What's Cropping Up?

A NEWSLETTER FOR NEW YORK FIELD CROPS & SOILS VOLUME 13, NUMBER 4, JULY-AUGUST, 2003

CORN SILAGE HARVEST

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Corn hybrids differ in grain and stover content, which contributes to silage quality differences among hybrids. Corn hybrids also differ in stover fiber digestibility, which further contributes to silage quality differences. Corn hybrids may respond differently to both timing and cutting height at harvest, which affects both stover content and stover fiber digestibility, because of their differences in stover content and digestibility. We evaluated the silage yield and quality of 34B23 (dual-purpose hybrid), TMF108 (leafy), and F757 (brown-midrib) at early, medium, and late harvest dates (~ 72, 65, and 59% moisture, respectively) and three cutting heights (6, 12, and 18 in) in 2001 and 2002 to determine if different hybrid types had an optimum harvest time and cutting height. 34B23 and TMF108 responded similarly to harvest timing and cutting height so we have averaged their result and compared them with F757.

Average stover neutral detergent fiber (NDF) of 34B23 and TMF108 increased about 1.5 percentage units as harvest was delayed from the early to late harvest date, whereas stover NDF of F757, the brown midrib (BMR) hybrid, increased more than 7 percentage units (Table 1). Whole plant NDF, however, decreased about 3 percentage units as harvest was delayed from the early, to the medium, to the late harvest date for all hybrids, mainly because grain content increased at each successive harvest date in the dry 2001 and 2002 growing seasons. Cutting height had mostly significant but inconsequential effects on stover and whole plant NDF with about a 1.0 percentage unit change in all hybrids as cutting height increased from 6 to 18 in.

Stover NDF digestibility of the three hybrids did not change between the early and medium harvest date but decreased about 2.5 percentage units in 34B23 and TMF108 and 6 percentage units in F757 between the medium and late harvest date (Table 2). Stover NDF digestibility strongly influences whole plant silage quality so the 6 percentage unit decrease in F757 raises concerns about delaying the harvest of BMR hybrids. Average stover NDF digestibility of 34B23 and TMF108 consistently increased 2 percentage units with each successive increase in cutting height. Stover NDF digestibility of F757, however, increased 2.7 percentage units as cutting height increased from 6 to 12 in but remained the same as cutting height increased from 12 to 18 in. Stover and whole plant NDF digestibility are closely correlated so whole plant and stover NDF digestibility showed similar responses to timing of harvest and cutting height at harvest.

Table 1. Average stover and whole plant neutral detergent fiber (NDF) of 34B23 and TMF108 compared with F757 at early (E), medium (M), and late (L) harvest dates and at three cutting heights, averaged across the 2001 and 2002 growing seasons, at the Aurora Research Farm.

	NDF							
	34B23 and TMF108				F757			
Height	E	M	L	AVG	E	M	L	AVG
in.	%							
Stover								
6	59.8	60.6	63.1	61.1	52.1	52.6	59.9	54.9
12	59.4	60.9	63.3	61.1	51.8	50.7	57.3	53.3
18	60.0	62.4	62.1	61.5	54.4	52.6	60.8	55.9
Avg	59.7	61.3	62.8	61.2	52.8	52.0	59.3	54.7
LDS 0.05		1.0		NS		2.1		0.9
Whole Plant								
6	44.8	42.3	38.9	42.0	43.6	41.9	39.1	41.5
12	44.4	41.2	38.4	41.3	44.0	42.4	37.9	41.4
18	44.1	40.6	38.3	41.0	45.0	39.5	37.6	40.7
Avg	44.4	41.3	38.5	41.4	44.2	41.3	38.2	41.2
LDS 0.05		0.8		0.7		1.3		0.8

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Table 2. Average stover and whole plant neutral detergent fiber (NDF) digestibility of 34B23 and TMF108 compared with F757 at early (E), medium (M), and late (L) harvest dates and at three cutting heights, averaged across the 2001 and 2002 growing seasons, at the Aurora Research Farm.

