

What Crop Traits are Genetically Engineered (or GMO)?

Joe Lawrence, Dairy Forage Systems Specialist, PRO-DAIRY

There continues to be a great deal of discussion on potential markets for “GMO Free” crops and products, such as milk, from animals fed these crops.

GMO is the commonly used term for a genetically modified organism and is really being misused in this context. In reality many things in agriculture are genetically modified compared to its ancestors. Humans have used selection criteria to propagate crops that better fit their needs for thousands of years. In the last century this has been accelerated by what are now commonly referred to as conventional plant breeding techniques.

When we hear terms such as GMO free corn or GMO free milk, the groups looking for these products are actually referring to genetically engineered (GE) crops. The definition of genetic engineering is “the deliberate modification of the characteristics of an organism by manipulating its genetic material”. The primary examples of this in row crops are herbicide tolerant crops and crops with traits that protect them from certain insect pest, notably the *Bacillus thuringiensis* (Bt) trait.

As producers are asked to consider shifting production to “GMO Free” and identifying the potential price incentives attached to that shift, there are a number of questions surrounding what it means to be “GMO Free”.

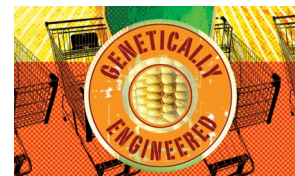
Here we will address a few areas of those questions:

- What traits are derived from genetic engineering

Table 1 provides a list of crop traits and identifies which traits are derived from genetic engineering and those derived from natural breeding.

- How do conventional varieties/hybrids compare in yield and production cost?

It is difficult to find clear data on this question. The yield potential of conventional varieties and hybrids is on par with their genetically engineered counterparts; however, the cost, management considerations and potential risk for problems during the growing season can vary widely and produce scenarios that can favor either conventional or GE crops.



- What is GMO contamination?

GMO contamination refers to the fact that there is cross pollination of crops and in some cases a GE plant will pollinate a conventional plant. This contamination can be found in seed used for planting as seed production is often concentrated to certain regions and it is likely that conventional AND GE seeds are produced in these areas.

In the case of “GMO free” milk, guidelines are being developed referring to the total amount of contamination in the total ration fed to the dairy herd. In this case, the producer needs to account for potential contamination from all feed ingredients from homegrown forages to purchased grains and other additives.

As such, the producer assumes a great deal of risk in assuring the final product remains under defined thresholds for contamination. When purchasing seed for planting or feed ingredients, it will be important to verify with the supplier if they have tested their products and measured the level of contamination in the seed.

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Janice Degni
Team Leader &
Field Crops Specialist
607.391.2672
jgd3@cornell.edu

Betsy Hicks
Area Dairy Specialist
607.391.2673
bjh246@cornell.edu

Jen Atkinson
Administrative Asst. II
607.391.2662
jma358@cornell.edu

Fay Benson
Small Dairy Ext. Educator
607.391.2669
afb3@cornell.edu

Abbie Teeter
Organic Dairy Assistant
607.391.2670
ajt248@cornell.edu

Melanie Palmer
Ag Educator
315.424.9485 Ext. 228
mjp232@cornell.edu

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Early-Planted Corn & Cold Weather

R.L. (Bob) Nielsen, Agronomy Department, Purdue University

Newly Planted Corn

One of the risks that newly planted corn faces is that of **imbibitional chilling injury** due to cold soil temperatures during the initial 24 to 36 hours after seeding when the kernels imbibe water and begin the germination process. In response to the imbibition of water, kernels naturally swell or expand. If the cell tissues of the kernel are too cold, they become less elastic and may rupture during the swelling process. Symptoms of imbibitional chilling injury include swollen kernels that fail to germinate or arrested growth of the radicle root and/or coleoptile following the start of germination. Instances of chilling injury following germination during the emergence process can also occur, often causing stunting or death of the seminal root system, deformed elongation of the mesocotyl (the so-called "[corkscrew](#)" symptom) and either delayed emergence or complete failure of emergence (i.e., leafing out underground).

With the end of winter teasing us with spring like conditions and then snapping back to frigid conditions consider this article as a cautionary tale for those who might jump the gun and plant early before the weather settles down. Consider the forecasted temperature and weather as a guide to planting decisions during the unsettled spring weather.

– Janice

It is not clear how low soil temperatures need to be for imbibitional chilling or subsequent chilling injury to occur. Some sources simply implicate temperatures less than 50F (10C). Others suggest the threshold soil temperature is 41F (5C). Daily minimum soil temperatures at the 4-inch depth (typical depth for National Weather Service measurements)

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have certainly dropped into the mid- to high-40'sF in recent days, with some growers reporting temperatures as low as 40F at seed depth.

