Table S1. Summary statistics for neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL), cellulose (CELL), hemicellulose (HEMI), carbon (C), and nitrogen (N) in Pullman 2016, Central Ferry 2017, Pullman 2017, and Mansfield 2017.

Pullman 2016				
Trait	**Min**	**Max**	**Mean**	**SD**
NDF	73.02	88.29	82.86	2.25
ADF	46.83	59.57	54.57	2.16
ADL	5.06	9.27	7.09	0.78
Cellulose	40.77	51.90	47.48	1.73
Hemicellulose	24.28	31.35	28.29	1.18
N	0.04	0.45	0.17	0.05
C	44.24	47.76	46.15	0.52
Central Ferry 2017				
Trait	**Min**	**Max**	**Mean**	**SD**
NDF	64.41	82.73	76.32	3.08
ADF	39.94	57.31	49.93	2.97
ADL	4.08	9.13	6.24	0.86
Cellulose	34.59	48.74	43.66	2.38
Hemicellulose	22.56	30.90	26.45	1.32
N	0.01	0.64	0.29	0.10
C	39.39	45.93	43.28	1.21
Pullman 2017				
Trait	**Min**	**Max**	**Mean**	**SD**
NDF	76.39	86.34	82.40	1.61
ADF	49.59	60.14	54.89	1.73
ADL	4.96	9.98	6.89	0.85
Cellulose	43.25	51.13	47.99	1.37
Hemicellulose	23.76	31.33	27.54	1.16
N	<0.01	0.39	0.13	0.07
C	39.90	45.24	41.98	1.31

Mansfield 2017				
Trait	Min	Max	Mean	SD
NDF	63.64	83.78	75.20	3.20
ADF	40.43	53.46	47.06	2.38
ADL	3.79	8.03	5.50	0.69
Cellulose	35.20	46.23	41.56	2.00
Hemicellulose	23.72	33.26	28.14	1.53
N	<0.01	0.34	0.07	0.05
C	38.75	45.59	41.87	1.84

Table S2. Near-infrared spectroscopy (NIRS) calibration statistics of the specific equations developed from the population of 480 in individual environments. Traits include neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL), cellulose (CELL), hemicellulose (HEMI), carbon (C), and nitrogen (N). Table includes trait, math treatment, number of samples (n), mean, standard deviation (SD), standard error of calibration (SEC), coefficient of determination (R^2), standard error of cross-validation (SECV), 1 minus the variance ratio (1-VR), standard deviation to standard error of cross-validation ratio (SD/SECV).

Trait	Math treatment	n	mean	SD	SEC	R^2	SECV	1-VR	SD/SECV
Central Ferry 2017									
NDF	1,4,4,1	263	76.45	2.85	1.57	0.70	1.63	0.67	1.75
ADF	3,5,5,1	261	49.90	2.79	1.47	0.73	1.58	0.68	1.77
ADL	1,4,4,1	259	6.15	0.77	0.49	0.58	0.54	0.51	1.43
CELL	3,5,5,1	260	43.73	2.27	1.10	0.77	1.19	0.72	1.91
HEMI	3,5,5,1	266	26.50	1.27	1.06	0.30	1.16	0.17	1.09
C	3,5,5,1	265	43.27	1.22	0.65	0.72	0.71	0.66	1.72
N	3,5,5,1	266	0.29	0.09	0.06	0.56	0.07	0.43	1.28
Pullman 2016									
NDF	3,5,5,1	266	82.88	2.20	1.13	0.73	1.24	0.68	1.77
ADF	1,4,4,1	265	54.54	2.07	1.11	0.72	1.20	0.67	1.73
ADL	1,10,10,1	265	7.03	0.75	0.53	0.50	0.56	0.44	1.34
CELL	1,4,4,1	264	47.46	1.68	0.84	0.75	0.88	0.73	1.91
HEMI	3,5,5,1	267	28.26	1.17	1.00	0.26	1.05	0.18	1.11
C	3,5,5,1	265	46.16	0.52	0.30	0.67	0.32	0.62	1.63
N	1,10,10,1	268	0.17	0.05	0.05	0.07	0.05	0.05	1.00
Pullman 2017									
NDF	3,5,5,1	268	82.49	1.54	1.12	0.47	1.19	0.40	1.29
ADF	3,5,5,1	268	54.92	1.71	1.19	0.52	1.28	0.45	1.34
ADL	2,6,4,1	266	6.89	0.83	0.59	0.49	0.64	0.41	1.30
CELL	3,5,5,1	264	48.00	1.29	0.73	0.68	0.78	0.63	1.65
HEMI	1,4,4,1	266	27.53	1.12	0.95	0.27	0.99	0.21	1.13
C	3,5,5,1	269	41.89	1.26	0.81	0.58	0.87	0.52	1.45
N	3,5,5,1	265	0.12	0.07	0.04	0.62	0.04	0.59	1.75
Mansfield 2017									
NDF	3,5,5,1	267	75.32	3.04	1.79	0.65	1.83	0.64	1.66
ADF	3,5,5,1	265	47.08	2.33	1.42	0.63	1.47	0.60	1.59
ADL	1,10,10,1	263	5.46	0.68	0.47	0.52	0.51	0.43	1.33
CELL	2,6,4,1	269	41.63	1.95	1.08	0.69	1.14	0.66	1.71
HEMI	2,4,4,1	264	28.06	1.45	1.10	0.42	1.14	0.38	1.27
C	3,5,5,1	269	41.80	1.81	1.66	0.16	1.70	0.12	1.06
N	3,5,5,1	259	0.07	0.05	0.04	0.17	0.04	0.13	1.25

