Predicting Alfalfa Quality Using the Mean Stage by Count Method[1]

Richard J. Roseberg, Associate Professor

Introduction

The first seasonal alfalfa cutting typically accounts for 35-40% of the annual yield in four-cut systems common in much of the Pacific Northwest, USA. Because price is strongly related to quality, timing of the first cutting has a large impact on the yearly economic return. Because quality rapidly decreases with maturity, the time delay inherent with laboratory analysis decreases its utility as a management tool. Two rapid and inexpensive field methods to estimate laboratory quality analysis were developed by Fick and Mueller (1989). Both methods used a weighted average of the portion of alfalfa stems from a random sample that fell into separate maturity classes. Using either weight or number of stems in each maturity class, a "mean stage" for the samples was calculated. If such mean stages correlate with laboratory analysis, the mean stage methods could be used to estimate factors. Because it is less tedious, the mean stage by count (MSC) method is more likely to be used by farmers. This concept has been tested by Robert Vodraska in Idaho (personal communication, 1992), Ben Simko and Gary Schneider (1992) and others in Oregon, and has shown promise as a farm management tool (T. Moore, 1992).

Objective

To examine the relationship between the Mean Stage by Count and laboratory-measured quality factors for several varieties and stand ages of alfalfa in SW Oregon.

Materials & Methods

Alfalfa variety trials and adjacent fields located at the Southern Oregon Agricultural Experiment Station, located between Medford and Jacksonville, Oregon were used for this study. The soil was mapped as a Central Point sandy loam, and is a deep, well drained soil suited for irrigated or dryland alfalfa production. On May 4, 11, 18, 26, and June 2, 1993 (prior to first cutting), random samples were taken from 2 replications of varieties planted in 1986 (3), 1990 (1), and 1992 (8). From each plot, several grab samples were cut off near ground level, resulting in 48 to 149 stems per variety. Mean Stage by Count (MSC) was rapidly determined according to Fick and Mueller (1989). Samples were then dried at 47 to 51°C and transported to Oregon State University Crop & Soil Science Dept. for grinding and Near Infra-red Reflectance Spectroscopy (NIRS) analysis. Using equations developed there, common parameters of alfalfa forage quality were determined, including crude protein (CP), acid detergent fiber

[1] Use of product common or brand names is for the convenience of the reader only and does not imply endorsement or registration of the products by the author or Oregon State University, nor criticism of other products not named.

(ADF), neutral detergent fiber (NDF), digestible dry matter (DDM), and relative feed value (RFV).

Results & Discussion

MSC values ranged from approximately 1.8 to 4.5 during the month prior to first cutting. Thus, the very early vegetative and late flowering growth stages were not represented. Combining the results from all 12 varieties, crude protein was not well correlated with MSC, while ADF, NDF, DDM, and RFV exhibited weak linear correlation with MSC (see figures). In each case, R^2 values were less than 0.50. Vernal and WL-320 planted in 1986 exhibited the most consistent linear correlation between MSC and ADF, NDF, DDM, and RFV values compared to themselves (1990 and 1992 plantings) as well as other varieties tested. Lahontan planted in 1986 exhibited correlations nearer to the expected than its 1992 planting, but was less ideal than the Vernal and WL-320 correlations. Varieties planted in 1992 exhibited non-correlated responses (some not shown). This suggests that a mature stand may be more amenable to using the MSC method than a young stand. However, none of the samples tested in 1993 generated correlations strong enough to allow use of MSC as a predictive tool.

Conclusions

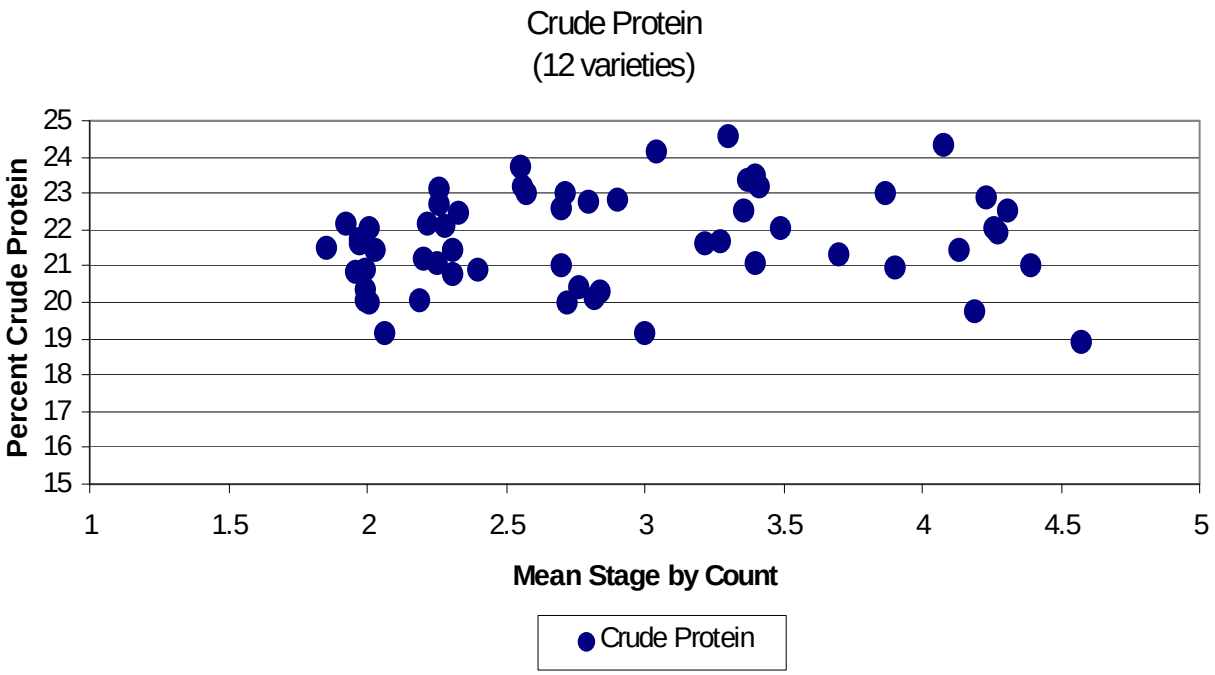
The MSC method as tested in 1993 did not generate correlations strong enough to allow prediction of NIRS measured quality parameters. Improved correlations from 1986 plantings compared to the same varieties planted in 1990 or 1992 suggest that mature stands may be more amenable to this technique. Further evaluation using wet laboratory analysis, sampling at earlier and later growth stages, and comparison with other staging techniques (such as mean stage by weight) would help define the utility of this method in SW Oregon.