Newly Emerged Corn

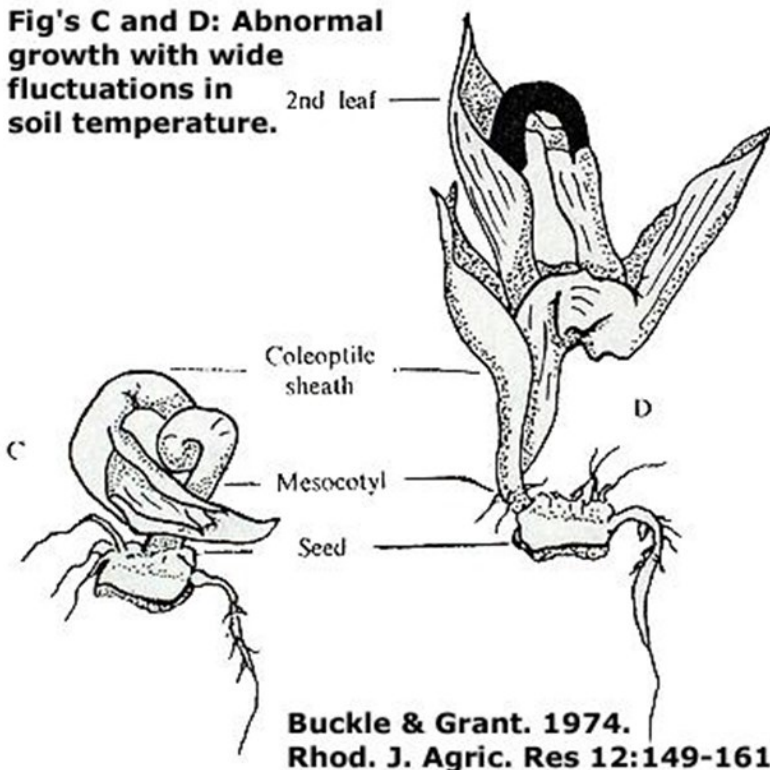
Damage from **exposure of above-ground plant tissue to frost** can range from minor leaf injury to complete death of all exposed leaf tissue. That's the bad news. The good news is that the all-important **growing point** region of a young corn plant remains below the soil surface, safe from exposure to frost, until the **V4 to V6 stages** of development. That means that the above-ground plant tissue you see in fields younger than about V4 is composed primarily of leaves and rolled up leaf tissue in the whorl, but does not include stalk tissue or the growing point. As long as temperatures are not lethally cold, "simple" frost injury usually does not literally kill such young corn plants. Damaged plants will begin to show recovery from the whorl within 5 to 7 days, depending on temperatures following the frost event.

Disclaimer: Repeated frost events that re-inflict damage to recovering corn plants can cause permanent stunting or death.

When folks worry about the effects of cold weather on corn, they often fail to distinguish between simple frost events and lethal cold temperatures. Frost can occur at temperatures easily up to the high 30's F, but **lethal cold temperatures** for corn are generally thought to be 28F (-2C) or colder. Air temperatures in recent days have certainly dropped to 28F or lower in areas of the state.



Fig's C and D: Abnormal growth with wide fluctuations in soil temperature.



Whether such cold temperatures "penetrated" the upper inch of soil near the growing point region of corn seedlings is not clear, but may be possible in fields where soils are excessively dry and free from surface residue.

Bottom Line

Recovery of damaged plants will usually be evident within 5 to 7 days following such events. We will only know for certain whether this year's early planting risk takers will have "won the game" or not at harvest. Ω

Conventional corn weed control revisited

Mike Hunter, Field Crops Specialist
CCE NNY Regional Ag Team

Over the winter there were a lot of growers asking me about conventional corn weed control options. Some growers are looking to capture potential non-GMO corn premiums, dairy producers are intrigued by the possible GMO free milk markets, others are looking to save money on seed costs and some feel that they need to become more proactive with their herbicide resistance management strategies on the farm.

Regardless of a growers' reason to plant conventional corn, preemergence weed control programs are almost a necessity for a conventional weed control program. It is extremely difficult to rely on a total postemergence conventional weed control program. There is a high risk of yield loss if the postemergence application is delayed. Application delays due to weather conditions can lead to tall weeds that are difficult or too big to control.

The goal is to select a solid, one pass preemergence corn herbicide program. It is especially important to use a very good soil residual grass herbicide because it is difficult (and costly) to control certain emerged annual grasses with conventional postemergence herbicides. In conventional corn, a postemergence annual grass rescue treatment will cost around \$24 per acre. These are reasons why so many of the preemergence herbicide programs contain acetamide (s-metolachlor, metolachlor, acetochlor, dimethenamid-P) products or premixes containing one of these active ingredients.