NDF DIGESTIBILITY								
	34B23 and TMF108				F757			
Height	E	M	L	AVG	E	M	L	AVG
in.	%							
				Stover				
6	61.7	62.6	60.3	61.6	76.2	78.6	69.1	74.6
12	65.3	64.1	61.5	63.6	77.5	79.4	75.0	77.3
18	67.0	66.0	63.9	65.6	80.9	77.9	73.3	77.4
Avg	64.7	64.2	61.9	63.6	78.2	78.6	72.5	76.4
LDS 0.05		1.5		1.5		2.3		2.1
				Whole Plant				
6	62.6	61.3	58.2	60.7	78.8	75.5	68.4	74.2
12	65.5	61.9	59.9	62.4	78.1	78.2	70.6	75.6
18	66.2	64.7	63.9	64.9	78.8	77.9	70.7	75.8
Avg	64.8	62.6	60.7	62.7	78.6	77.2	69.9	75.2
LDS 0.05		1.9		1.8		2.5		NS

Grain and starch contents of the three hybrids increased at each successive harvest date (Table 3). Grain and starch contents of silage usually don't differ between 65 and 59% whole plant moistures but the dry August conditions of both growing seasons resulted in premature senescence of the stover. Consequently, whole plant drydown proceeded at a more rapid rate than grain development resulting in significant increases in grain and starch contents between the medium and late harvest date. Cutting height had mostly significant but only slight effects on grain and starch contents.

Average in vitro true digestibility (IVTD) of 34B23 and TMF108 did not change across harvest dates (Table 3), despite the 4 percentage unit decrease in whole plant NDF digestibility (Table 2). Evidently, the significant increase in grain content offset the decrease in NDF digestibility resulting in similar whole plant IVTD concentrations across harvest dates. F757, however, had a 2 percentage unit decrease in whole plant IVTD between the medium and late harvest date. Evidently, the increase in grain content did not offset the more than 7 percentage unit decrease in whole plant NDF digestibility of F757 between the medium and late harvest date. Whole plant IVTD of 34B23 and TMF108 showed a consistent 1 percentage unit increase at each successive increase in cutting height, whereas whole plant IVTD of F757 did not respond to cutting height.

Average milk ton^{-1}, a silage quality index, of 34B23 and TMF108 decreased at each successive harvest date (Table 4). Milk ton^{-1} of F757 did not change between the early and medium harvest date but decreased between the me-

Table 3. Average grain content, and whole plant starch and in vitro true digestibility (IVTD) of 34B23 and TMF108 compared with F757 at early (E), medium (M), and late (L) harvest dates and at three cutting heights, averaged across the 2001 and 2002 growing seasons, at the Aurora Research Farm.

	34B23 and TMF108				F757			
Height	E	M	L	AVG	E	M	L	AVG
in.	%							
				Grain				
6	25.9	32.2	40.3	32.8	23.1	28.3	38.7	30.0
12	28.9	34.5	41.8	35.1	24.6	30.4	39.5	31.5
18	29.0	38.1	41.9	36.3	25.0	34.5	40.5	33.3
Avg	27.9	34.9	41.3	34.7	24.2	31.1	39.6	31.6
LDS 0.05		2.3		1.8		2.9		2.2
				Starch				
6	14.7	16.3	21.1	17.4	11.2	13.5	19.6	14.8
12	14.4	16.8	22.2	17.8	9.2	12.5	19.7	13.8
18	15.5	18.5	21.8	18.6	9.9	15.6	21.2	15.6
Avg	14.9	17.2	21.7	17.9	10.1	13.9	20.2	14.7
LDS 0.05		1.7		1.2		2.3		NS
				IVTD				
6	83.3	83.7	84.1	83.7	90.7	89.7	87.6	89.3
12	84.7	84.4	84.6	84.6	90.4	90.8	88.9	90.0
18	85.1	85.7	86.2	85.7	90.5	91.4	88.9	90.2
Avg	84.4	84.6	85.0	84.7	90.5	90.6	88.5	89.9
LDS 0.05		NS		0.8		1.8		NS

dium and late harvest date. Average milk ton^{-1} of 34B23 and TMF108 increased between the 6 and 18 in cutting height because of increases in stover NDF digestibility and grain content. Milk ton^{-1} of F757, however, did not respond to cutting height probably because of the minimal response of whole plant NDF digestibility to cutting height. An increase in cutting height apparently improves silage quality of dual-purpose and leafy hybrids but does little to improve silage quality of BMR hybrids.

Silage yields of all three hybrids increased between the early and late harvest dates (Table 4). Silage yields typically are maximized at around 65% moisture but silage yields continued to increase until 59% because of the premature senescence of the stover in both years. An increase in cutting height from 6 to 18 in decreased silage yields about 10% in 34B23 and TMF108 and 15% in F757. Obviously, any improvement in silage quality with an increase in cutting height will come at the expense of yield.

