



Northern New York Agricultural Development Program FACT SHEET

Why Study N, P, and K removal by BMR Sorghum Sudangrass?

Grown in a two-cut system with planting after June 1, brown midrib sorghum sudangrass allows for application of manure in times that the manure nutrients are less conducive to leaching and runoff.

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Nitrogen, Phosphorus, and Potassium Removal by Brown Midrib Sorghum Sudangrass

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Introduction: Determining Best Management Practices for a Crop of Growing Interest

In the past five years, Northeastern US dairy producers have shown a growing interest in brown midrib sorghum sudangrass as an environmentally sound alternative to corn. Grown in a two-cut system with planting taking place after June 1, brown midrib sorghum sudangrass allows for the application of manure in times that the manure nutrients are less conducive to leaching and runoff. These past years, research has been focused on determining the best management practices, including seeding rate, stand height management in a two-cut system, nitrogen and potassium management.

For the long-term sustainability of the dairy industry, manure application rates should not exceed crop removal for more years than needed to bring low fertility soils to optimum fertility. Thus, it is important to know nitrogen (N), phosphorus (P), and potassium (K) removal rates by this crop. Three N rate research trials in Northern New York contributed to the objectives to determine N, P, and K removal with harvest. N rate studies were also conducted in Eastern NY (1 trial) and Central NY (2 trials). This fact sheet shares the results of work in Northern New York (NNY). The results of all trials are printed in What's Cropping Up? Vol. 16 No. 1 published by Cornell University's Department of Crop and Soil Sciences.

Methods:

The three NNY trials had six treatments (0, 50, 100, 150, 200, 250 lbs N/acre per cut as ammonium sulfate). Cutting height was 3-3.5 inches and harvest was initiated

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when the plots that received 150 lbs N/acre per cut had reached 35-45 inches. At each site, two harvests were done with the exception of the site in Jefferson County where only one cut was feasible due to late planting. Table 1. shows brief descriptions of the NNY sites participating in this study.

We determined yield and took subsamples to determine moisture content and nutrient concentrations. All samples were analyzed for total N, P, and K. Optimum N rates ranged from less than 50 lbs N/acre per cut in the field with a recent sod history in Essex County to 120-140 lbs N/acre cut for the sites in Jefferson and St. Lawrence counties.

Results

Attention was focused on N, P, and K concentration in the forage and total nutrient removal with harvest. Table 2. shows the forage N, P, and K concentrations.

Forage N content increased with N application. The lowest N concentrations in plants grown without additional N were seen in Essex and Jefferson county trials. This may be

Table 1. Soil fertility of three Northern New York sites used for N rate studies for BMR sorghum sudangrass in 2004.

	Jefferson	St. Lawrence	Essex
	Rhinebeck silt loam	Soil Series Hailesboro silt loam	Cosad loamy fine sand
	Continuous corn	Cropping History Sorghum sudangrass	1st year after grass/alfalfa sod kill
Soil Fertility (Morgan extraction)			
pH (1:1)	6.1	6.4	6.5
OM (%)	4.3	4.1	3.4
P (lbs P/acre)	14 (H)	10 (H)	28 (H)
K (lbs K/acre)	116 (H)	106 (M)	48 (L)
Ca (lbs Ca/acre)	2416	2654	2500
Mg (lbs Mg/acre)	406 (VH)	446 (VH)	182 (VH)
Nitrate (ppm)	5.6	10.5	7.9
Salts (mmho)	0.14	0.14	0.16
Fertilizer Addition at Planting			
lbs P ₂ O ₅ /acre	38	45	20
lbs K ₂ O/acre	38	30	80

Table 2. Nitrogen, phosphorus and potassium concentrations as impacted by N fertilization rate in BMR sorghum sudangrass trials in Northern New York (2004 season). Shaded are ranges for optimum economic N rate.