Here are a number of suggested conventional preemergence corn herbicide programs to consider. These suggestions are based on the assumption that the herbicide will be applied before the corn and weeds have emerged. The soil residual herbicides are to be used at the full labeled rate based on weed species and pressure. Some of the products' application rates are determined by soil type, pH and organic matter content. If sufficient rainfall is received soon after the preemergence herbicide is applied we should expect season long residual weed control with the following herbicide programs.

S-metolachlor + atrazine premixes (Bicep Lite II Magnum, Cinch ATZ, Cinch ATZ Lite) *or* acetochlor + atrazine premixes (Harness Xtra, Keystone NXT, Keystone LA NXT, Degree Xtra, Fultime NXT, Breakfree NXT ATZ, Breakfree NXT Lite) *or* dimethenamid-P (Outlook) + atrazine will provide good annual broadleaf, annual grass and nutsedge control. For the control of triazine resistant lambsquarters and additional broadleaf weed control include pendimethalin (Prowl 3.3, Prowl H2O) or Hornet WDG (a flumetsulam (Python WDG) + clopyralid (Stinger) premix) or Python WDG with one of these listed acetamide + atrazine combinations. If crabgrass or fall panicum is a problem, include simazine (Princep) in the tank mix. Be aware that simazine carryover will injure triazine sensitive rotational crops. If heavy nutsedge pressure is expected, the preference would be to use one of the S-metolachlor + atrazine premixes.

Lumax EZ or Lexar EZ are premixes that contain Dual II Magnum, atrazine and mesotrione (Callisto). Both Lumax EZ and Lexar EZ will provide good annual broadleaf, annual grass and nutsedge control. Lumax EZ contains less atrazine than Lexar EZ. If common ragweed is a problem add an



additional pint of atrazine to the Lumax EZ.

Acuron is a combination of Dual II Magnum, atrazine, Callisto, and bicyclopyrone (brand new active ingredient). The site of action for bicyclopyrone is HPPD inhibitor (group 27), like Callisto. You should expect Acuron to control weeds similar to Lumax EZ and Lexar EZ. Acuron will have enhanced control of common ragweed over Lumax EZ and does not require additional atrazine to be added.

Prowl 3.3 or Prowl H2O plus atrazine is a conventional corn herbicide program that controls many annual broadleaf and annual grasses. This program will not control nutsedge. For improved common ragweed control consider using the highest labeled atrazine rate allowed. Sharpen herbicide can be added to this tank mix to assist with annual broadleaf weed control, including common ragweed. Or Verdict (a saflufenacil (Sharpen) + Outlook premix) can be used for improved broadleaf and grass control. Verdict will also add suppression or partial control of nutsedge to this weed control program.

Resicore is a premix of Surpass NXT, Stinger and Callisto. Resicore will control annual broadleaf, annual grasses and nutsedge. For additional broadleaf and grass control add atrazine to this tank mix.

Instigate is a premix of rimsulfuron (Resolve) and Callisto, it should be tank mixed with one of the acetamide + atrazine premixes (Cinch ATZ, Breakfree NXT ATZ etc...) for improved residual broadleaf and grass control. This tank mix addition will also provide nutsedge control. The active ingredients in Instigate are similar to those in Realm Q; however, Instigate does not contain the safener (isoxadifen). Instigate cannot be used on corn taller than V2 growth stage.

Capreno is a premix of tembotrione (Laudis) and thien carbazon-methyl and should be tank mixed with atrazine. If nutsedge is a problem the addition of Dual II Magnum is necessary. Dual II Magnum will also provide additional residual control of annual grasses.

A well planned, total preemergence conventional corn herbicide program can provide season long weed control. While the success of these programs are dependent on sufficient rainfall to move the herbicide into the soil, our spring rainfall patterns are usually adequate to accomplish this. Try to avoid the temptation to skimp on herbicide rates to save money. Always read and follow label directions prior to using any herbicide.

If you have questions, feel free to contact Janice at 607.391.2672 or email jgd3@cornell.edu. ∞

Early Wheat Management Tips

Mike Stanyard, Regional Agronomist, CCE Northwest NY Dairy & Field Crops Program

It is time to take care of your wheat! As I write this, I am staring out my window on March 9 and it is 70 degrees! There was a short window for frost seeding. If it didn't get done by March 4th it probably didn't. Many of the earlier planted fields will be greened up nicely as you read this. See the reminders below on tiller counting, fertility, herbicides, and fungicides.

Nitrogen. In past articles I have discussed counting the number of tillers to determine if you should put all of your nitrogen up front, split it into two applications, or put it all on at a second application at Stage 6 (jointing). If you need a refresher course, see Mike's video on how to do so, <https://vimeo.com/124455368>.