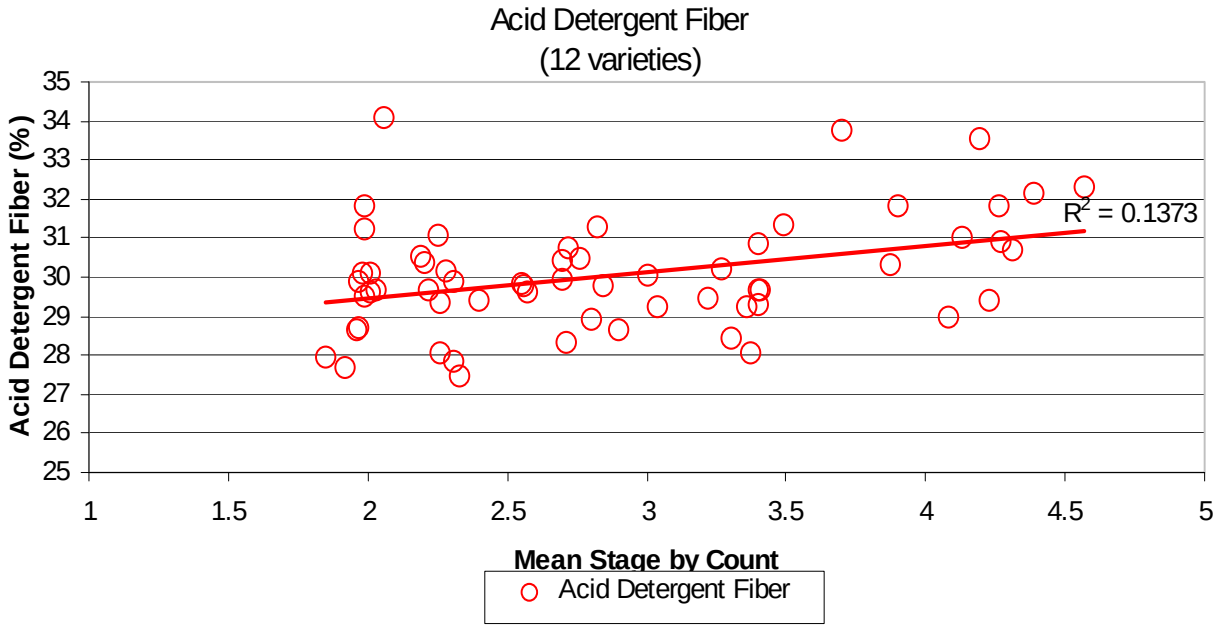
References

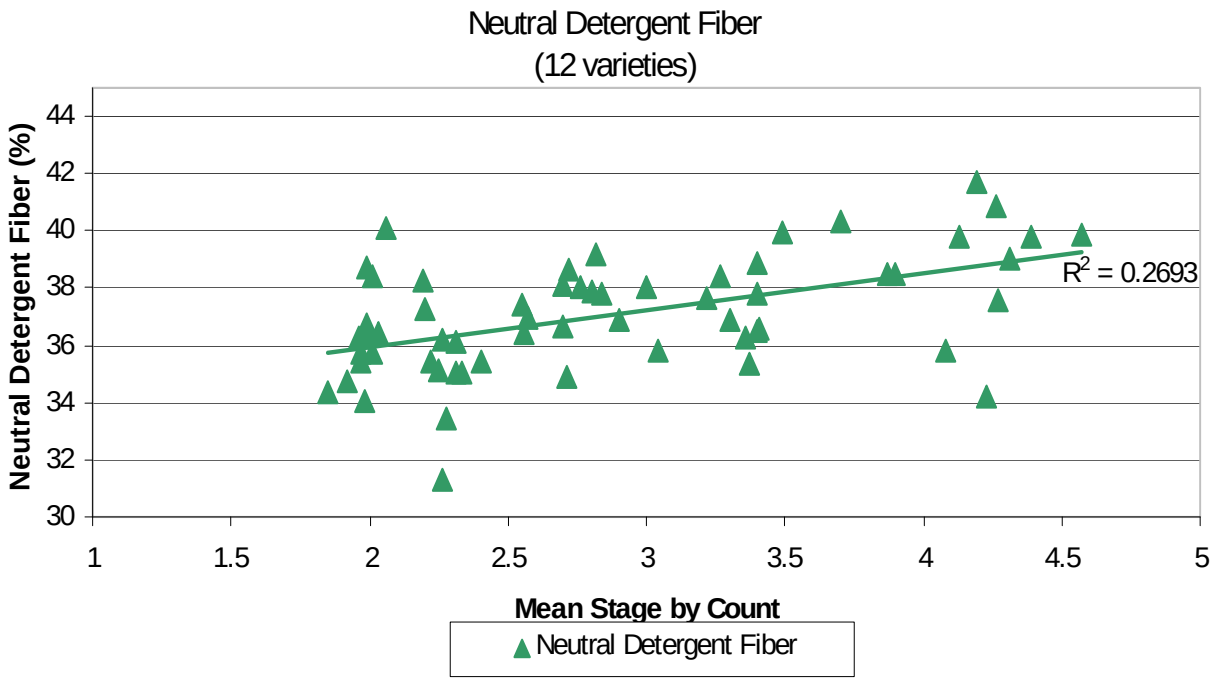
Fick, G.A. and S.C. Mueller. 1989. Alfalfa quality, maturity, and mean stage of development. Cornell Univ. Coop. Extension Information Bulletin 217.

