SELECTING CORN SILAGE HYBRIDS AND ALFALFA VARIETIES USING MILK2000

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Undersander et al. (1993) developed a method for estimating milk per ton of forage dry matter (DM) as an index of forage quality. The milk per ton index is based on energy content of the forage predicted from acid detergent fiber (ADF) content and DM intake potential of the forage predicted from neutral detergent fiber (NDF) content.

The milk per ton index has now been modified to use new NRC recommendations (National Research Council, 2001) for calculating energy (Schwab and Shaver, 2001), and an easy to use Excel 5.0 spreadsheet called Milk2000 has been developed. MILK2000 uses forage analyses (crude protein, NDF, *in vitro* NDF digestibility, starch (corn silage only), and non-fiber carbohydrate) to estimate energy content using a modification of the NRC (2001) summative approach and DM intake from NDF (Mertens, 1987) and *in vitro* NDF digestibility (Oba and Allen, 1999) to predict milk production per ton of forage DM. In MILK2000, the intake of energy from forage for a 1350 lb. milking cow consuming a 30% NDF diet is calculated and the cow's maintenance energy requirement (proportioned according to the percentage of forage in the diet) is then subtracted from energy intake to provide an estimate of the energy available from forage for conversion to milk (NRC, 1989). Forage DM yield multiplied times the milk produced per ton of forage DM provides an estimate of the milk produced per acre and combines yield and quality into a single term.

Greater documentation of the equations used to calculate Milk2000 and the Excel spreadsheets are available at the following website:
http://www.uwex.edu/ces/forage/articles.htm#milk95.

Near infrared (**NIR**) calibrations and (or) wet chemistry techniques are available in commercial forage testing laboratories for all nutrients needed to calculate milk per ton on forage samples. The University of Wisconsin Marshfield Soil and Forage Analysis Laboratory now performs wet chemistry in vitro digestible dry matter and NDF digestibility (NDFD), and NIR calibrations for NDFD on alfalfa/grass and corn silage samples are available from the UW Marshfield Soil and Forage Analysis Laboratory and a number of commercial forage testing laboratories. The summative equations have been made available to commercial forage testing labs and some have programmed these equations into their reporting system.

When using milk per ton and milk per acre it is important to remember that the calculations provide relative rankings of forage samples, and should not be considered as predictive of actual milk production in specific situations or on individual farms

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because calculations have been simplified to reduce inputs for ease of use and do not consider animal genetic, dietary, and environmental differences affecting feed utilization. However the ranking of forages is appropriate in terms of animal response (milk production) when the forages are used in an animal diet.

The milk per ton index has been used in alfalfa and corn silage hybrid performance trials at the University of Wisconsin - Madison (Undersander et al., 1996; Lauer et al., 1997). This can be a great tool to consider value of hybrids/varieties in terms of animal use. Forage quality can always be increased simply by reducing yield so that the stem to leaf ratio increases. Since leaves have higher forage quality than stems, the lower yielding varieties will generally have higher forage quality. However, this is not profitable to the farmer growing and feeding the crop. Milk per ton and per acre is to allow comparison of hybrid/variety value when both forage quality and forage yield are changing.

As the data in Figures 1a and 2a show, there is little correlation between quality estimates based on ADF and in vitro digestibility. Most animal scientists would consider that, when the two differ, in vitro digestibility is the most accurate because it involves actual digestion in rumen conditions rather than a chemical approximation of digestion. The new procedures should allow much more accurate estimation of the value of quality forage to an animal.

The milk per acre comparisons in Figures 1b and 2b are much more linear, reflecting the large impact that yield has on the milk figures in both cases. However there are significant differences, some that were over estimated in quality and some that were underestimated.

The best way to estimate value of varieties and hybrids is shown in Figure 3 where forage quality (milk/ton) is plotted on the vertical axis and milk/acre is plotted on the horizontal axis. In this graph, the upper portion is high quality forage and the right portion is high yielding forage. Those varieties in the upper right quadrant will be the high quality, high yielding varieties that are most profitable to the farmer.