See chart as example of tiller number and N timing and amounts. If your plant/tiller counts are low, be prepared to get more N on early as wheat plants green up fast and need to be fed. This N is utilized to increase vegetative production and promote additional tillers. If tiller counts are in the middle, then get some N on early and the remainder on at jointing. If tiller counts are high, hold off on applying N at green-up and apply it all at jointing.

This later N application timing should coincide with stem elongation which means nitrogen is going towards increasing the number of seeds per head and seed size, not additional tillers. However, I will throw in a word of caution here. Last year was a wet year and those who held off for just one later application of N could not get in the field when they needed to and the wheat turned off-color. This is definitely not what we want at this crucial growth stage and yield potential was lost. I now have some growers who are going to apply 20 pounds of N early even if their tiller count is high, to protect against the potential for a delayed second application.

Weeds. We continue to encourage the earliest planted fields to be sprayed for winter annual weeds (purple deadnettle, chickweed, chamomile) in late fall. Some of the later planted fields may have had a burndown sprayed prior to planting. You never know what the weather will be like in the spring and timely weed control can be tricky. Most fields are sprayed in the spring. We are still encouraging that you do not mix your herbicide and nitrogen applications and spray



separately. The leaf burning can cost us up to 10 bushels and could get worse as temperatures increase.

If grasses such as roughstalk bluegrass and cheat are a problem, Osprey does a good job of cleaning them up. It has no activity on broadleaves. Research by Russ Hahn has found that it has been very effective on bluegrass with better control achieved in the spring versus the fall. It can be applied up the jointing stage in winter wheat.

Fungicides. We have seen that fungicide applications in wheat can really pay off. Powdery mildew and leaf rust can move in during the early vegetative stages and result in yield losses. These leaf diseases can be more prevalent with thicker wheat stands. Weather conditions also can play a role. Wet, cool conditions are more conducive to disease development. Scouting of all your wheat fields early for powdery mildew is crucial to stay on top of this disease! Look for large areas where the leaves are turning yellow. Lower leaves will gradually turn light brown. If you applied higher N rates (90-120 pounds), fungicides are even more important to keep the wheat healthy to prevent lodging. π

Tiller Numbers (per sq. yard)	Nitrogen Recommendation
< 300	up to 60 units of N at green up, rest applied at GS 5-6
450-600	Up to 45 units of N at green up, rest applied at GS 5-6
>700	No N at green up, all N applied at GS 5-6

Understand No-Till Common Practices - Survey Results

William Curran, Professor of Weed Science, Penn State

Timely Cover Crop Control a Prerequisite for No-till Systems - William Curran, Penn State Extension Agronomist & Weed Scientist

There are plenty of opinions about when to terminate cover crops prior to planting cash crops ranging from weeks before to planting green.

Part of this decision should be based on what benefits you hope to achieve with the cover crop? Nitrogen fixation, sequestration, soil moisture management, etc. You should also consider difficulty or speed of cover crop control, herbicide options and crop safety, and how much cover crop residue can be reasonably managed. We are also thinking a lot about the potential for slugs and insect pests, and of course cash crop performance based on all these factors.

Cereal grains such as rye, wheat, and triticale are probably the most common covers in our area. We are also seeing greater adoption of annual ryegrass and some legumes with the clovers probably leading the pack. We often hear about problems killing certain cover crops during spring time and especially cereal grains and annual ryegrass. We have had a few experiments over the last few years with cereal rye, wheat and annual ryegrass cover crops trying to replicate some of the problems encountered in the "real world". In general, we did not encounter performance issues that we could not predict; meaning that the treatments we thought would work did and in fact, many treatments worked better than they should have. Assuming you choose an effective herbicide program and the application is accurate, sufficient cover crop growth and air temperatures at the time of application are probably the most important variables. Herbicide effectiveness ratings for cover crop control are provided in Table 1.

As examples, back in 2009, we had a test at Landisville where we compared glyphosate (Roundup PowerMax) rates ranging from 16 fl. oz/acre up to 44 fl. oz/acre alone and in combinations with citric acid, atrazine or simazine, standard rates of Touchdown Total, generic Clearout 41 Plus, Gramoxone, and Gramoxone plus atrazine. AMS was included with all glyphosate treatments and NIS with Gramoxone. Treatments were applied on April 13 between 9 and 11 am when the cereal rye was 8 to 10 inches tall and the low temperature the night before was 23°F with a high of 53°F the day of application. To make a long story short, all the glyphosate treatments provided over 90% control by the June 3 evaluation. Gramoxone alone at 3 pt/acre only provided 70% control, but over 90% control when 1 lb of atrazine or simazine was included.