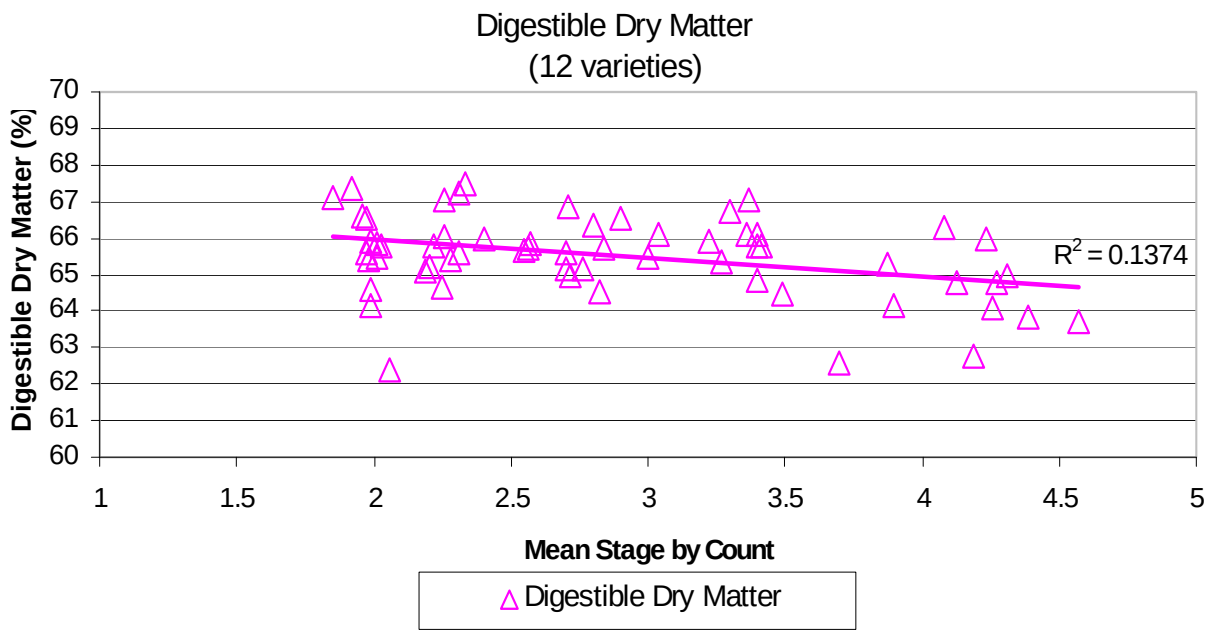
Moore, T. 1992. Researchers will issue new alfalfa cut guides. Capital Press, Salem, OR 20 Nov.

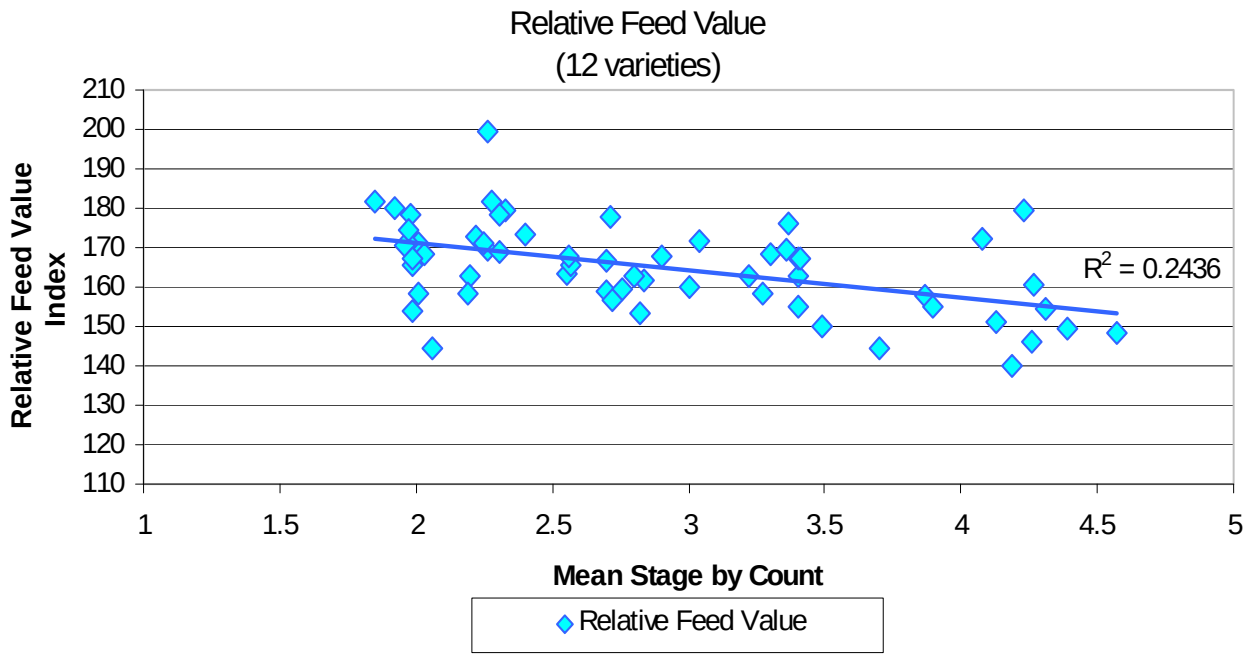
Simko, B. and G. Schneider. 1992. Correlation of alfalfa growth stages in Malheur County, Oregon with NIRS forage quality analysis. Oregon St. Univ. Malheur Co. Extension Agent Report. Pacific Northwest Forage Workers Conference, Klamath Falls, OR, 26-28 Oct.