Timing of harvest did not affect calculated milk yields (Table 4) because the decrease in silage quality was offset by an increase in silage yield as harvest was delayed. Evidently, in dry years, there is a broad harvest window (72 to 59% moisture) to optimize calculated milk yields. An increase in cutting height from 6 to 18 in decreased average calculated milk yields of 34B23 and TMF108 about 3.5%. In contrast, calculated milk yields of F757 decreased 13% as cutting height increased from 6 to 18 in. An increase in cutting is obviously not a sound management strategy for BMR hybrids.

Conclusion

The results from this study indicate that dairy producers should manage BMR hybrids differently than leafy and dual-purpose hybrids at harvest. For example, dairy producers may wish to delay harvest of leafy and dual-purpose hybrids in dry years to about 60% moisture content to maximize silage yields, which are below-average, at the expense of silage quality, which is typically above-average in dry years. The sharp decline in stover digestibility of the BMR hybrid, however, between 65 and 59% moisture content raises concerns about delaying the harvest of BMR hybrids. Also, dairy producers may wish to increase cutting height for hybrids that have average stover digestibility, such as 34B23 and TMF108, in high-yielding years to improve silage quality at the expense of above-average silage yields. An increase in cutting height of BMR hybrids, however, is not a good management practice because the additional removal of highly digestible stover does little to improve silage quality and results in a further reduction in the inherently low silage yields.

Table 4. Average milk ton^{-1}, silage yield, and calculated milk yield of 34B23 and TMF108 compared with F757 at early (E), medium (M), and late (L) harvest dates and at three cutting heights, averaged across the 2001 and 2002 growing seasons, at the Aurora Research Farm.

	34B23 and TMF108				F757			
Height	E	M	L	AVG	E	M	L	AVG
in.	--%							
	Milk Ton^{-1} (lbs ton^{-1})							
6	2904	2803	2533	2747	3222	3180	3074	3158
12	2982	2787	2716	2828	3099	3232	3097	3143
18	3074	2939	2868	2960	3216	3279	3157	3217
Avg	2987	2843	2706	2845	3179	3230	3109	3173
LDS 0.05		108		100		119		NS
	Silage Yield (65% H_20)							
6	18.9	18.6	19.8	19.1	16.7	17.3	17.6	17.2
12	17.5	18.4	18.7	18.2	15.4	15.5	16.8	15.9
18	16.9	17.5	17.6	17.3	13.8	14.9	15.0	14.6
Avg	17.8	18.2	18.7	18.2	15.3	15.9	16.5	15.9
LDS 0.05		0.6		0.5		1.1		0.8
	Calculated Milk Yield (lbs acre^{-1})							
6	19460	18330	18260	18683	18655	19457	19155	19089
12	18241	17812	18306	18120	16918	17663	18379	17653
18	18315	17821	17982	18039	15792	17393	16489	16558
Avg	18672	17988	18183	18280	17121	18008	18171	17767
LDS 0.05		NS		630		NS		717

Crop Management

Cutting Management for Brown Mid Rib Sorghum Sudangrass

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Introduction

There is a growing interest in Brown Mid Rib (BMR) sorghum sudangrass as an environmentally-sound alternative to corn silage in the Northeast. Its ability to compete with corn is totally dependent on how well we can manage the crop for yield and quality. During the past three years field studies were conducted to determine optimum timing of first and second cutting for yield and quality in 2-cut systems in different climatic and soil regions of New York State. In this article we present and discuss the results of these trials.

Materials and Methods

Four studies (two in 2000, and one each in 2001 and 2002) were conducted on excessively drained outwash gravel in a low elevation and warmer location in Columbia County (Eastern NY). Another three trials (one in 2001 and two in 2002) were conducted on glacial outwash at high elevation in Delaware County (Southeastern NY) while one trial (2002) was conducted on lake-deposited silt in St. Lawrence County (Northern NY). Most of the 2000 and 2001 trials focused on determining optimum harvest time for first cut, while the 2002 trials were managed as 2-cut systems. In St Lawrence County a rain-delayed July planting and drought in August and September limited harvest to one cut only. For all trials, harvests took place at 1-2 week intervals during active growth periods in July and August/September. Actual stand heights at harvest varied from 24 to 71 inches for the first cutting and 29 to 63 inches for the second cutting. Plant height, yield and dry matter content were taken at each harvest. All samples were analyzed for mineral content and quality parameters at the forage laboratory of Dairy One Cooperative Inc. in Ithaca, NY. The alfalfa-grass spreadsheet of Milk2000 version 7.4, was used to estimate milk yields using standard values for neutral detergent insoluble crude protein (NDICP; 2.4% on a dry matter basis) and ether extract (3.6% on a dry matter basis) as reported for sorghum sudangrass silage in the 2001 Nutrient Requirements for Dairy Cattle (National Research Council, 2001). The 30 hour dNDF was multiplied by 1.16 to obtain an estimate of the dNDF at 48 hours (J.H. Cherney, unpublished, 2003).