Table S3. Near-infrared spectroscopy (NIRS) validation statistics displaying laboratory reference measurements vs. NIRS predicted results of the specific equations developed from the population of 480 in individual environments. Measurements for neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL), cellulose (CELL), hemicellulose (HEMI), C, and N. Includes trait, number of samples (n), range of reference data, lab mean, lab standard deviation (Lab SD), NIRS predicted mean, bias, coefficient of determination (R^2), standard error of prediction (SEP), and slope.

		Laboratory Measurements			Validation Results				
Trait	n	Range	Lab Mean	Lab SD	NIRS mean	Bias	R^2	SEP	Slope
Central Ferry 2017									
NDF	200	68.40 – 82.73	76.57	2.79	76.69	-0.118	0.60	1.77	1.01
ADF	200	43.33 – 56.92	50.18	2.84	50.00	0.178	0.57	1.87	1.02
ADL	199	4.30 – 8.95	6.34	0.88	6.17	0.162	0.36	0.72	0.88
CELL	200	34.59 – 48.74	43.83	2.22	43.86	-0.031	0.64	1.33	0.96
HEMI	200	22.56 – 30.90	26.39	1.37	26.57	-0.175	0.17	1.27	0.79
C	200	40.18 – 45.46	43.33	1.15	43.33	0.005	0.59	0.75	0.85
N	200	0.04 – 0.56	0.03	0.10	0.28	0.011	0.50	0.07	1.00
Pullman 2016									
NDF	200	75.30 – 87.68	82.99	2.18	83.00	-0.012	0.66	1.27	0.93
ADF	200	46.83 – 59.57	54.68	2.16	54.66	0.021	0.65	1.27	0.98
ADL	200	5.06 – 9.27	7.15	0.79	7.11	0.044	0.41	0.60	0.95
CELL	200	41.77 – 51.90	47.53	1.73	47.52	0.011	0.68	0.98	0.99
HEMI	200	25.39 – 31.35	28.30	1.12	28.28	0.024	0.16	1.03	0.79
C	198	44.24 – 47.76	46.16	0.53	46.19	-0.030	0.59	0.34	0.92
N	199	0.04 – 0.35	0.17	0.06	0.17	0.051	0.12	0.05	1.33
Pullman 2017									
NDF	200	77.97 – 86.34	82.46	1.51	82.49	-0.028	0.36	1.21	0.87
ADF	200	49.95 – 59.13	54.87	1.64	54.94	-0.070	0.37	1.32	0.82
ADL	200	5.02 – 9.73	6.82	0.81	6.91	-0.086	0.24	0.69	0.71
CELL	200	43.33 – 51.10	48.05	1.36	48.01	0.039	0.57	0.89	1.00
HEMI	200	23.76 – 31.33	27.59	1.11	27.55	0.043	0.13	1.06	0.65
C	200	39.90 – 44.94	42.04	1.34	41.84	0.204	0.45	1.01	0.96
N	200	0.01 – 0.37	0.13	0.08	0.13	0.009	0.51	0.05	1.00
Mansfield 2017									
NDF	200	68.10 – 83.66	75.40	2.97	75.14	0.257	0.52	2.10	0.99
ADF	200	41.37 – 53.04	47.12	2.22	46.92	0.195	0.51	1.57	0.89
ADL	200	3.79 – 7.47	5.50	0.64	5.42	0.082	0.41	0.50	0.89
CELL	200	37.11 – 46.22	41.62	1.88	41.55	0.073	0.66	1.10	0.99
HEMI	199	24.12 – 32.35	28.26	1.53	28.09	0.171	0.34	1.26	0.91
C	200	38.75 – 45.42	41.98	1.87	41.79	0.192	0.26	1.62	1.27
N	194	< 0.01 – 0.23	0.07	0.05	0.07	0.004	0.08	0.05	0.70