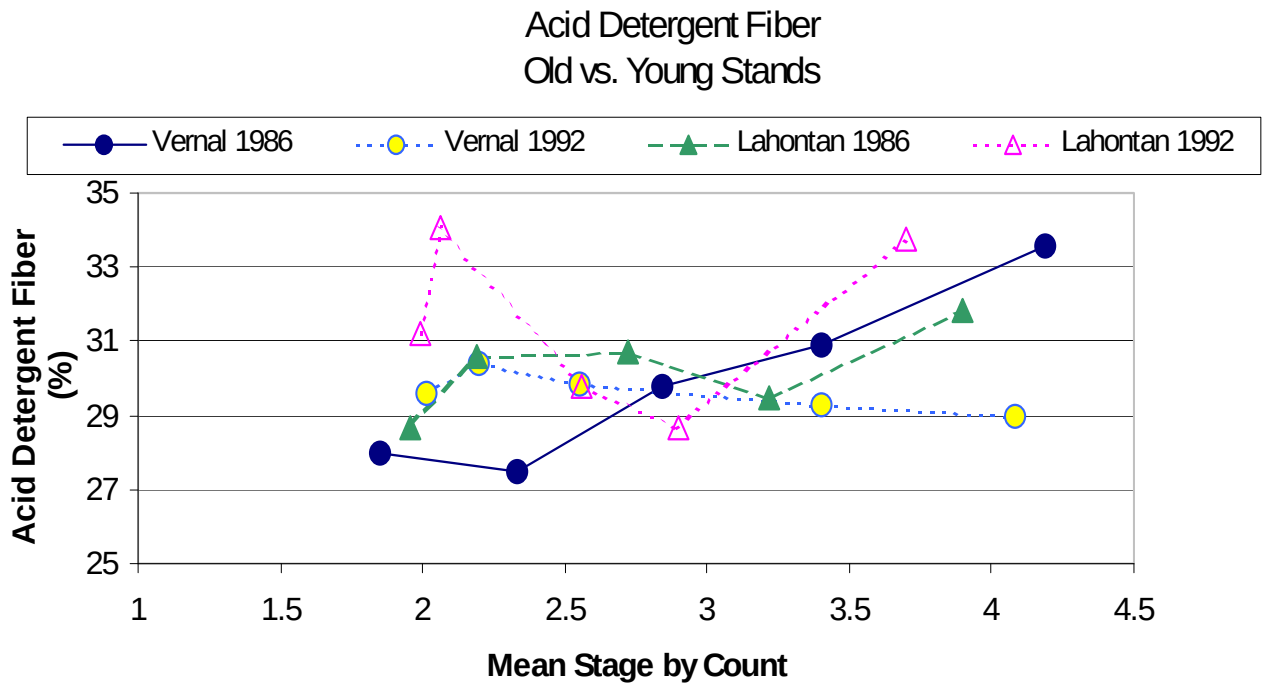

Crude Protein
(12 varieties)
Percent Crude Protein
25
24
23
22
21
20
19
18
17
16
15
1
1.5
2
2.5
3
3.5
4
4.5
5
Mean Stage by Count
Crude Protein

