A Field Guide to Winter Cereal Rye Forage Quality

A.S. Leaflet R3309

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Summary and Implications

Winter cereal rye is a durable cover crop for cold climates with potentially good forage yield and quality. Although forage yield and forage quality are inversely related and a compromise must occur, the resilience of this crop allows frequent, early harvests and provides a source of high quality forage early in the season before other forages are typically ready for grazing or mechanical harvest.

Introduction

The government initiative to protect land and open waters from the detrimental effects of soil erosion and residual nutrients left from a previous crop has spawned an interest in the use of cover crops. Since cover crops are generally sown after fall harvest the use of cold tolerant plant species like cereal winter rye *Secale cerale L*. has become a popular choice. The wide extent of cultivation, the ease in establishment and the aggressive late fall/early spring growth lends this plant to be used as a forage resource as well. As a forage resource, forage quality becomes a concern and is quite variable depending on the stage of maturity. Temperature has a large role in changing plant quality and this paper will address this point during the spring growth. Along with this, harvest height also could play a role in the quality of this forage and this will also be addressed in this paper.

Materials & Methods

From the point of a firm break from winter dormancy (approximately the beginning of April) through the R3 stage of grass maturity where the seed head has fully emerged (approximately the middle of May) winter cereal rye samples were gathered weekly from three locations across Iowa (Anamosa, Nevada and Chariton). Apart from the initial sample at the break from winter dormancy where plant height was about three inches, samples were taken leaving either a two inch or four inch stubble remaining in the field. These two stubble heights were selected because they are two common heights left by machine forage harvest. The samples were sent to Dairyland Laboratories of Arcadia, Wisconsin and the nutrient analysis was performed along with a 48 hour neutral detergent fiber (NDF) digestibility. Growing degree days were calculated using air temperatures of 38 degrees Fahrenheit as the lower value and 85 degrees Fahrenheit as the upper value from the point of the initial sampling. The grass maturity stage was recorded at the time of sampling. Yield data were not taken, but a measure of the plant height and a picture were taken for reference. The sample nutrient data were averaged for each stage at each cutting height. The range was included.

Results

The following provides a summary of the nutrient results observed at each point of collection giving the nutrient content, the stage of maturity and the growing degree days from dormancy. It should be noted that there was minimal growth from the previous fall on all the - sampled in the spring during the trial. The difference in nutrient content between the forage cut leaving a two inch and that cut leaving a four inch stubble height was provided. In general, the higher cutting height only has benefit in forage quality (considering protein and energy content) with more mature plants. Ash content tends to decrease in the plant matter with a higher cutting height by about one percentage point. It should be noted that the delay from sampling to lab analysis may have decreased the nonfiber carbohydrate (NFC) thus resulting in an apparent increase of the NDF, crude protein (CP) solubility and CP content slightly from the fresh value. The graphic images illustrate the decline or increase in the measured nutrient component. The equations provided with each image indicates the probable quantity of the nutrient on a dry matter basis at the specified growing degree days (x value) since the break in dormancy.

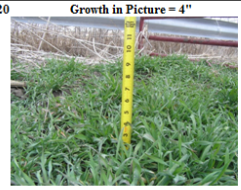
Acknowledgement

This trial was made possible by the Iowa Beef Center, ISU Outlying Research Farms, Stickle Farms and Couser Cattle Company