References

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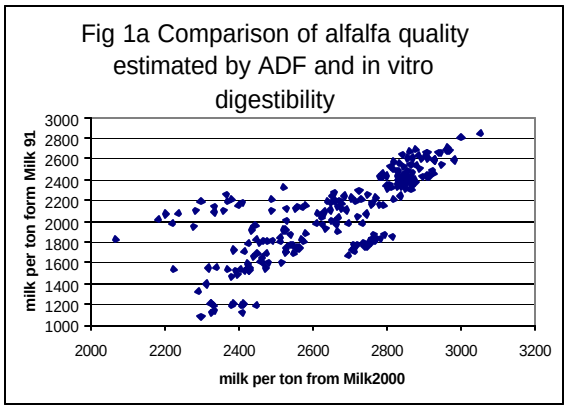
Fig 1a Comparison of alfalfa quality estimated by ADF and in vitro digestibility
milk per ton form Milk 91
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
2000
2200
2400
2600
2800
3000
3200
milk per ton from Milk2000

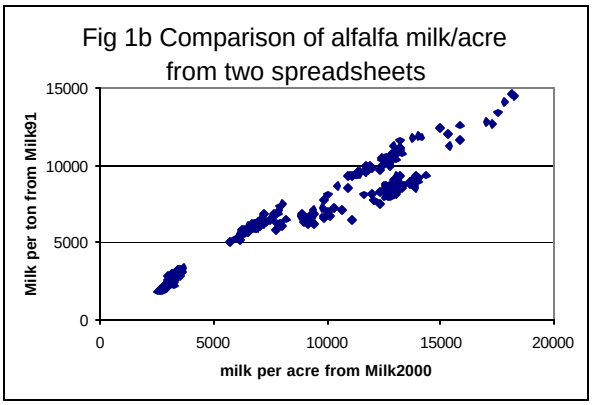
Fig 1b Comparison of alfalfa milk/acre from two spreadsheets
Milk per ton from Milk91
15000
10000
5000
0
0
5000
10000
15000
20000
milk per acre from Milk2000

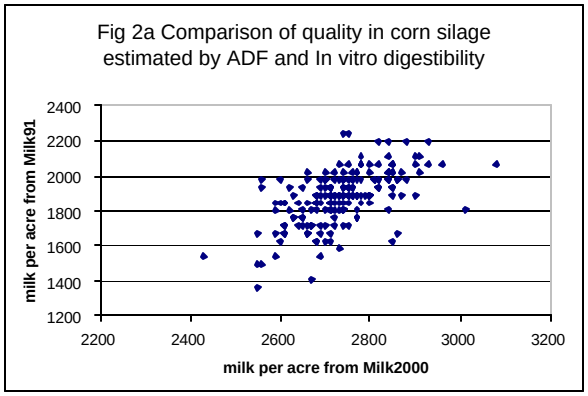
Fig 2a Comparison of quality in corn silage estimated by ADF and In vitro digestibility
milk per acre from Milk91
2400
2200
2000
1800
1600
1400
1200
2200
2400
2600
2800
3000
3200
milk per acre from Milk2000

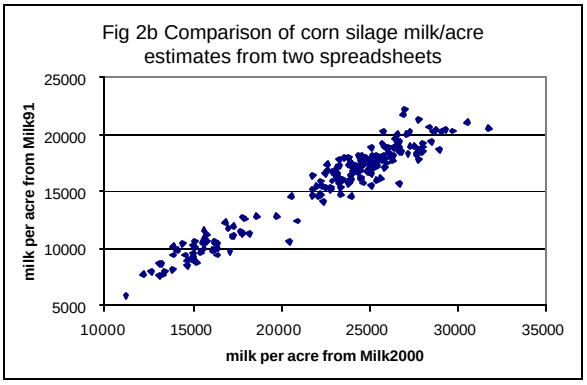
Fig 2b Comparison of corn silage milk/acre estimates from two spreadsheets
milk per acre from Milk91
25000
20000
15000
10000
5000
10000
15000
20000
25000
30000
35000
milk per acre from Milk2000