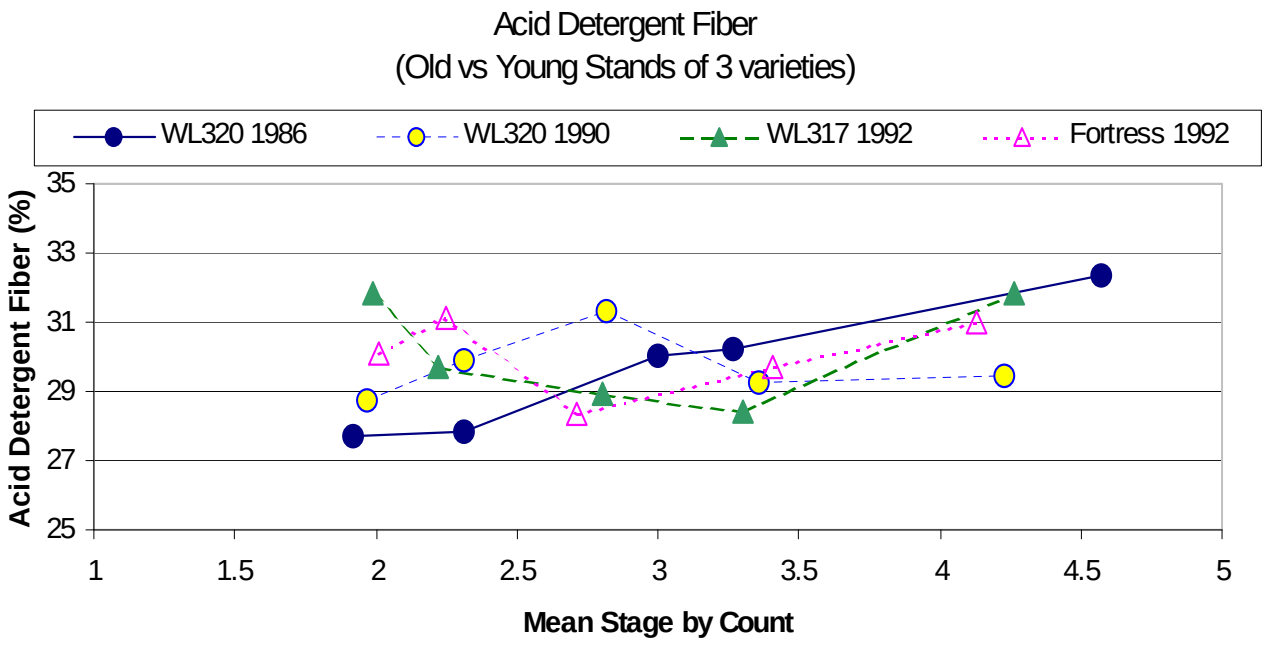

Acid Detergent Fiber
(12 varieties)
Acid Detergent Fiber (%)
35
34
33
32
31
30
29
28
27
26
25
1
1.5
2
2.5
3
3.5
4
4.5
5
R2 = 0.1373
Mean Stage by Count
Acid Detergent Fiber

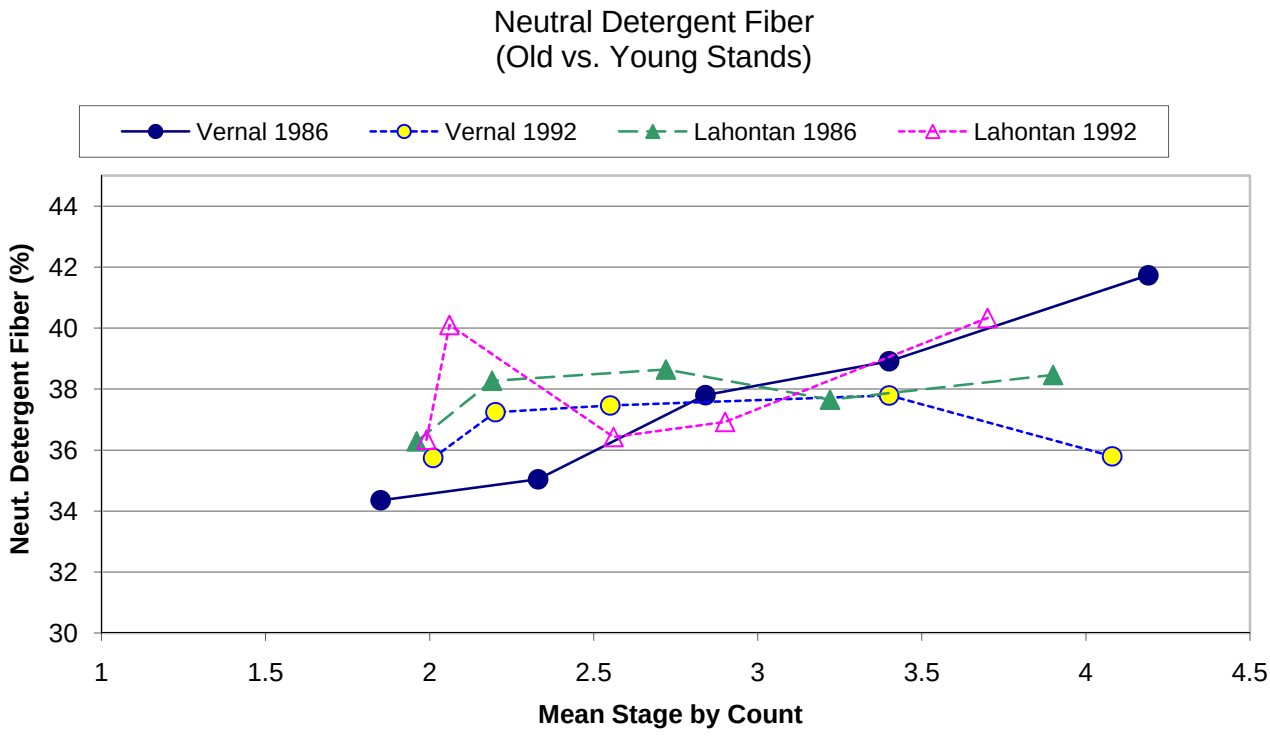

Neutral Detergent Fiber
(12 varieties)
Neutral Detergent Fiber (%)
44
42
40
38
36
34
32
30
1
1.5
2
2.5
3
3.5
4
4.5
5
R2 = 0.2693
Mean Stage by Count
Neutral Detergent Fiber