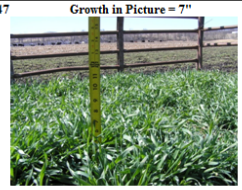
	Breaking Dormancy			V2-V3 Vegetative - 2 to 3 leaves per plant						V3 -V4 Vegetative - 3 to 4 leaves per plant					
	2 inch stubble left			2" stubble remaining			4" stubble remaining			2" stubble remaining			4" stubble remaining		
%	avg	min	max	avg	min	max	avg	min	max	avg	min	max	avg	min	max
DM	21.6	21.3	21.9	21.8	21.0	22.6	21.6	20.4	22.7	21.4	16.0	25.4	22.3	16.9	25.6
CP	36.0	34.0	38.0	29.6	27.8	31.4	27.0	25.3	28.7	24.7	22.1	26.3	25.5	24.5	27.1
ADF	15.7	14.8	16.6	13.3	13.2	13.4	14.5	13.7	15.4	19.7	17.6	21.9	14.7	13.9	15.6
aNDFom	21.6	21.1	22.0	25.4	25.3	25.4	27.6	27.3	28.0	32.4	27.9	35.4	27.8	26.8	29.3
aNDFd 48	86.5	86.0	87.1	83.1	82.8	83.4	85.6	83.8	87.5	85.4	83.7	87.0	85.2	84.9	85.5
uNDFd 48	3.2	2.8	3.6	4.3	4.2	4.4	4.0	3.5	4.4	5.1	4.4	5.8	4.2	4.1	4.2
prot sol	50.3	45.3	55.3	47.7	47.2	48.1	44.3	43.4	45.1	51.3	49.2	53.3	44.1	43.9	44.2
Fat	2.8	2.7	2.9	2.6	2.5	2.7	2.5	2.5	2.6	2.1	2.1	2.1	2.7	2.6	2.8
NFC	31.4	28.0	34.8	34.2	32.4	36.0	34.2	32.4	35.9	32.8	26.9	43.5	36.6	32.1	42.5
Ash	11.1	10.0	12.3	11.2	10.3	12.0	11.9	11.0	12.8	11.5	6.9	13.8	10.6	7.1	12.6
Ca	0.7	0.7	0.7	0.4	0.3	0.6	0.4	0.2	0.6	0.5	0.4	0.7	0.5	0.4	0.5
P	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.4	0.5
Mg	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
K	3.4	3.4	3.5	2.9	2.8	3.1	3.1	2.9	3.2	3.3	3.1	3.4	3.1	2.9	3.3
S	0.4	0.3	0.4	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
RFV	290.1	269.5	310.8	269.9	261.9	278.0	247.6	244.2	251.0	189.9	181.6	198.2	244.3	233.7	254.9
RFQ	372.7	349.7	395.7	342.4	337.5	347.3	324.9	322.0	327.9	264.7	255.6	273.8	319.8	312.9	326.8
		0.0	0.0												
calc TDN	79.4	79.1	79.7	75.7	74.6	76.8	75.1	73.7	76.5	72.2	71.7	72.6	74.3	73.7	74.9
calc NEm	0.86	0.85	0.86	0.81	0.79	0.82	0.79	0.76	0.82	0.76	0.75	0.76	0.78	0.77	0.79
calc Neg	0.57	0.57	0.57	0.53	0.51	0.54	0.52	0.50	0.53	0.49	0.48	0.49	0.51	0.50	0.52

Day = 0 GDD = 0 Growth in Picture = 2-3"

Day = 7 GDD = 20 Growth in Picture = 4"



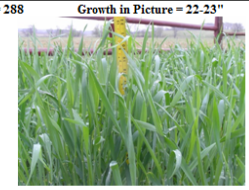
Day = 14 GDD = 47 Growth in Picture = 7"