In an annual ryegrass experiment in 2012 at Rock Springs, we compared glyphosate (Roundup PowerMax 4.5L) rates as low as 11 fl. oz/acre up to 44 fl. oz/acre with or without AMS, at 10 GPA vs 20 GPA, at 4 mph vs. 8 mph, flat fan vs. air induction tips, citric acid or not, and some common tank mixtures like atrazine, Lumax, Balance, Prequel, etc. Keep in mind that the recommended glyphosate rate for annual ryegrass control is generally at least 1.125 lb ae/acre. In the end, most treatments provided 90% control or better by June 4 and only two treatments were less than 90% (reduced rate of 11 fl. oz/acre applied at 10GPA). We had a mild spring in 2012 and herbicides were applied on April 19 to ryegrass that was 8 to

This study was conducted among a small number of no-till farmers (27) in PA who were very committed to no-tillage and cover crops. Researchers want to capture their thoughts about "planting green" or not killing a cover crop until after cash crop planting.

There are several reasons for interest in this tactic including improving soil quality, moisture management, slug management, and perhaps more successful establishment of the cash crop and improved weed control. This survey just touched on the surface of the issue of planting green but will hopefully help us better design field trials that investigate the potential benefits and disadvantages of allowing cover crops to grow longer in the spring. The following is a summary of what we learned in this survey.

Most of the farmers in our survey group grow corn, soybean, small grains, and perennial forages. Over 90% of the group used cover crops in the previous 3 years and about one-third had used cover crops for more than 10 years. The most common cover crop was cereal rye (92%), followed by other cereals (oats, triticale, etc.) and forage radish (64 to 68%), crimson clover (52%), annual ryegrass (48%), other legumes such as hairy vetch or winter peas (40%), and 20% utilized red clover. Almost half of the respondents have used cover crop mixtures.

Producers were asked about their preferred timeline to kill the cover crop relative to planting the cash crop under "normal" weather conditions. Almost 40% currently terminate their cover crop more than 2 weeks before planting, about 25% one to two weeks ahead, 8% less than one week ahead, and about 30% at or after planting ("planting green"). Although planting green is used by one-third of these farmers, it appears that many still like to make sure the cover crop is dead at planting time.

When asked why they kill their cover crops when they do, almost 50% consider soil moisture conservation as a very important driver and 35% are very concerned about too much cover crop residue, which might compromise seed placement. Several of these farmers have commented that ensuring cover crops are not seeded too dense can help with cash crop planting the following spring. Slugs were also an important consideration for timing of control (35%) as was waiting a bit longer for N fixation from legumes. About 25% of the respondents terminated at a time to ensure effective cover crop control. Interestingly, few farmers terminated based on insect pests, concerns for N immobilization, allelopathy, or for weed control. We think this survey will help us formulate some research plans and we thank these farmers for participating.

Glyphosate Performance

- Affected by many factors and you have little or no control over them
- To maximize the performance of glyphosate follow the outlined guidelines, specifically the proper timing of application and the right rate for the situation



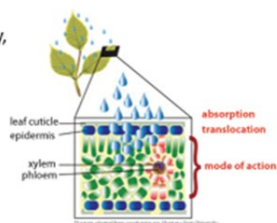
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10 inches tall and vigorous at the time of application with a low/high air temperature of 37/71°F. You can view the results of both of these trials on-line in the [2009 or 2012 Field Trials Annual Report](#). **Bottom line: make sure the cover crops are actively growing and choose warm sunny days when herbicides are applied.**

Special Cover Crop Control Considerations-Bill Curran, Professor of Weed Science and Dwight Lingenfelter, Program Development Specialist, Penn State

Factors for effective cover crop control

- Herbicide rate
 - Glyphosate rate depends on stage of growth
 - With glyphosate, include appropriate adjuvants (if required) plus AMS at 8.5-17 lbs/100 gal water
 - Gramoxone Inteon 3 pts/ac better on smaller rye before boot stage
 - Air temperature before, during and after application can influence control
 - Cold nights (<40°F) will reduce activity, especially when followed by cool (<55°F) days.



Spray Volume: Why is less water better?



1. As spray gallonage increases, the ratio of antagonistic salts to glyphosate increases
2. The simple "dilution effect"- Low spray volumes improve foliar absorption by increasing the concentration of glyphosate and surfactant present in the spray droplets
 - Situations with larger weeds and dense crop canopies, higher spray volumes (15 to 20 Gal/A) may prove beneficial

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Table 1. Effectiveness of herbicides for control of common cover crops (based on Penn State research or our best guess). Control ratings: 10 = 95-100%; 9 = 85-95%; 8 = 75-85%; 7 = 65-75%; 6 = 55-65%; and N = less than 55%.