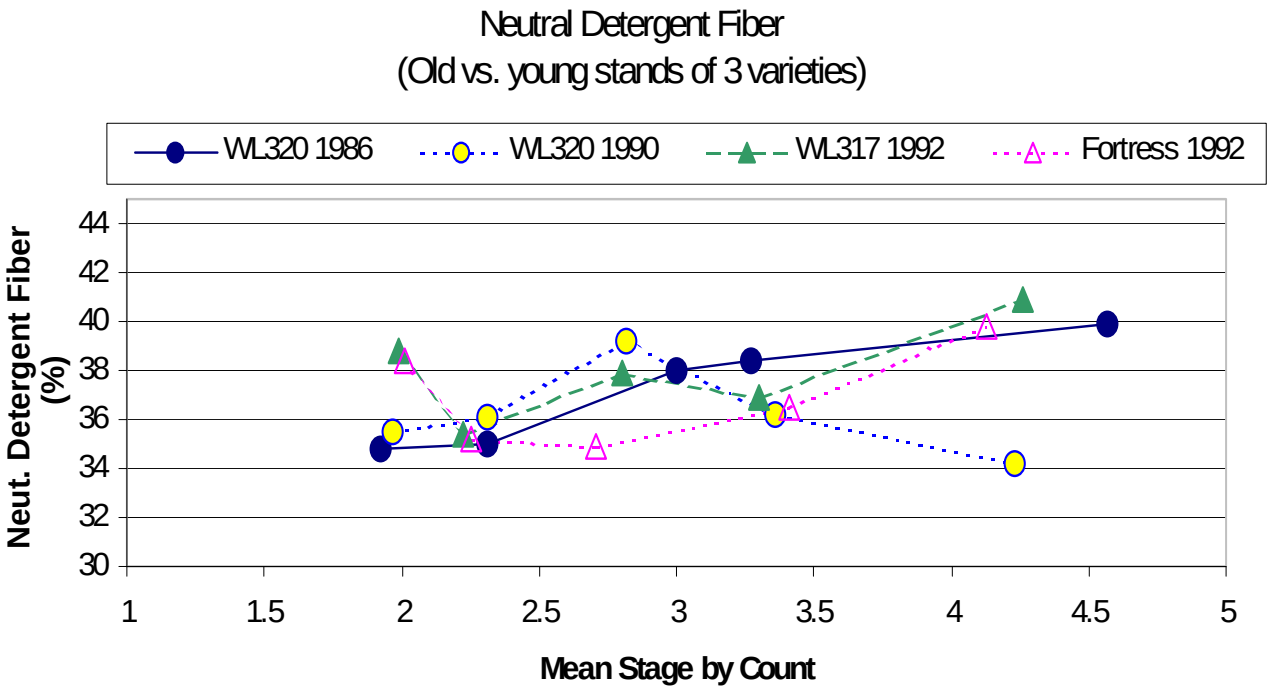

Digestible Dry Matter
(12 varieties)
Digestible Dry Matter (%)
70
69
68
67
66
65
64
63
62
61
60
1
1.5
2
2.5
3
3.5
4
4.5
5
R2 = 0.1374
Mean Stage by Count
Digestible Dry Matter

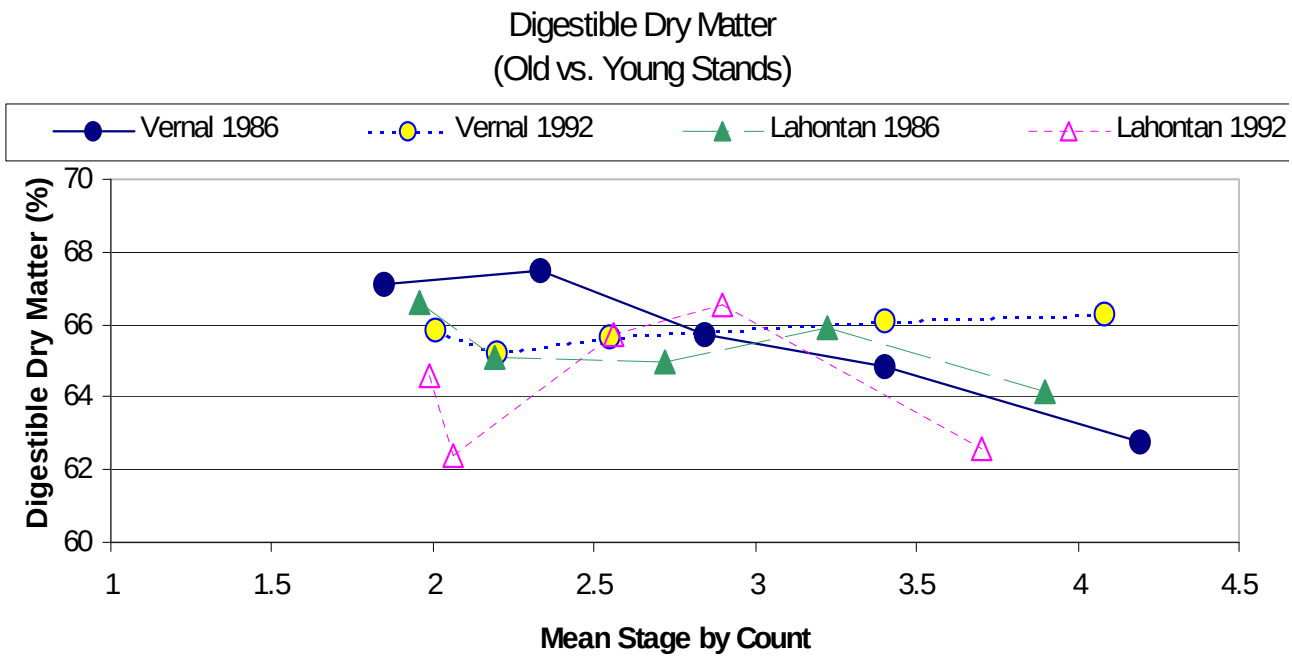

Relative Feed Value
(12 varieties)
Relative Feed Value Index
210
200
190
180
170
160
150
140
130
120
110
1
1.5
2
2.5
3
3.5
4
4.5
5
Mean Stage by Count
R^2 = 0.2436
Relative Feed Value