	Vn - E0 Final Vegetative leaf set to initial Elongation phase						En - R0 (Boot Stage) Transition from Elongation to initial Reproductive phase					
	2" stubble remaining			4" stubble remaining			2" stubble remaining			4" stubble remaining		
%	avg	min	max	avg	min	max	avg	min	max	avg	min	max
DM	20.1	19.6	20.3	18.8	16.7	20.7	13.0	10.6	14.2	13.3	11.6	15.6
CP	23.8	20.4	26.4	26.6	23.4	29.9	24.0	19.6	26.7	24.7	20.0	29.2
ADF	20.6	17.9	25.3	18.4	18.2	18.5	26.6	24.9	28.9	25.8	23.1	28.0
aNDFom	40.7	38.0	45.1	35.5	32.9	38.2	45.4	39.9	48.5	45.3	44.7	45.9
aNDFd 48	85.9	82.0	92.1	87.9	83.0	90.4	78.8	77.0	81.0	77.1	73.0	80.4
uNDFd 48	5.8	3.0	8.1	4.4	3.2	6.5	9.3	7.0	10.5	9.8	8.9	11.5
prot sol	44.1	38.4	50.0	45.6	35.8	52.1	44.1	39.8	48.0	43.8	36.8	52.9
Fat	2.0	1.7	2.2	2.2	1.9	2.7	2.0	1.8	2.2	2.0	1.8	2.2
NFC	25.9	16.7	33.8	28.0	25.5	31.2	20.3	13.8	23.8	20.6	12.8	27.8
Ash	11.2	8.6	14.0	11.2	9.1	12.7	11.6	9.2	13.7	11.1	8.2	13.2
Ca	0.7	0.5	1.1	0.6	0.5	0.6	0.5	0.4	0.6	0.5	0.3	0.8
P	0.5	0.4	0.5	0.5	0.4	0.6	0.6	0.4	0.8	0.6	0.4	0.8
Mg	0.3	0.2	0.5	0.3	0.2	0.3	0.3	0.3	0.4	0.3	0.3	0.3
K	3.0	2.4	3.4	3.5	2.8	4.1	3.9	3.1	4.9	3.8	2.8	4.7
S	0.2	0.2	0.3	0.3	0.2	0.4	0.3	0.2	0.3	0.3	0.2	0.3
RFV	162.3	139.4	177.2	187.8	174.4	201.1	135.4	125.6	152.4	136.9	135.2	139.6
RFQ	244.1	206.9	274.5	275.2	251.9	292.7	204.1	185.7	232.2	200.2	183.2	214.1
							0.0			0.0		
calc TDN	75.8	71.8	79.1	77.1	76.1	78.3	69.8	66.0	72.3	69.7	64.9	74.3
calc NEm	0.81	0.75	0.85	0.82	0.81	0.84	0.72	0.67	0.76	0.72	0.65	0.78
calc Neg	0.53	0.48	0.56	0.54	0.53	0.56	0.45	0.41	0.48	0.45	0.39	0.51

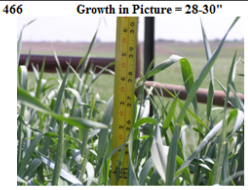
Day = 21 GDD = 143 Growth in Picture = 10"

Day = 28 GDD = 288 Growth in Picture = 22-23"



