	56.5	495	47.2

Figure 1: An example of the cow-to-feed whole bale calculator screen.