Results and Discussion

Growth rates and yield

Growth rates during harvest windows ranged from an average of less than 0.5 inch per day (all sites during mid-August and September of 2002) to 2 inches per day under moist and warm conditions in Columbia in July of 2000 and Delaware County in July of 2002. Growth rates were close to zero during the extended drought periods in early August in 2002 in all three counties indicating that BMR sorghum sudangrass is not insensitive to extreme drought. Unlike corn, however, sorghum sudangrass yield potential is not permanently damaged by severe drought and growth will continue relatively normally after drought. On average across all sites and years, yields increased by 0.16 tons/acre per inch (35% dry matter) for first cut (July period) to 0.20 tons/acre per inch for the second cut (mid-August through September).

Quality parameters

Because stand height measurements were difficult to standardize and because yield and stand height were positively correlated in each trial, we compared yield rather than stand height with quality parameters across sites and years.

The average fiber content (%NDF) was greatest at a yield of 6.3 tons (35% dry matter) per acre (Figure 1). This equals a harvest stand height of about 40 inches. The average fiber content decreased from 59% to below 58% with stand heights of 50 inches or greater. Sorghum sudangrass behaves more like corn than other grasses and legumes, with a relatively narrow range in optimum yield, but a relatively wide range for optimum quality. Most grasses and legumes have a distinct forage quality decline coinciding with increased yield. The 48 hr digestibility of NDF (Figure 2), lignin, starch, sugar content (data not shown) and crude protein (Figure 3) decreased with yield, especially after booth stage had been reached. The fiber digestibility fell below 65% at a yield of 8 tons/acre and an average stand height of 50 inches. Dry matter yield and predicted milk yield per acre were highly correlated despite a decrease in quality with increase in yield (Figure 4). These results were similar to those reported by Cerosaletti and others in the 2001 growing season and suggest that at stand heights of 50 inches or shorter, yield drives milk production whereas at greater stand heights, quality declines become significant.

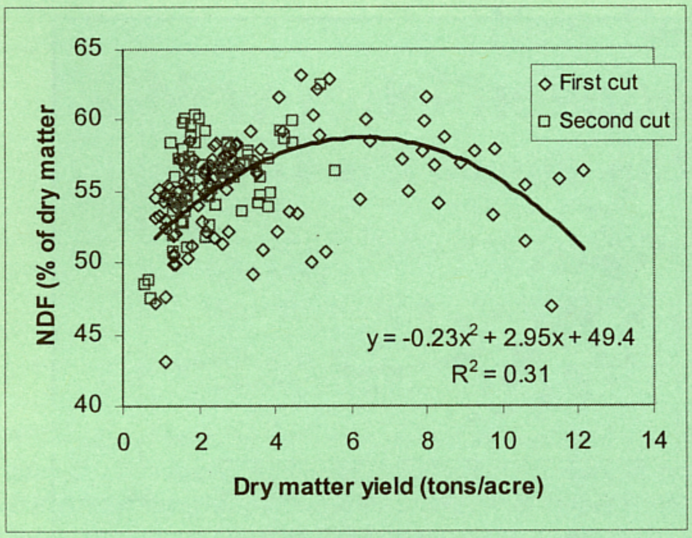

Figure 1: Neutral detergent fiber concentration at harvest as affected by dry matter yield. A dry matter yield of 8 tons/acre corresponds with a stand height of about 50 inches.