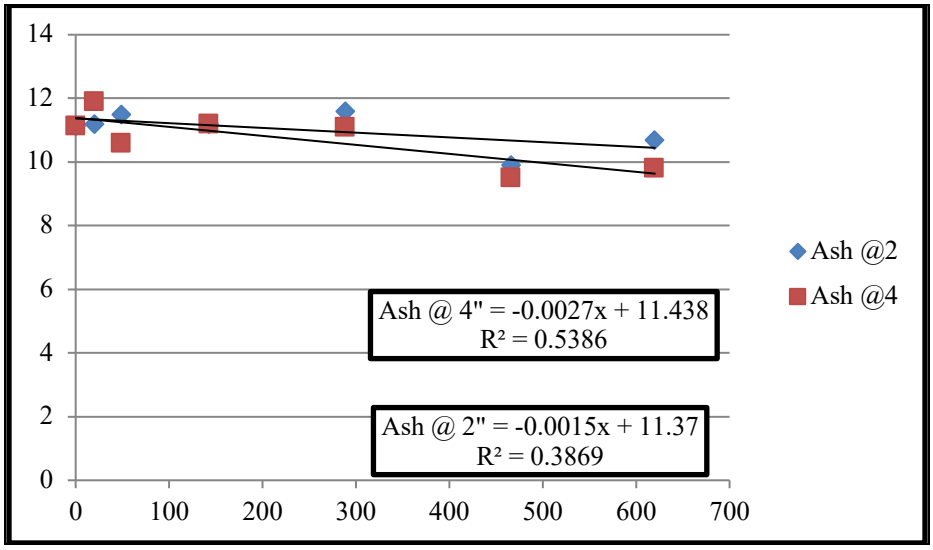
	R1 Seed head emergence						R2-R3 Seed head fully emerged					
	2" stubble remaining			4" stubble remaining			2" stubble remaining			4" stubble remaining		
%	avg	min	max	avg	min	max	avg	min	max	avg	min	max
DM	17.3	15.1	19.5	16.2	14.4	17.9	19.8	19.2	20.3	21.4	19.8	23.0
CP	18.5	16.2	20.8	21.7	21.6	21.9	14.3	13.5	15.2	13.5	13.0	14.0
ADF	30.3	27.5	33.2	25.8	25.0	26.6	40.7	40.7	40.8	38.3	37.9	38.7
aNDFom	48.8	44.8	52.7	45.8	42.2	49.4	61.5	60.8	62.2	61.9	61.1	62.6
aNDFd 48	72.5	72.0	73.0	78.2	78.0	78.4	61.0	60.0	62.0	64.3	62.5	66.0
uNDFd 48	12.8	11.0	14.5	9.6	9.1	10.0	23.3	22.5	24.0	21.0	19.0	23.0
prot sol	43.4	35.5	51.4	38.5	33.7	43.2	34.3	33.6	35.1	31.5	30.4	32.6
Fat	1.5	1.0	1.9	1.7	1.4	2.0	1.4	1.3	1.4	1.5	1.3	1.6
NFC	23.4	20.4	26.3	23.9	19.6	28.3	13.2	12.8	13.6	14.3	14.2	14.4
Ash	9.9	9.0	10.8	9.5	8.9	10.0	10.7	10.3	11.0	9.8	9.7	9.8
Ca	0.4	0.4	0.5	0.5	0.4	0.5	0.4	0.4	0.5	0.3	0.3	0.4
P	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.4
Mg	0.3	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2
K	3.3	2.9	3.7	3.2	2.8	3.7	3.0	2.9	3.0	2.9	2.8	3.0
S	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.2	0.2	0.3
RFV	119.5	104.1	134.9	133.5	119.4	147.5	82.4	82.0	82.9	84.3	81.5	87.0
RFQ	171.0	145.8	196.2	198.0	175.7	220.2	100.8	99.9	101.7	112.8	105.4	120.1
calc TDN	65.7	62.4	69.0	71.0	69.3	72.6	53.1	52.9	53.3	56.7	54.8	58.6
calc NEm	0.67	0.62	0.71	0.74	0.72	0.76	0.48	0.48	0.48	0.53	0.50	0.56
calc Neg	0.40	0.36	0.44	0.47	0.45	0.49	0.23	0.23	0.23	0.28	0.25	0.31

Day = 35 GDD = 466 Growth in Picture = 28-30"

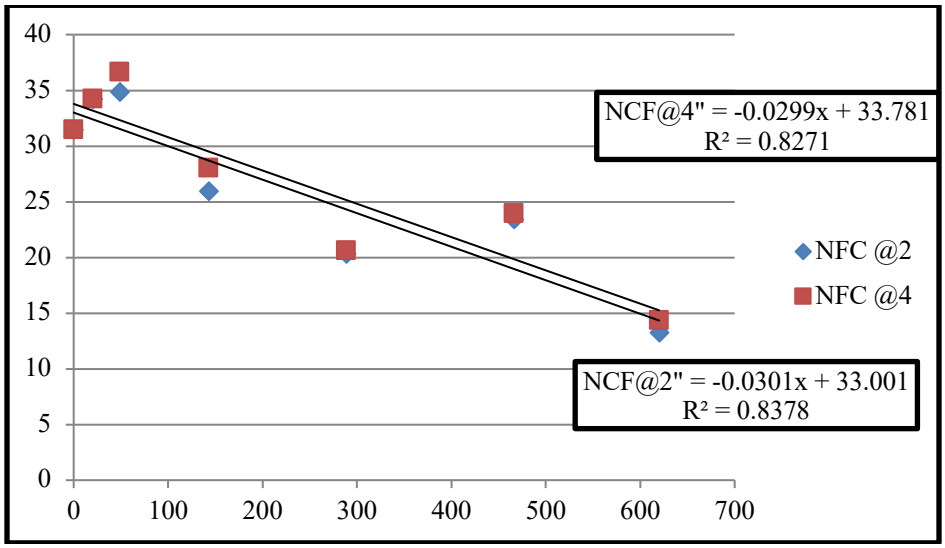


Day = 42 GDD = 620 Growth in Picture = 48"