	Rate* (lb./acre)	Annual ryegrass	Winter rye	Winter wheat	Crimson clover	Red clover	White clover	Hairy vetch
*0.75 lb. Glyphosate = 32 fl. oz. of a 41% glyphosate; 0.5 lb. paraquat = 2 pt. Gramoxone SL; Clopyralid is a component of Stinger, Hornet, and Surestart/Tripleflex.								
2,4-D ester	0.5	N	N	N	8+	8	6	9
	1	N	N	N	9	9	7	10
Atrazine	1	6	6	6	7	6	6	7
	2	7	7	7	8	7	7	8
Clopyralid	0.25	N	N	N	9	9	9	9
Dicamba	0.5	N	N	N	9	9	9	9
Glyphosate	0.75	8	9	9	7	7	6	7
	1.5	9	9	9	8	7+	7	8
Glyphosate + 2,4-D or	0.75 + 0.5	8	9	9	10	8	8	10
Glyphosate + dicamba	0.75 + 0.5	8	9	9	10	9	9	10
Paraquat	0.5	6	7	8	7	7	7	7
	0.75	6	8	8+	8	8	7	8
Paraquat +	0.5 +	7	8+	8+	9	8+	7	9
Atrazine or	1 or							
Metribuzin	0.25							

Guidelines for Glyphosate All cover crops should be actively growing and capable of intercepting the herbicide spray (e.g. not covered with crop residue). Remember to use a sufficient rate, which generally ranges from 0.75 lb. ae to 1.5 lb. ae/acre. The 22 fl. oz. rate of Roundup or 32 fl. oz. rate of Credit, Rascal, Clearout, etc. = 0.75 lb. In general, application alone in good quality water along with appropriate adjuvants (surfactant + AMS) is best and reducing the carrier volume to 10 gal/acre can increase activity. Do not add 28 or 32% UAN or other fluid fertilizers to the spray tank. If the water source has a high pH (8 or greater), consider adding an acidifying agent to the spray solution. Avoid tank mixing with higher-rate (> 0.25 lb.) clay-based herbicides (WDG, WG, DF, DG, F) like atrazine, simazine, and metribuzin. Other herbicides such as 2,4-D, dicamba, clopyralid, Balance or Corvus, Resolve or Basis Blend, etc. are OK.

Selected Glyphosate Products

Trade Name	Acid Equivalent (a.e.)	Rate for 0.75 lb a.e.*
Roundup Original	3.0	32 fl. oz.
Roundup UltraMax	3.75	26 fl. oz.
Cornerstone 5 Plus	4.0	24 fl. oz.
Durango DMA	4.0	24 fl. oz.
Roundup PowerMAX	4.5	22 fl. oz.
Touchdown HiTech	5.0	20 fl. oz.

* Recommended rate for most postemergence applications in glyphosate resistant crops

Winter Wheat

Some research suggests that wheat is less susceptible to control with glyphosate than cereal rye. In general, make sure you have a sufficiently high glyphosate rate and follow other guidelines to maximize herbicide activity. The Roundup Powermax label recommends 32 fl. oz. (1.125 lb.) up 18-inch tall wheat. Performance is better for applications made prior to the boot stage of growth. Gramoxone can also be effective, but rate, adjuvant, spray volume, nozzles, timing (prior to tillering or after boot), and the addition of atrazine or metribuzin are important for effective control.

Annual Ryegrass

Annual ryegrass continues to be somewhat challenging to control. Glyphosate is the preferred herbicide and paraquat (Gramoxone) does not provide consistent control. Application during sunny warm days is best and cloudy weather will slow activity. Under cool conditions, it may take 2 to 3 weeks to kill the ryegrass and a second application may be necessary. Previous research suggests that small ryegrass is easier to control, but mild air temperatures 1 to 2 days before, during, and 1 to 2 days after application are likely more important. Apply glyphosate at 1.25 to 1.5 lb. ae/acre following the guidelines provide previously.

Hairy Vetch, Red Clover, and Crimson Clover

For control of clover or other legume cover crops, glyphosate alone will not kill most legumes, but it is useful in mixture

with other herbicides. Gramoxone alone is also not very effective on legumes and should be mixed with atrazine or metribuzin for increased performance. Dicamba (Banvel/Clarity) is one of the best herbicides for control of legume cover crops. It is often a necessary tank-mix partner with glyphosate for control of red or white clover. A 2,4-D ester formulation will effectively control hairy vetch and field peas. I am less familiar with crimson clover control and unsure if 2,4-D is adequate or dicamba is necessary. Both 2,4-D ester and dicamba can be tank-mixed with glyphosate without loss in activity and can be used in corn. Use a minimum of 12 fl. oz./acre of Banvel or Clarity or 2,4-D ester tank-mixed with glyphosate. For corn, apply dicamba or 2,4-D ester 7 to 14 days before planting or 3 to 5 days after planting for greater crop safety and plant corn at least 1.5 inches deep. Clopyralid is also effective on legumes and is a component of several corn herbicides. Dicamba and clopyralid are not suitable for soybean and 2,4-D ester (1 pt.) must be applied at least 7 days ahead of soybean planting. ¥