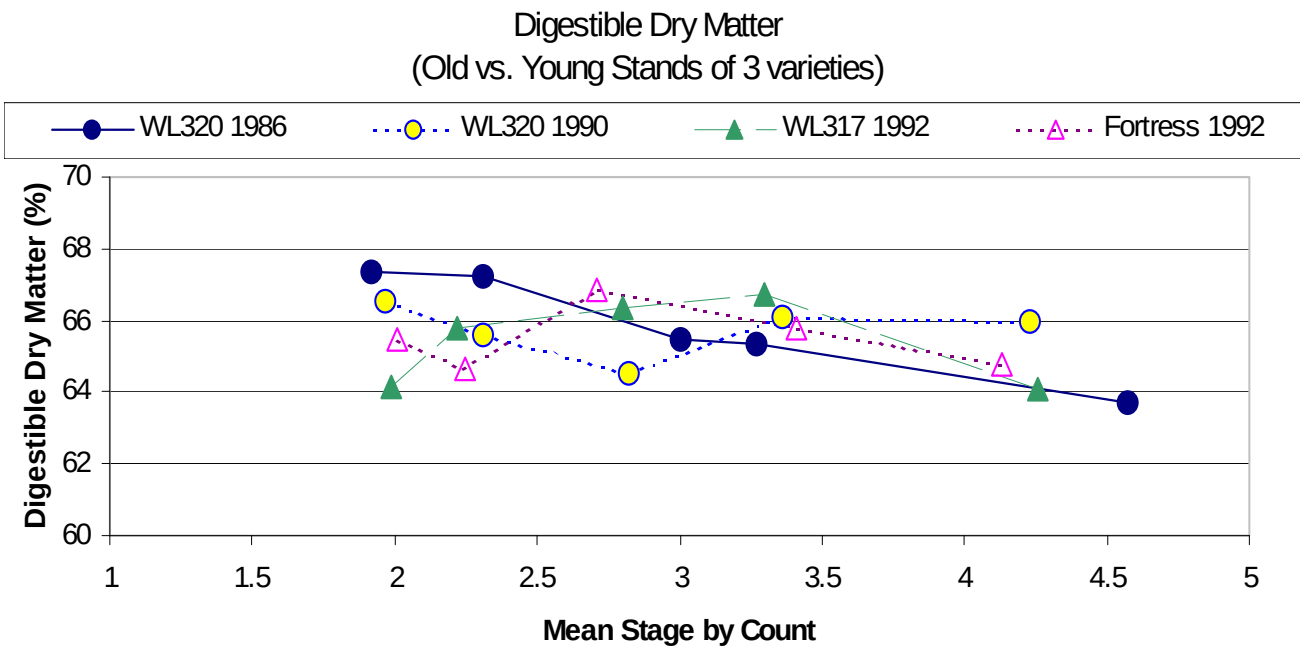

Acid Detergent Fiber
Old vs. Young Stands
Vernal 1986
Vernal 1992
Lahontan 1986
Lahontan 1992
Acid Detergent Fiber (%)
35
33
31
29
27
25
1
1.5
2
2.5
3
3.5
4
4.5
Mean Stage by Count


Acid Detergent Fiber
(Old vs Young Stands of 3 varieties)
WL320 1986
WL320 1990
WL317 1992
Fortress 1992
Acid Detergent Fiber (%)
35
33
31
29
27
25
1
1.5
2
2.5
3
3.5
4
4.5
5
Mean Stage by Count


Neutral Detergent Fiber
(Old vs. Young Stands)
Vernal 1986
Vernal 1992
Lahontan 1986
Lahontan 1992
Neut. Detergent Fiber (%)
44
42
40
38
36
34
32
30
1
1.5
2
2.5
3
3.5
4
4.5
Mean Stage by Count


Neutral Detergent Fiber
(Old vs. young stands of 3 varieties)
WL320 1986
WL320 1990
WL317 1992
Fortress 1992
Neut. Detergent Fiber (%)
44
42
40
38
36
34
32
30
1
1.5
2
2.5
3
3.5
4
4.5
5
Mean Stage by Count


Digestible Dry Matter
(Old vs. Young Stands)
Vernal 1986
Vernal 1992
Lahontan 1986
Lahontan 1992
Digestible Dry Matter (%)
70
68
66
64
62
60
1
1.5
2
2.5
3
3.5
4
4.5
Mean Stage by Count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WL320 1990
WL317 1992
Fortress 1992
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60
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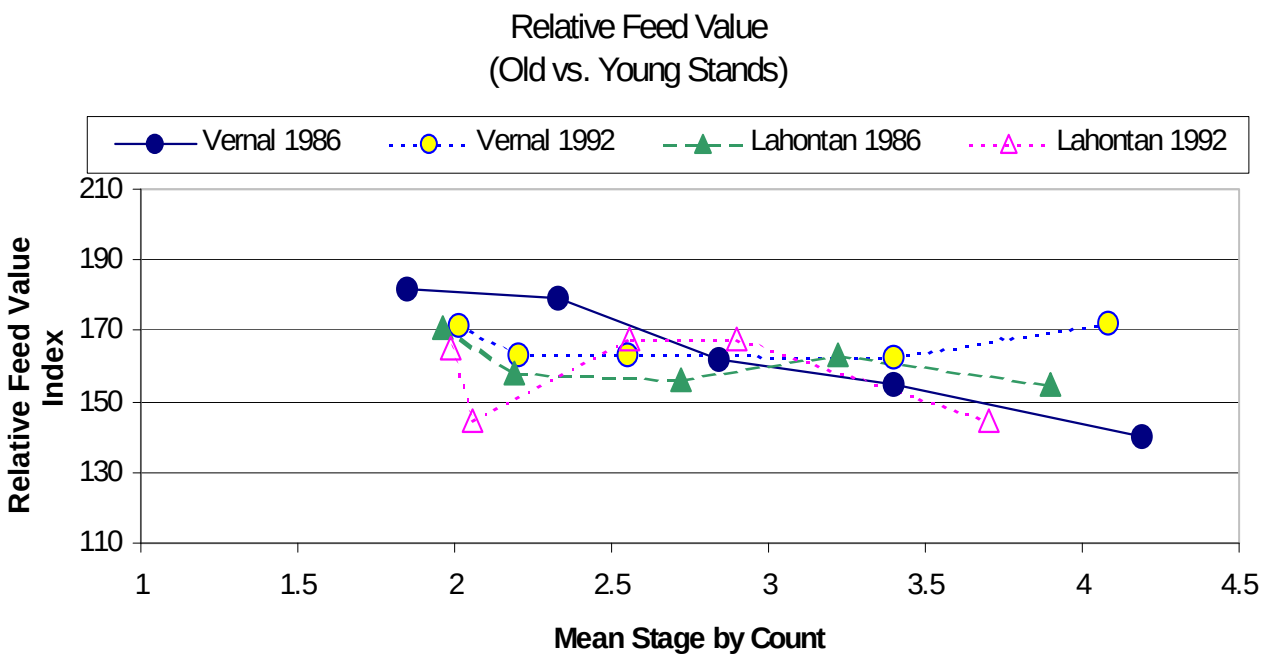
1.5
2
2.5
3
3.5
4
4.5
5
Mean Stage by Count


