NIRS Platforms

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Foss

- Model 5000
- Model 6500

Foss

- InfraXact™
- XDS
- ISIscan™ , WinISI™ III software,

Unity Scientific

- SpectroStar

Perten

- DA7200
  - Diode array

Bruker Optics

- **MATRIX-I**

Efforts of NIR Consortium for differing instruments

- Instrument standardization
  - Equations perform the same on different instruments
  - Instrument restandardization after repair
- Instrument repeatability over time
- Equation transformation to different platforms

Comparison of Alfalfa Haylage Predictions

Foss DM	Perten 7200	Diff	Foss PROTEIN	Perten 7200	Diff	Foss NDF	Perten 7200	Diff	Foss dNDF48	Perten 7200	Diff
91.02	91.61	-0.56	20.61	20.32	0.75	47.73	48.97	-1.25	19.00	22.37	-2.85
91.39	90.19	1.23	16.18	16.32	0.31	55.02	54.04	0.97	23.66	26.09	-1.91
91.27	90.23	1.07	18.07	18.69	-0.16	45.48	46.03	-0.56	19.36	22.09	-2.21
90.72	89.77	0.98	26.57	24.75	2.27	37.12	36.15	0.96	16.85	17.42	-0.05
90.44	90.81	-0.34	19.18	19.41	0.23	49.22	49.74	-0.53	19.73	22.53	-2.28
91.37	90.86	0.54	15.15	15.46	0.15	55.63	55.19	0.44	23.94	26.47	-2.01
91.76	90.50	1.29	15.17	15.15	0.48	56.63	58.27	-1.65	40.53	28.46	outlier
90.48	90.46	0.05	18.73	19.47	-0.29	49.16	49.83	-0.67	19.93	22.75	-2.30
90.46	90.66	-0.18	20.90	21.11	0.25	47.45	46.86	0.59	19.90	21.45	-1.04
89.45	90.93	-1.44	23.32	23.93	-0.16	43.12	43.90	-0.79	16.89	18.51	-1.10
91.74	91.72	0.04	7.95	12.08	outlier	50.44	52.44	-2.01	32.06	22.38	outlier
91.13	90.30	0.86	17.36	17.70	0.11	51.49	52.29	-0.81	22.30	24.33	-1.50
91.40	92.35	-0.92	15.84	19.00	-2.71	47.22	46.71	0.51	19.56	22.42	-2.34
89.31	91.96	-2.63	22.42	23.40	-0.52	35.00	36.00	-1.00	14.10	15.18	-0.57
90.06	90.50	-0.40	24.00	24.22	0.23	45.96	42.96	3.00	16.85	18.48	-1.11
90.75	91.22	-0.44	22.31	22.11	0.66	42.56	42.63	-0.08	19.26	19.18	0.59
91.06	88.52	2.57	20.90	20.26	1.10	50.49	48.02	2.46	20.90	19.65	1.76
90.54	90.79	-0.23	18.62	18.95	0.12	50.00	49.21	0.78	21.07	22.68	-1.08
91.30	91.80	-0.47	20.91	20.75	0.62	49.53	48.60	0.92	19.73	22.22	-1.97
90.09	91.14	-1.02	18.00	18.23	0.22	50.13	51.40	-1.28	23.11	24.45	-0.83
Mean	**90.787**	**90.816**		**19.110**	**19.564**		**47.969**	**47.962**		**21.437**	**21.957**	
Bias		**-0.029**			**-0.454**			**0.007**			**-0.520**	
Slope		**-0.062**			**1.192**			**0.939**			**1.320**	
RSQ		**0.006**			**0.929**			**0.947**			**0.539**	
Std Dev			1.14			0.92			1.31			1.17

SECV of NIRSC and Combined Equat1ons

Component	NIRSC	Combined
DM	.81	.91
Protein	.85	.96
ADF	2.05	2.21
NDF	2.26	2.36
dNDF	2.49	2.72

NIRS consortium

- Members must belong to National Forage Testing and participate in certification process.
- Members should use NFTA recommended procedures for reference chemistry.

NIRS Consortium Equations

- Alfalfa hay
- Grass hay
- Mixed hay
- Haylage
- Corn silage
- Breeders equations
  - Alfalfa
  - Corn for silage

Alfalfa Hay equation

Constituent	N	Mean	SD	SEC	RSQ	SECV	1-VR	source
DM	106	93.87	1.50	0.24	0.98	0.31	0.96	06AH50-3.eqa
PROTEIN	615	20.73	2.97	0.59	0.96	0.64	0.95	NEW
ADF	737	32.38	5.81	1.75	0.91	1.80	0.90	NEW
NDF	901	40.92	7.80	1.69	0.95	1.75	0.95	NEW
dNDF48	287	20.48	5.67	1.91	0.89	2.10	0.86	NEW
CA	395	1.47	0.32	0.16	0.74	0.18	0.69	NEW
P	391	0.26	0.06	0.03	0.72	0.04	0.67	NEW
K	343	2.49	0.61	0.24	0.85	0.27	0.80	NEW
MG	339	0.32	0.09	0.05	0.75	0.05	0.70	NEW
ASH	529	8.43	3.02	0.80	0.93	0.87	0.92	06AH50-3.eqa
Lignin	101	7.50	1.97	0.75	0.85	1.03	0.73	06AH50-3.eqa
FAT	188	1.99	0.76	0.19	0.94	0.22	0.92	06AH50-3.eqa
RUP	102	25.37	6.78	1.40	0.96	2.35	0.88	06AH50-3.eqa