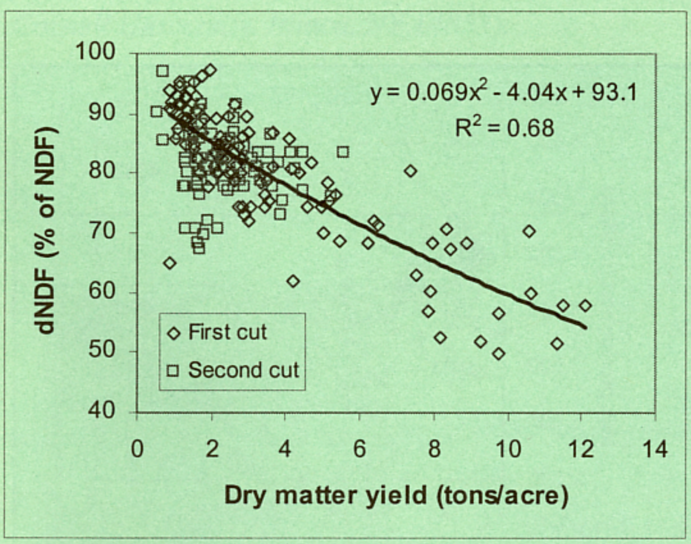

Figure 2: Digestibility of neutral detergent fiber and yield were negatively correlated.

The modest decline in milk production with increased harvest height enlarges the harvest window. However, there are two reasons why a maximum stand height of 50 inches may be preferred. First of all, the shift from vegetative to reproductive growth lowers quality. Secondly, the amount of water that needs to be evaporated increases with yield. The average moisture content at harvest across all studies was 84% (ranges from 78 to 92% moisture). This means that to dry 12 tons of BMR sorghum sudangrass at 84% moisture to 65% moisture, about 6.5 tons of water will need to be evaporated.

Conclusions

Since dry matter yield was highly correlated with milk yield per acre, we conclude that BMR sorghum sudangrass has a relatively large harvest window in which to achieve quality forage able to compete with corn silage. However, to prevent the shift from vegetative to reproductive growth and better manage the amount of water at harvest, BMR sorghum sudangrass should be harvested when stand heights are 50 inches or less. There was a trend toward decreasing crude protein with increasing height. Trials conducted at the Mt Pleasant Research Farm in Tompkins and Columbia Counties (see What's Cropping Up? 12(5) pages 6-9 and 13(2) pages 1-3) showed that nitrogen fertilizer application greatly impacted the crude protein concentration in the forage. Additional trials are being conducted this 2003 growing season to determine optimum nitrogen recommendations but preliminary results show that a decline in crude protein concentration with yield can be avoided with appropriate N fertilizer and manure management.

References

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2. Ketterings, Q.M., T.W. Katsvairo, J.H. Cherney, and T.F. Kilcer (2003). Nitrogen management for brown mid rib sorghum sudangrass: results of the 2002 Mt Pleasant trial. "What's Cropping Up?" 13(2): 1-3.

3. Kilcer, T., Q.M. Ketterings, T.W. Katsvairo and J.H. Cherney (2002). Nitrogen management for sorghum sudangrass: how to optimize N uptake efficiency? "What's Cropping Up?" 12(5): 6-9.

4. National Research Council (2001). Nutrient requirements of dairy cattle. 7th edition. National Research Council. National Academy Press, Washington, D.C. 408 pages.

Acknowledgments and for Further Information

This research was funded by a research grant from Townsend and Garrison Inc. For further information on BMR sorghum sudangrass projects in New York contact Thomas Kilcer at the Rensselaer Cooperative Extension Office (tfk1@cornell.edu or 518-272-4210) or visit our website (http://nmsp.css.cornell.edu/projects/bmr.asp).

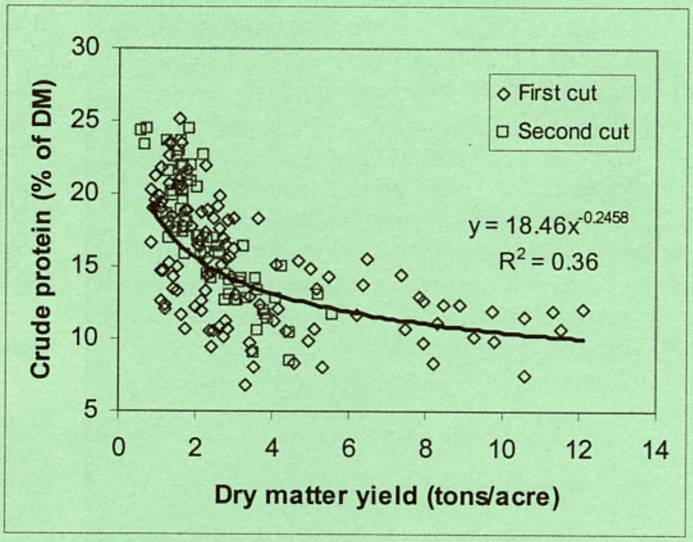

Figure 3: Crude protein decreased with increase in yield at the time of harvest.

