

SUPPLEMENTAL

Website Resources:

Weather

https://www.dnr.state.mn.us/climate/historical/select_data.html?sid=217107&sname=ROSEMOUNT%20RESEARCH%20AND%20OUTREACH%20CENTER&sdate=por&date=por&temperature=true

Table S1 Mean comparison of agronomic yields.

Site	Treatment	Grain kg ha ⁻¹			Straw unitless			Straw RFV		
		Fertilizer	2020	2021	2022	2020	2021	2022	2020	2021
MN	commercial	726 ±74.5	883±85.3a	140±14.9a	4081±494	5605±369a	4702±323a	81.2±1.84	74.1±1.08ab	58.5±1.34 b
	control	727 ±74.5	461±85.3b	41±14.9b	4315±494	3843±369b	2500±323b	78.3±1.84	72.0±1.08b	53.6±1.34 c
	manure	851 ±74.5	692±85.3a b	119±14.9a	5338±494	4744±369ab	4043±323a	77.5±1.84	76.4±1.08a	64.4±1.34 a
KS	control	627±102	135±34.9b	104±13.2b	4626±911	2865±354b	1800±57	73.8±5.38	77.1±1.74	NA
	manure	681±102	260±34.9a	226±13.2a	4981±911	4039±354a	1758±57	75.2±5.38	79.9±1.74	NA
MN	Defoliation									
	none	NA	617±69.7	95±13.0	NA	4524±305	3824±264	NA	76.7±0.97a	71.3±1.09
	fall	NA	740±69.7	106±13.0	NA	4938±305	3673±264	NA	71.7±0.97b	69.9±1.09
KS	control	NA	NA	172±13.2	NA	NA	1685±57b	NA	NA	NA
	fall	NA	NA	158±13.2	NA	NA	1873±57a	NA	NA	NA

Presented are the means of control, manure, and commercial fertilizer treatments agronomic yields (kg ha⁻¹) at both Minnesota and Kansas sites (2020-2022). Means of defoliation treatments are also included (kg ha⁻¹). Treatment means sharing the same letter within each site × year combination are not statistically different at a threshold of P <0.05, based on mixed effects models analysis (see methods). Error bars represent 1 standard error from the mean.

Table S2 Mean comparison of forage RFV and protein

Site	Treatment	Mean Forage RFV and Protein			
		RFV		Protein	
		unitless		%	
	Fertilizer	2020	2021	2020	2021
MN	commercial	114±4.6	96±3.6b	9.47±0.9	6.67±0.7b
	control	117±4.6	99±3.6b	9.98±0.9	7.08±0.7b
	manure	120±4.6	113±3.6a	10.66±0.9	9.49±0.7a
KS	control	95±6.8	97±3.4b	9.50±0.8	8.60±0.5b
	manure	93±6.8	109±3.4a	10.30±0.8	11.20±0.5a

Presented are the means of control, manure, and commercial fertilizer treatments for forage RFV (unitless) and forage protein (%) at both Minnesota and Kansas sites (2020-2021). Treatment means sharing the same letter within each site × year combination are not statistically different at a threshold of $P < 0.05$, based on mixed effects models analysis (see methods). Error bars represent 1 standard error from the mean.

Table S3 Sampling dates for nitrogen (N) mineralization and extractable nitrogen (N)

	MN	Spring	Summer	Fall
2020	Initial	6/10/2020	7/21/2020	9/15/2020
	Final	7/8/2020	8/19/2020	10/16/2020
2021	Initial	5/24/2021	6/30/2021	8/18/2021
	Final	6/16/2021	8/4/2021	9/15/2021
KS				
2020	Initial	5/10/2020	7/6/2020	8/28/2020
	Final	6/10/2020	8/4/2020	9/28/2020
2021	Initial	5/13/2021	7/6/2021	9/27/2021
	Final	6/9/2021	8/3/2021	10/19/2021

Initial and Final dates when 23 cm samples were removed from all treatments for nitrogen (N) mineralization and extractable nitrogen testing (N) Table S4. Mean nitrogen mineralization ($\text{mg N kg}^{-1} \text{ soil day}^{-1}$) and Extractable Nitrogen ($\text{mg N kg}^{-1} \text{ soil}$) across spring, summer, and fall sampling.

Table S4 Mean nitrogen mineralization and extractable nitrogen.

Year		2020		
Treatment	MN		KS	
Fertilizer	N Min	Extr N	N Min	Extr N
control	-0.031	7.40	-0.027	8.90
manure	0.032	9.67	0.087	9.21
Season				
spring	0.078	8.36b	0.184ab	8.36
summer	-0.135	13.69c	0.379b	8.59
fall	0.059	3.56a	0.093a	10.21

Year		2021		
Treatment	MN		KS	
Fertilizer	N Min	Extr N	N Min	Extr N
control	0.182a	1.61a	0.062	3.73
manure	0.331b	2.06b	0.082	4.27
Season				
spring	0.378b	1.53a	0.028ab	6.40c
summer	0.142a	2.72b	0.184b	4.08b
fall	0.249ab	1.25a	0.004a	1.53a

Presented are the means of control, manure, and commercial fertilizer treatments for N mineralization ($\text{mg N kg}^{-1}\text{soil day}^{-1}$) and extractable N ($\text{mg N kg}^{-1}\text{soil}$) at both Minnesota and Kansas sites (2020-2021). Means were averaged across fertilizer treatments in 2020-2021. Treatment means sharing the same letter within each site \times year combination are not statistically different at a threshold of $P < 0.05$, based on mixed effects models analysis (see methods). Error bars represent 1 standard error from the mean.