

# Forage Quality

## in the South Coastal Region in 2001

The twenty-third annual South Coastal Forage Competition was held recently in conjunction with the Pacific Agriculture Show. A total of 113 entries of hay, grass silage and corn silage were received from farmers in the Fraser Valley and on Vancouver Island. Feed analysis was carried out on all samples and formed the basis for judging. Following is a summary of the feed analysis results for each class, with average values for the previous five years also given for comparison.

### Hay Class (24 entries)

1) Dry Matter	2001	2000	1999	1998	1997
Average	86.7%	86.6%	86.4%	87.8%	88.3%
Range	80.1 - 90.8%				

Average dry matter content was very similar to the previous two years.

2) Crude Protein	2001	2000	1999	1998	1997
Average	14.9%	16.3%	17.2%	15.4%	16.9%
Range	9.7 - 19.9%				

This is an estimate of total protein, based on measuring the amount of nitrogen in a sample. Nitrogen makes up 16% of protein by weight, so to estimate crude protein, a lab measures nitrogen and multiplies by 6.25 (100% divided by 16%). Not all of the nitrogen is in protein form (i.e. nitrates) and not all of the protein is digestible, so crude protein provides only a rough estimate of what is available for animal use.

3) Nitrate Nitrogen	2001	2000	1999	1998	1997
Average	0.05%	0.09%	0.12%	0.09%	0.10%
Range	<0.01 - 0.18%				

Nitrates are nitrogen compounds that can accumulate in plants under certain growing conditions, i.e. frost, drought, high nitrogen fertilization. High nitrate levels in ruminant diets are associated with reproductive and other health problems. High levels in crops may indicate excessive use of manure and/or fertilizer. Four of the 24 entries contained more than the 0.10% that can cause livestock health problems. The 0.05% average was the lowest since this test was first done in 1989, perhaps an indication that forage plants were under few stresses in 2001. It is probably also a reflection of less total nitrogen use on perennial forages, as evidenced by the lower average protein content in recent years. Since average protein content peaked in 1993 in the case of grass silage (18.3%) and 1994 in the case of hay (18.9%), the trend has been to lower levels.

# Forage FACTSHEET



**BRITISH  
COLUMBIA**

Ministry of Agriculture,  
Food and Fisheries  
Abbotsford Agriculture Centre  
1767 Angus Campbell Road  
Abbotsford, B.C. V3G 2M3  
Phone: 604 556-3001  
Fax: 604 556-3030

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<b>4) Neutral Detergent Fiber (NDF)</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
Average 51.1%	51.6%	50.6%	49.4%	54.4%	56.3%
Range 45.6 – 57.2%					

NDF is a measure of the total fiber fraction of a forage. It represents the fiber components cellulose, hemicellulose and lignin that make up the cell walls of all forages. High NDF forages result in greater gut fill in ruminant animals, thus limiting the amount they can eat. High NDF is associated with low forage intake and high ration supplementation cost.

<b>5) Acid Detergent Fiber (ADF)</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
Average 28.8%	29.2%	29.8%	29.1%	30.0%	30.0%
Range 22.6 – 35.8%					

ADF measures the cellulose and lignin fiber components of forage and is commonly used to predict energy content. Forages with low ADF have high energy values. This year's average was the lowest in the 23-year history of the competition, indicating that grass forage crops harvested for hay were cut at an earlier stage of maturity.

<b>6) Total Digestible Nutrients (TDN)</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
Average 67.5%	67%	66%	67%	66%	66%
Range 58 - 76%					

TDN is calculated from ADF using equations derived from livestock feeding experiments. As ADF increases, TDN decreases. Because of this year's record low average ADF, the average TDN is the highest in the competition's history.

## Grass Silage Class (31 entries)

1) <b>Dry Matter</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
Average 38.8%	37.5%	40.2%	41.8%	40.6%	42.2%
Range 22.2 – 62.0%					

There was the usual wide range of results, and the average was fairly similar to last year's.

2) <b>Crude Protein</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
Average 15.0%	15.1%	16.8%	17.2%	17.2%	17.9%
Range 10.2 – 20.4%					

See comments under Hay Class. Average crude protein content has declined slightly in the past two years compared to previous years.

3) <b>Heat-Damaged Protein</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
Average 3.9%	4.1%	3.9%	4.2%	4.7%	5.0%
Range 1.9 – 7.2%					

This is the amount of crude protein that is bound to fiber and cannot be digested by animals. Heat damage is caused by too much air being in the silage during fermentation and is usually worst in dry silages. No samples had more than the 7 - 10% that is considered normal.

4) <b>Nitrate Nitrogen</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
Average 0.06%	0.06%	0.07%	0.07%	0.07%	0.06%
Range <0.01 – 0.57%					

See comments under Hay Class. Five of the 31 entries contained more than 0.10% nitrate nitrogen. Nitrates are normally less of a problem in silages than in hays because some are converted to nitrogen gas during the fermentation process and escape into the atmosphere. For the first time since nitrate was measured (1989), the average level in the hay class was lower than that in the grass silage class.

5) <b>Ammonium Nitrogen</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
Average 10.0%	16.5%	7.4%	16.4%	15.4%	18.1%
Range 2.4 – 41.9%					

This is the percent of total nitrogen that is present in the ammonium form. It indicates the amount of protein breakdown that has occurred during fermentation. A value less than 10% represents a good fermentation, 10 - 15% a moderate fermentation and greater than 15% a poor one. Only two of the 31 entries contained more than 15% ammonium nitrogen. The problem is generally, but not always, worse in wet silages.

<b>6) Neutral Detergent Fiber (NDF)</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
Average 46.8%	48.4%	46.7%	42.7%	46.0%	48.4%
Range 40.8 – 57.2%					

See comments under Hay Class.