N applied	Jefferson		St. Lawrence		Essex	
	1st	2nd	1st	2nd	1st	2nd
lbs N/acre per cut	Nitrogen (% N)					
0			1.63c	1.35d	0.98b	1.26b
38	0.91bc					
50	0.84c		1.97bc	1.53cd	1.42ab	1.16b
100	0.89bc		1.81bc	1.90bc	2.02ab	1.46ab
150	1.39b		2.32ab	2.29ab	2.05ab	1.57a
200	1.99a		2.70a	2.51a	2.24a	1.60a
250	2.23a		2.72a	2.64a	1.92ab	1.74a
	Phosphorus (% P)					
0			0.32a	0.43a	0.26a	0.41a
38	0.19a					
50	0.16ab		0.32a	0.37b	0.27a	0.30b
100	0.12b		0.29a	0.32c	0.22a	0.24b
150	0.14b		0.31a	0.30c	0.22a	0.23b
200	0.14b		0.29a	0.29c	0.23a	0.20b
250	0.14b		0.29a	0.29c	0.23a	0.24b
	Potassium (% K)					
0			2.73a	1.76a	2.12a	1.69a
38	2.33a					
50	2.21a		2.50a	1.66a	1.70ab	0.97b
100	2.07a		2.55a	1.56a	1.59ab	0.92b
150	1.98a		2.38a	1.54a	1.42ab	0.93b
200	1.80a		2.30a	1.63a	1.58ab	0.91b
250	2.19a		2.37a	1.62a	1.14b	0.81b

Note: Average values within columns with different letters (a,b,c) are statistically different (P <0.05).

related to the higher first cut yields for both trials (4.4 tons/acre at 35% dry matter in Jefferson County and 6.05 tons/acre in Essex County). Nitrogen removal at optimum N rates ranged from from about 39-70 lbs of N/acre in the one-cut system in Jefferson County to 117-169 lbs N/acre in the two-cut system in St. Lawrence County. (Table 3).

Phosphorus uptake at optimum N rates ranged from 12-15 lbs P₂O₅ in Jefferson County (one-cut system) to 40-65 lbs P₂O₅ in the two-cut systems in Essex County (Table 3). Although sites differed in P uptake per unit yield, P uptake was linearly related to dry matter yield at all locations.

The potassium content of 2nd cut forage was at all sites less than the 2.5% upper limit for feeding of forage to non-lactating cows (Table 2). First cuts were too high in K for

Table 3. Nitrogen, phosphorus, and potassium removal with harvest as impacted by N fertilization rate in BMR sorghum sudangrass trials in NNY (2004 season). Shaded are ranges for optimum economic N rate.

Nutrient Removal w/Harvest (1st & 2nd cut combined - one cut only for Jefferson County)			
N applied	Jefferson	St. Lawrence	Essex
per cut lbs N/acre		Nitrogen (lbs N/acre)	
0		50c	63b
38	27c		
50	30bc	91b	125ab
100	39bc	117b	166a
150	70ab	169a	173a
200	105a	177a	183a
250	95a	201a	165a
		Phosphorus (lbs P₂O₅/acre)	
0		26.8c	41.4a
38	13.3a		
50	13.1a	41.0b	64.0a
100	12.3a	44.2ab	51.0a
150	15.4a	51.2a	47.9a
200	17.0a	46.0ab	47.5a
250	14.2a	49.4ab	49.3a
		Potassium (lbs K₂O/acre)	
0		99.6c	152.9a
38	87.9a		
50	106.1a	138.7bc	169.6a
100	117.4a	165.9ab	159.6a
150	127.5a	184.6a	145.4a
200	122.1a	173.9ab	151.2a
250	125.2	192.2a	113.9a

Note: Average values within columns with different letters (a,b,c) are statistically different (P <0.05).

non-lactating cows at all sites with the exception of the Essex County site. This was also the only site where K uptake was not linearly related to overall dry matter yield. This was due to low K concentrations in the 2nd cut and may be because this site tested low in K at the onset of the trial and K was applied at planting only.

Conclusions:

Nutrient removal was linearly related to dry matter yields and not impacted by N application rate as long as a minimal amount of N was added (50 lbs/acre per cut or greater). However, results were very site-specific indicating that for accurate crop removal estimates, dry matter yields need to be determined and forage analyses need to be done.

N, P, and K Removal by BMR S/S Research Project Sponsors

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Participating Farms

Essex County: Cornell E.V. Baker Research Farm at Willsboro; Jefferson County: Robinson Farms, LaFargeville; St. Lawrence County: Cornell Cooperative Extension Learning Farm, Canton.

Participating Educators and Research Institute Representatives:

See Principal Investigators above.

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For more information on the N, P, and K Removal by BMR S/S project, contact:

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The Northern New York Agricultural Development Program selects and prioritizes research the results of which can be practically applied to farms in the six-county region of Northern NY: Jefferson, Lewis, St. Lawrence, Franklin, Clinton and Essex Counties.

To learn more about the Northern New York Agricultural Development Program, contact Co-Chairs Jon Greenwood, 315-386-3231, or Joe Giroux, 518-563-7523; or R. David Smith, Cornell University, 607-255-7286; or visit www.nnyagdev.org. ♦



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