Mixed Hay equation

Constituent	N	Mean	SD	SEC	RSQ	SECV	1-VR	
DM	106	93.87	1.50	0.24	0.98	0.31	0.96	06mh50.eqa
PROTEIN	1139	17.70	5.43	0.76	0.98	0.80	0.98	NEW
ADF	1021	34.19	6.60	1.63	0.94	1.67	0.94	NEW
NDF	1274	46.60	12.36	2.01	0.97	2.07	0.97	NEW
dNDF48	365	22.64	7.02	2.01	0.92	2.20	0.90	NEW
CA	774	1.07	0.54	0.16	0.91	0.17	0.90	NEW
P	764	0.27	0.08	0.04	0.72	0.04	0.70	NEW
K	687	2.25	0.77	0.29	0.86	0.31	0.84	NEW
MG	684	0.26	0.09	0.04	0.78	0.05	0.76	NEW
ASH	676	8.61	3.07	0.94	0.91	1.02	0.89	NEW
FAT	188	1.99	0.76	0.19	0.94	0.22	0.92	06mh50.eqa
Lignin	127	6.91	2.15	1.24	0.67	1.36	0.60	NEW
RUP	102	25.37	6.78	1.40	0.96	2.35	0.88	06mh50.eqa

Grass Hay

Constituent	N	Mean	SD	SEC	RSQ	SECV	1-VR	Source
DM	878	94.44	2.45	0.64	0.93	0.69	0.92	New
PROTEIN	799	12.61	6.51	0.71	0.99	0.73	0.99	New
ADF	470	40.74	7.15	1.48	0.96	1.61	0.95	New
dNDF48	250	25.39	7.40	2.62	0.87	2.96	0.84	New
NDF	531	59.60	13.13	2.32	0.97	2.57	0.96	New
CA	562	0.50	0.22	0.08	0.86	0.09	0.84	New
P	567	0.18	0.07	0.03	0.80	0.03	0.77	New
K	484	1.53	0.71	0.21	0.91	0.23	0.89	New
MG	483	0.22	0.11	0.04	0.88	0.04	0.85	New
ASH	164	8.26	2.97	0.87	0.91	1.09	0.89	New

Haylage equations

Constituent	N	Mean	SD	SEC	RSQ	SECV	1-VR	source
DM	793	94.70	2.34	0.65	0.92	0.69	0.91	06hg50-3.eqa
PROTEIN	499	17.66	4.69	0.87	0.97	0.96	0.96	NEW
ADF	497	37.82	6.44	1.87	0.92	1.98	0.91	NEW
NDF	882	47.34	10.89	2.25	0.96	2.35	0.95	NEW
dNDF48	400	20.46	4.53	1.84	0.83	1.99	0.81	NEW
ASH	563	10.07	3.72	1.10	0.91	1.19	0.90	NEW
CA	487	1.11	0.47	0.16	0.89	0.17	0.87	NEW
P	498	0.31	0.08	0.05	0.63	0.05	0.55	NEW
K	473	2.50	0.81	0.31	0.85	0.36	0.81	NEW
MG	478	0.29	0.10	0.06	0.71	0.06	0.67	NEW
Lignin	142	8.07	2.75	1.07	0.85	1.23	0.80	NEW
FAT	116	2.65	0.77	0.31	0.84	0.35	0.79	NEW
ADP	126	2.04	1.46	0.53	0.87	0.65	0.80	06hg50-3.eqa
RUP	116	21.92	4.14	1.24	0.91	1.42	0.88	06hg50-3.eqa

Fermented Corn Silage

Constituent	N	Mean	SD	SEC	RSQ	SECV	1-VR	source
DM	421	96.24	3.60	1.42	0.85	1.53	0.82	cslg50-2.eqa
PROTEIN	702	9.26	1.86	0.53	0.92	0.56	0.91	NEW
ADF	633	27.52	4.66	1.53	0.89	1.61	0.88	NEW
NDF	1056	46.29	7.36	2.03	0.92	2.08	0.92	NEW
dNDF48	535	27.67	4.95	1.63	0.89	1.72	0.88	NEW
IVTDMD	534	82.19	3.14	1.37	0.81	1.47	0.78	NEW
FAT	192	2.43	0.42	0.17	0.83	0.19	0.79	NEW
ASH	286	6.00	3.22	0.64	0.96	0.79	0.94	cslg50-2.eqa
Lignin	307	3.80	1.11	0.48	0.81	0.55	0.75	cslg50-2.eqa
P	263	0.22	0.04	0.03	0.51	0.03	0.41	cslg50-2.eqa
CA	262	0.27	0.10	0.06	0.63	0.08	0.48	cslg50-2.eqa
K	300	1.20	0.47	0.26	0.69	0.28	0.64	NEW
MG	293	0.21	0.07	0.04	0.66	0.04	0.61	NEW

Plant Breeders equations

- Alfalfa
- Corn for silage (unfermented)

NIRS Consortium

- New Tests
  - 48-hour dNDF and In vitro Dry Matter
  - Will add 30-hour dNDF
  - Rumen undegraded protein (RUP)

Equation level

- 1=Basic =DM, CP, ADF, NDF, CA, P, K, MG
- 2=Basic + dNDF + RFQ + Ash
- 3= same as 2 + RUP.

NIRS Consortium

Guidelines for Optimizing Accuracy and Consistency in the NIRSC Laboratory

On NIRSC website

Sample Handling

- Dry enough to grind and analyze immediately (>90% dry matter)
- Dry enough to grind too wet to fine grind/analyze (85% to 90% dry matter)
- Samples needing to partially dried before grinding (<85% dry matter)

Sample handling

- Subsampling
  - Use proper sample splitting procedure
  - At least 75 g to be ground
- Grinder condition and maintenance

NIR Consortium

- Annual Conference
  - Presentations/discussion on using NIR
  - New developments in NIR
  - New forage/feed tests development/use