<b>7) Acid Detergent Fiber (ADF)</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
Average 30.9%	32.1%	30.3%	29.8%	30.1%	30.7%
Range 22.4 – 35.2%					

See comments under Hay Class. The average returned to the level of earlier years after last year's jump.

<b>8) Total Digestible Nutrients (TDN)</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
Average 65%	63%	65.5%	66%	66%	65%
Range 59 - 76%					

See comments under Hay Class. The average TDN returned to more normal levels as a result of the lower average ADF.

<b>9) pH</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
Average 4.6	4.5	4.7	4.5	4.9	4.9
Range 3.8 – 6.5					

pH is a measure of the acidity of silage. Generally, the lower the pH, the better the silage is preserved. Dry silages become stable at higher pH levels than wet ones. Large, wrapped bales tend to have higher pH than chopped silage because the material goes through a very limited fermentation.

## Corn Silage Class (58 entries)

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1)	<b>Dry Matter</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
	Average 27.7%	26.4%	26.4%	29.8%	27.6%	24.8%
	Range 20.4 – 34.3%					

Average dry matter content rebounded somewhat from the generally low levels of the previous two years.

2)	<b>Crude Protein</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
	Average 7.9%	7.4%	7.9%	8.1%	7.5%	8.0%
	Range 5.5 – 9.7%					

The protein content of corn silage does not usually vary much from around 8%.

3)	<b>Nitrate Nitrogen</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
	Average 0.03%	0.04%	0.04%	0.04%	0.02%	0.05%
	Range <0.01 - 0.11%					

See comments under Hay Class and Grass Silage Class. Three samples contained more than the 0.10% that can cause livestock problems.

4)	<b>Neutral Detergent Fiber (NDF)</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
	Average 37.8%	43.4%	39.7%	40.7%	40.6%	46.2%
	Range 31.6 – 46.4%					

See comments under Hay Class.

5)	<b>Acid Detergent Fiber (ADF)</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
	Average 24.9%	28.2%	26.7%	25.5%	27.2%	29.0%
	Range 20.0 – 32.4%					

Unlike hay and grass silage, the ADF content of corn decreases with advancing maturity as grain content increases. This year's average was very close to the lowest in the history of the competition, indicating that the grain content of the corn silage was higher than usual.

<b>6) Total Digestible Nutrients (TDN)</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
Average 66%	65%	65%	66%	65%	64%
Range 63 - 68%					

Average TDN increased as a result of the lower average ADF.

<b>7) pH</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>
Average 3.9	3.8	3.8	3.8	3.9	4.0
Range 3.6 - 7.5					

See comments under Grass Silage Class.

## Mineral Analysis

Analysis	Hay Class	Grass Silage Class	Corn Silage Class
<b>Calcium (Ca)</b>			
Average	0.39%	0.43%	0.21%
Range	0.23 - 0.57%	0.26 - 0.66%	0.12 - 0.32%
<b>Potassium (K)</b>			
Average	2.89%	3.31%	1.28%
Range	1.94 - 3.61%	2.12 - 4.96%	0.39 - 1.87%
<b>Magnesium (Mg)</b>			
Average	0.23%	0.22%	0.16%
Range	0.17 - 0.28%	0.16 - 0.33%	0.07 - 0.26%
<b>K:Ca Ratio</b>			
Average	7.9:1	8.1:1	6.3:1
Range	4.7:1 - 15.2:1	3.7:1 - 11.8:1	2.8:1 - 11.1:1
<b>K:Mg Ratio</b>			
Average		12.8:1	15.7:1 8.3:1
Range	8.4:1 - 18.1:1	9.1:1 - 24.5:1	4.2:1 - 12.5:1
<b>Phosphorus</b>			
Average	0.28%	0.33%	0.22%
Range	0.21 - 0.37%	0.25 - 0.41%	0.09 - 0.29%
<b>Sulfur</b>			
Average	0.29%	0.26%	0.12%
Range	0.19 - 0.41%	0.17 - 0.45%	0.09 - 0.37%
<b>Copper</b>			
Average	8.2 ppm *	10.0 ppm *	8.1 ppm *
Range	5 - 13 ppm	6 - 21 ppm	4 - 12 ppm
<b>Zinc</b>			
Average	15.6 ppm	20.1 ppm	30.2 ppm
Range	7 - 27 ppm	10 - 33 ppm	17 - 50 ppm

## Mineral Analysis

Analysis	Hay Class	Grass Silage Class	Corn Silage Class
<b>Manganese</b>			
Average	86.7 ppm	81.4 ppm	35.4 ppm
Range	31 - 234 ppm	30 - 150 ppm	11 - 98 ppm
<b>Molybdenum</b>			
Average	1.6 ppm	2.4 ppm	1.0 ppm
Range	1 - 5 ppm	0.5 - 5 ppm	<0.5 - 2 ppm
<b>Iron</b>			
Average	153 ppm	411 ppm	125 ppm
Range	37 - 813 ppm	101 - 2062 ppm	48 - 605 ppm
<b>Sodium</b>			
Average	1349 ppm	1027 ppm	133 ppm
Range	73 - 6150 ppm	288 - 2911 ppm	58 - 3608 ppm

\*ppm is parts per million; 1 ppm is equal to 0.0001%

The average potassium level in grass silage was considerably higher than in the previous five years of the competition, although the levels in forage harvested as hay were marginally lower than in the previous two competitions. In general, it can be concluded that too much potassium is being added as fertilizer or manure to first-cut grass forages that are usually harvested as silage. These high potassium levels could be expected to have a negative effect on the ability of the dairy cow to utilize calcium and magnesium.

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