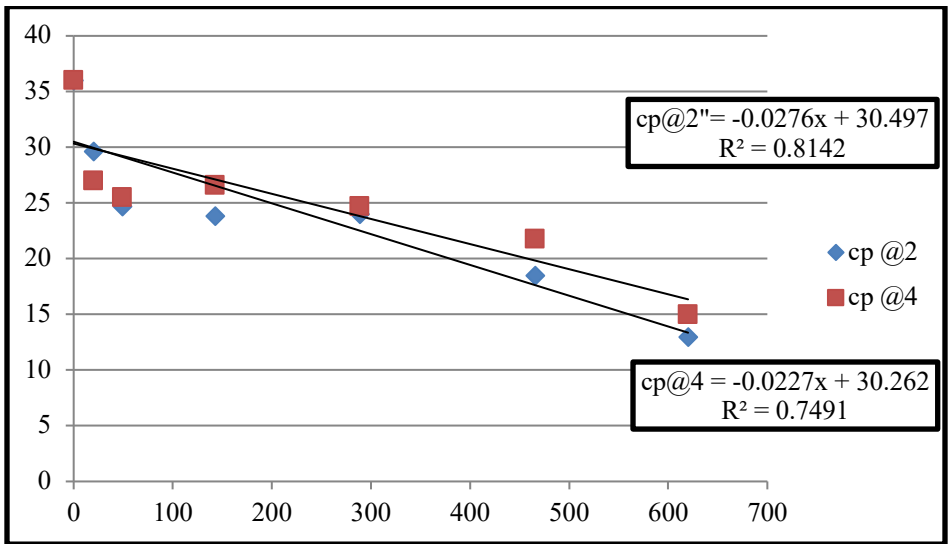
Percent Ash of Winter Cereal Rye Forage (Y) per Growing Degree Day (X)



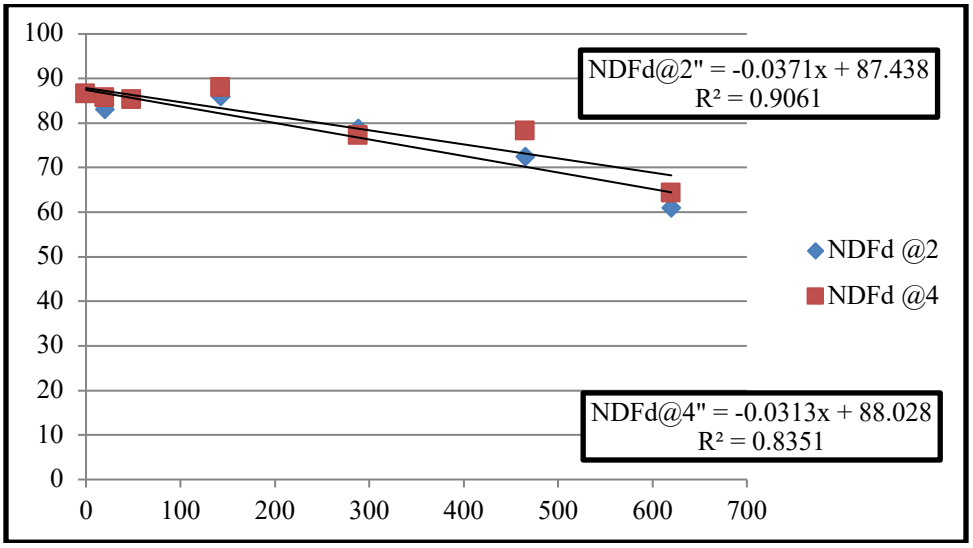
Nonfiber Carbohydrate Percent of Winter Cereal Rye Forage (Y) per Growing Degree Day (X)