GMO Crop Traits	
Genetically Engineered	Conventional
CORN	
<ul style="list-style-type: none"> Herbicide Tolerance <ul style="list-style-type: none"> Glyphosate tolerance <ul style="list-style-type: none"> Roundup Ready (RR) Glyphosate Tolerant (GT) Glufosinate tolerance <ul style="list-style-type: none"> Liberty Link 2,4-D tolerance <ul style="list-style-type: none"> Enlist Dicamba tolerance <ul style="list-style-type: none"> Roundup Ready Plus Extend Bt Insect Protection <ul style="list-style-type: none"> Corn Rootworm Lepidoptera (Moths & Butterflies) Drought Tolerance <ul style="list-style-type: none"> SOMETIMES, check with seed supplier 	<ul style="list-style-type: none"> Brown Mid Rib (BMR) Floury Starch Silage Hybrids Disease Tolerance Drought Tolerance <ul style="list-style-type: none"> SOMETIMES, check with seed supplier
SOYBEANS	
<ul style="list-style-type: none"> Herbicide Tolerance <ul style="list-style-type: none"> Glyphosate tolerance <ul style="list-style-type: none"> Roundup Ready (RR or RR2) Glyphosate Tolerant (GT) Glufosinate tolerance <ul style="list-style-type: none"> Liberty Link 2,4-D tolerance <ul style="list-style-type: none"> Enlist Dicamba tolerance <ul style="list-style-type: none"> Roundup Ready Plus Extend High Oleic 	<ul style="list-style-type: none"> Disease Tolerance
ALFALFA	
<ul style="list-style-type: none"> Herbicide Tolerance <ul style="list-style-type: none"> Glyphosate tolerance <ul style="list-style-type: none"> Roundup Ready (RR) Low Lignin <ul style="list-style-type: none"> HarvXtra 	<ul style="list-style-type: none"> High Quality (HQ) Low Lignin (other than HarvXtra) Potato Leafhopper Tolerance Alfalfa Snout Beetle Tolerance Disease Tolerance Branch Rooted
COTTON	
<ul style="list-style-type: none"> Herbicide Tolerance Bt Insect Protection 	
CANOLA	
<ul style="list-style-type: none"> Herbicide Tolerance 	
SUGAR BEETS	
<ul style="list-style-type: none"> Herbicide Tolerance 	

Take Stock of Manure Storage Needs Karl Czymmek, PRO-DAIRY, Cornell University

For many parts of NYS, not for the first time, March 2017 provided both deep snow and saturated wet conditions that presented significant manure related challenges, especially to daily spread and short term storage operations.

While the conditions are still fresh, every operation should take stock of manure storage options and look for ways to avoid application in these situations. Over the last few weeks, I have heard more comments than usual from farm and non-farm folks alike about seeing neighbors spreading manure on barely trafficable fields or even from the edge of the road. If you find your operation in this situation, or if you strained to find fields that can hold up the tractor and spreader without getting stuck, runoff risk is likely to be high and application should be avoided whether you are a regulated farm or not.

Spreading just before rain or snowmelt can be just as risky, even if a field can be driven on without getting stuck. For stackable manure in the short term, temporary pile locations can be identified with the help of SWCD, NRCS, or private sector planners until better storage options can be installed. New York State and federal cost share options are available annually; meet with your local SWCD and/or NRCS staff to start the process.

The Dairy Acceleration Program can help with cost of engineering on farms under 700 cows. Position your operation for the future: evaluate manure storage needs and implement solutions. ✕

<https://prodairy.cals.cornell.edu/dairy-acceleration>



Keeping Good Neighbors – Ten Things Dairy Farmers Can Do

- Get to know your neighbors by name and face - invite them over for a meal at the farm
- Ask neighbors to let you know of big events they are planning so you can plan manure events around them
- Clean up any road mess you make – mud or manure
- Grow sweet corn or pumpkins that neighbors can enjoy for free
- Start a monthly or quarterly newsletter to update neighbors on what's new with the farm
- Participate in Town Boards
- Sponsor a local softball team
- Host a farm tour event at your farm
- Participate in Ag Literacy Week – read a book related to agriculture to school children
- Ag-vocate using your farm on Facebook

The Public Controversy Over Building Manure Storage Janice Degni, Area Field Crops Specialist

I attended a town's public meeting in early March about a farm's proposed satellite manure storage.