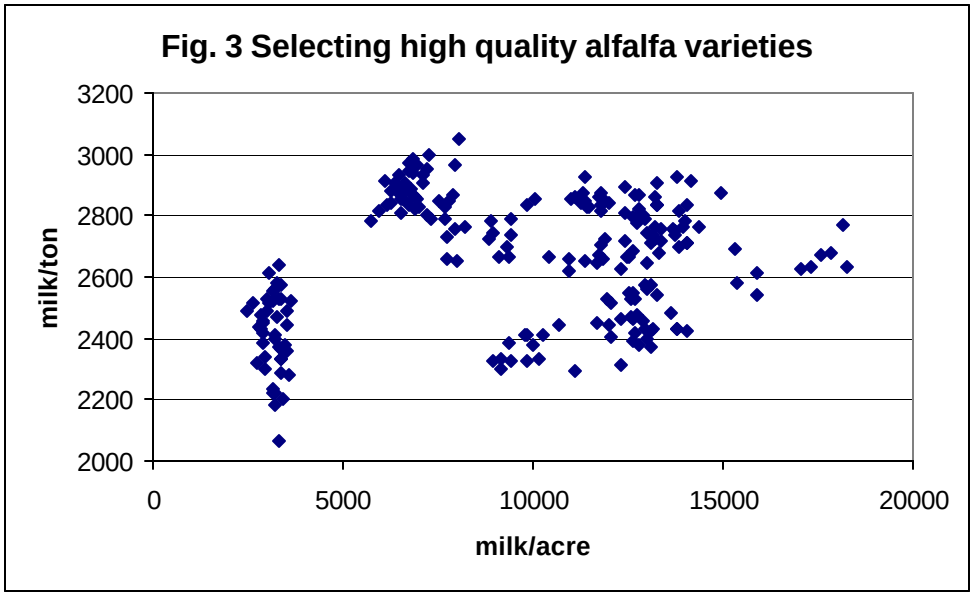
Fig. 3 Selecting high quality alfalfa varieties
milk/ton
3200
3000
2800
2600
2400
2200
2000
0
5000
10000
15000
20000
milk/acre

Normal Ranges of Values

Average and normal ranges for alfalfa/grass forage analysis of farmer samples are as follows:

	CP %	NDF %	dNDF % of NDF	NFC %	EE %	ash %	milk/ton lb/ton DM
Average	19.0	43.0	53.0	26	3.0	10.0	3,000
Minimum	10.0	30.0	30.0	10	1.0	6.0	1,600
Maximum	30.0	60.0	70.0	40	4.0	16.0	3,800

Average and normal ranges for corn silage forage analysis of farmer samples from the UW Marshfield Soil and Forage Analysis Laboratory are as follows:

	CP %	NDF %	dNDF % of NDF	starch %	NFC %	ash %	EE %	milk/ton lb./ton
Average	9.0	47.0	59.0	26.0	35.0	5.0	3.0	3,400
Minimum	5.0	29.0	43.0	6.0	6.5	1.0	1.0	1,600
Maximum	13.0	78.0	82.0	43.0	54.0	10.0	5.0	4,450

Average and normal ranges for corn silage variety trial (Lauer et al., 1997) quality parameters are as follows:

	CP %	NDF %	dNDF % of NDF	starch %	NFC %	milk/ton lb/ton DM
Average	7.0	46.0	52.0	30.0	41.0	3,100
Minimum	6.0	40.0	41.0	20.0	25.0	2,640
Maximum	9.0	53.0	63.0	40.0	50.0	3,500

Ash and ether extract are assumed constant at 5% and 2.5%, respectively.