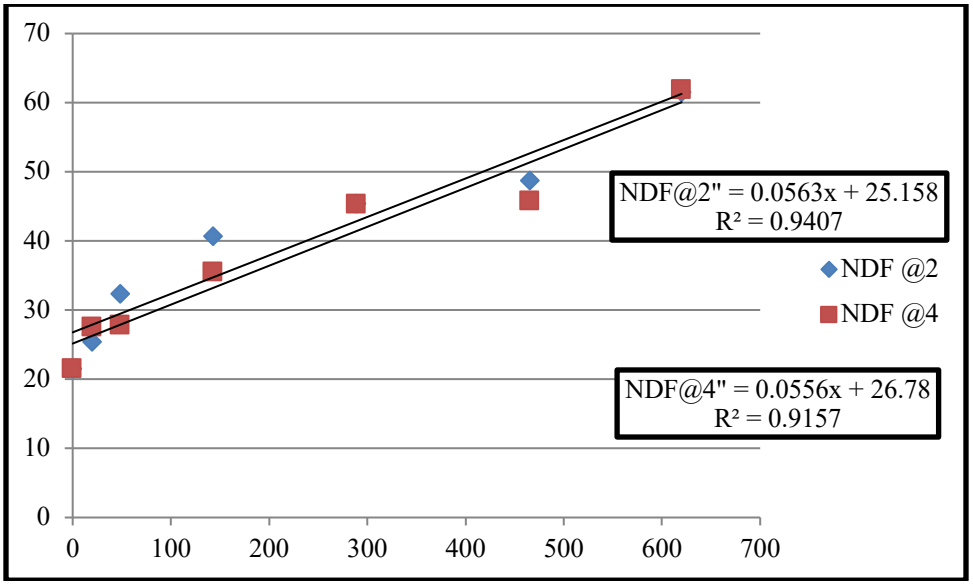
Crude Protein Percent of Winter Cereal Rye Forage (Y) per Growing Degree Day (X)



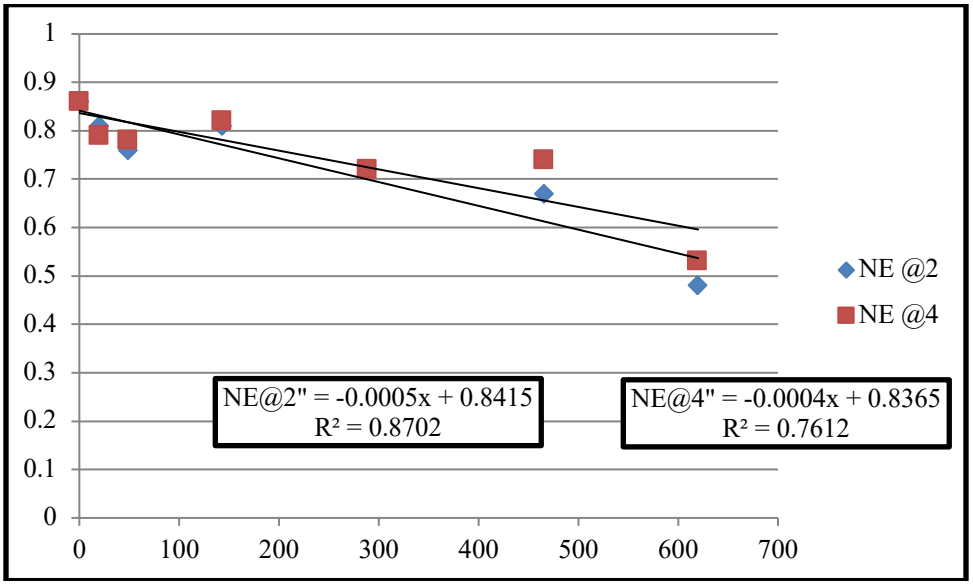
Percent Neutral Detergent Fiber Digestibility of Winter Cereal Rye Forage (Y) per Growing Degree Day (X)



Neutral Detergent Fiber Percent of Winter Cereal Rye Forage (Y) per Growing Degree Day (X)



Probable Net Energy (Mcal/lb DM) Content of Winter Cereal Rye Forage (Y) per Growing Degree Day (X)



Relative Forage Quality (RFQ) & Relative Feed Value (RFV) of Winter Cereal Rye Forage (Y) per Growing Degree Day (X)