Relative Feed Value
(Old vs. Young Stands)
Vernal 1986
Vernal 1992
Lahontan 1986
Lahontan 1992
Relative Feed Value Index
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190
170
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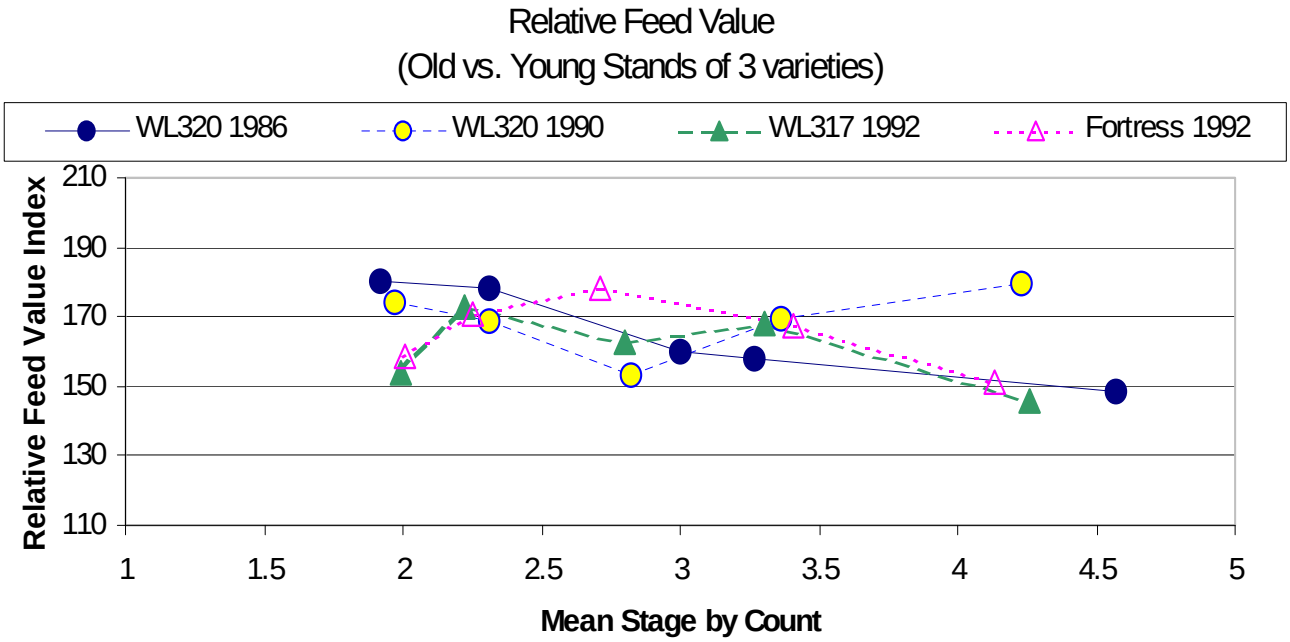
130
110
1
1.5
2
2.5
3
3.5
4
4.5
Mean Stage by Count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(Old vs. Young Stands of 3 varieties)
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WL320 1990
WL317 1992
Fortress 1992
Relative Feed Value Index
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1.5
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2.5
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4
4.5
5
Mean Stage by Count

Predicting Alfalfa Quality Using the Mean Stage by Count Method

J.A. Yungen and R.J. Roseberg*,

The quality of the large first cutting of alfalfa (*Medicago sativa*) strongly influences sale price, and thus the total yearly economic return to the alfalfa producers. Because quality rapidly decreases with maturity, the time delays inherent with laboratory analysis decrease its utility as a management tool. The Mean Stage by Count (MSC) method (Fick and Mueller, Cornell Univ.) was evaluated for its ability to rapidly predict laboratory analysis of alfalfa quality factors. Prior to the first cutting, random samples of above-ground plants were cut from 12 separate plots on five dates. These 12 plots represented varieties planted in 1986, 1990, and 1992. MSC values were calculated immediately after sampling, and samples were then oven-dried at 46°C to 59°C for five days. Plant material was ground up, tested for crude protein, acid detergent fiber, and neutral detergent fiber using both NIRS and standard “wet” laboratory techniques. The MSC data and the two laboratory-derived quality values were used to evaluate the MSC method in predicting the forage quality of several varieties and stand ages in southern Oregon.

Using the foregoing results, this abstract was presented as a poster at the 1993 annual meeting of the American Society of Agronomy (Agron Abstr. p. 171).

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