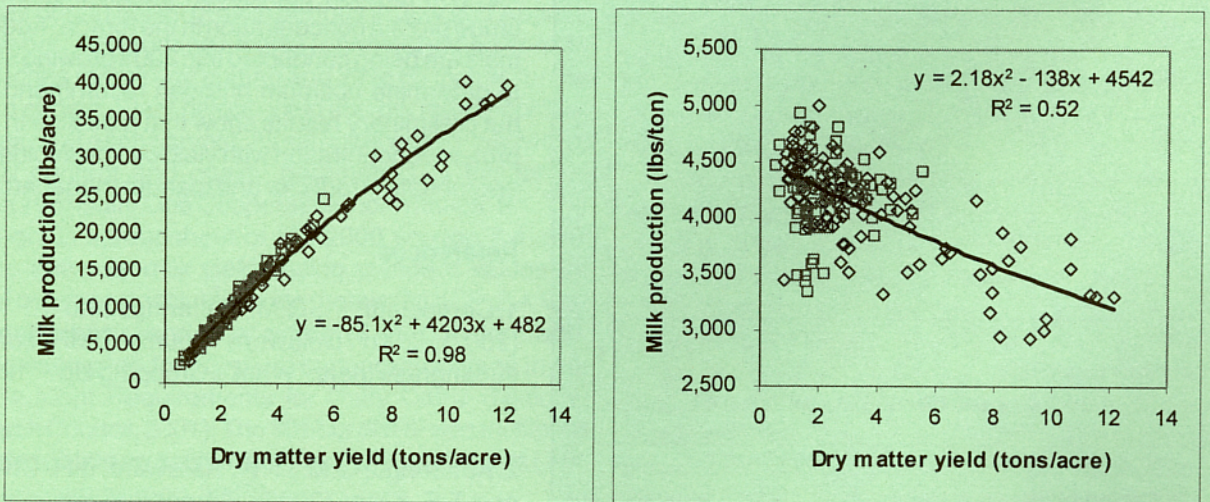

Figure 4: For all sites and years, the dry matter yield and predicted milk yield per acre were highly correlated whereas yield and quality were poorly correlated.

New Release:
New York Phosphorus Runoff Index
User's Manual and Documentation

Crop and Soil Sciences Extension Bulletin E03-13

Karl Czymmek, Quirine Ketterings, Larry Geohring and Greg Albrecht

This manual describes the various factors important to P fate and transport, provides some documentation as to the selection and weighting of the different source and transport factors, and aids the user in calculating the NY P Index for farm fields through the use of either the NY P Index spreadsheet or Cornell Cropware. The methodology for arriving at a qualitative risk-level score is presented in detail along with some case scenarios, discussion, and interpretations of how the NY P Index can be used to identify and reduce P losses to the environment. The 64 page manual is downloadable from the Phosphorus Index website:

http://nmsp.css.cornell.edu/publications/pindex.asp

For bound and color hardcopies ($15 per copy) contact Pam Kline by e-mail (pak1@cornell.edu), phone (607-255-2177) or regular mail (234 Emerson Hall, Department of Crop and Soil Sciences, Cornell University, Ithaca, NY 14853).

NMSP

Nutrient Management Spear Program

http://www.css.cornell.edu/nmsp/

A collaboration among the Department of Crop and Soil Sciences, Pro-Dairy, and Cornell Cooperative Extension.

Calendar of Events

August 1	Aurora Farm Field Day, Musgrave Research Farm, Aurora, NY
October 21	Field Crop Dealer Meeting, Comfort Suites, Clifton Park, NY
October 22	Field Crop Dealer Meeting, Ramada Inn, New Hartford, NY
October 23	Field Crop Dealer Meeting, Batavia Party House, Batavia, NY
October 24	Field Crop Dealer Meeting, Holiday Inn, Waterloo, NY
November 2-6	American Society of Agronomy Annual Meeting, Denver, CO
December 2-4	Certified Crop Advisor Training, Holiday Inn, Waterloo, NY

What's Cropping Up? is a bimonthly newsletter distributed by the Crop and Soil Sciences Department at Cornell University. The purpose of the newsletter is to provide timely information on field crop production and environmental issues as it relates to New York agriculture. Articles are regularly contributed by the following Departments at Cornell University: Crop and Soil Sciences, Plant Breeding, Plant Pathology, and Entomology. **To get on the mailing list, send your name and address to Pam Kline, 234 Emerson Hall, Cornell University, Ithaca, NY 14853.**

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