The hall was filled with a capacity crowd. The town supervisor acted as the moderator and opened the meeting by making a plea for civility and genuine discourse. The meeting was organized to have 'expert' panelists present the case for manure storage for 1 hour followed by questions for 1 hour. The panel presentation included the farm's story, environmental stewardship, CAFO regulation and the NYS Right to Farm Law. The 2nd hour was opened for questions from the public. After 2 hours the panelists were allowed to leave as many had long drives home and the Town Supervisor agreed to stay until all questions were addressed.

Manure storage is a lightning rod issue. Concerned and angry neighbors have gathered to have their fears and forebodings heard over the last couple of years in communities throughout the state (4 come to mind just in our region).



People don't trust the 'experts' to have their best interests at heart. Experts present at the meeting justify the project and are perceived to have the interests of the farmers first. The public fears that their health (respiratory issues from manure gases) and natural resources would be negatively impacted and even worse, forever impaired such as a contaminated aquifer. They see few or no alternatives if their water source is contaminated at least not without prohibitive expense. The audience expressed concerns for the worst case scenarios. Demonstrating that there are tested emergency responses to accidents or unexpected breaches might allay some of those fears by showing that there are stop gap measures and pre-defined emergency action plans.

We may not agree with the fears of our neighbors because of our familiarity with manure and its handling, but plenty of misinformation can circulate through the press, internet and social media that supports and reinforces fear. One that I remember that seemed like it should have been logically rejected was the 'fact' that migratory birds would drop dead out of the sky from the gases over a manure storage.

Most towns do not have site plan reviews in the local zoning code, which means there is no formal or legal requirement to announce to the public a farm's intention

to build manure storage. After listening to comments at the meeting it seems like reaching out to nearby neighbors that are likely to be affected by a manure storage is just a good idea to alleviate concerns before misinformation and gossip build.

Ag District law states "No local government shall exercise any of its powers to enact local laws or ordinances within an agricultural district in a manner which would unreasonably restrict or regulate farm structures or farming practices in contravention of the purposes of the Act unless such restrictions or regulations bear a direct relationship to the public health or safety".

I believe that standing behind the *Right to Farm Law* for complete protection without acknowledging your neighbor's legitimate concerns will eventually work against the ag community. People are clearly concerned about quality of life issues and rightly so. We don't truly

appreciate our clean air and water until we don't have it anymore. For many their home is their sanctuary and represents a lifetime investment. Just having the State tell them they have no recourse is not very satisfying.

Acting in good faith and being a good neighbor may seem risky by opening the farm up to hassles and criticism from the start. It could just as well work to your favor by providing the right information up front, giving neighbors the opportunity to see the plans and discuss location pros and cons, perhaps saving unintended expense and hassle and satisfying the worries of the majority of the neighbors. This approach potentially accomplishes two things; it demonstrates concern to your neighbors, who coexist with your farm operation, and informs them of your plans before fearmongering can take hold and turn neighbors against you before they have heard your story and plans directly. Often it is a small number of people that stir up the fears in the larger community. Facing a group of neighbors alone may seem like a daunting task. There are ag professionals who are available to help and include your CAFO planner, SWCD and Extension personnel, and folks from state agencies like the NYS Department of Agriculture and Markets. ♦



Alfalfa-Grass Mixtures – 2016 Update

J.H. Cherney, D.J.R. Cherney, and K.M. Paddock, Cornell University

The vast majority of alfalfa acreage in NY is sown with a perennial grass. Until recently, there has been very little research on grass species selection or management of mixtures. We do not know what the optimum percentage of grass should be in mixtures, and it is unclear how consistent grass percentage is across species, varieties and environments.

An informal survey of forage seed companies active in NY in 2014 found timothy to still be over 30% of all forage grass seed sales in NY, with tall fescue and orchardgrass each around 20% of grass seed sales. Eight other grass species make up the remaining 30%, with each of these less than 10% of total seed sales. Forage tall fescue seed sales went from essentially zero 10 years ago to 20% of grass seed sales, and most of it is seeded with alfalfa.

Alfalfa-Grass Ratio in Stands

The primary negative point with mixtures is not lower forage quality, but variable forage quality. The main cause of this variability is a variable alfalfa-grass ratio. Botanical composition of alfalfa-grass fresh and ensiled mixtures is a key parameter for assessing forage and diet quality, as well as for managing mixed stands.

Previous attempts to validate near infrared reflectance spectroscopy (NIRS) equations for estimating botanical composition have not been very successful. We collected alfalfa-grass samples from across NY over several years, and Dairy One Forage Laboratory has successfully calibrated NIRS instruments to estimate grass% in alfalfa-grass samples. NIRS evaluation of samples taken after harvesting will provide good estimates, as the forage is mixed during chopping and unloading.

Keeping track of grass% in alfalfa-grass fields is useful for field and forage management. Estimating grass% in the field is difficult due to variability within a field. We are developing a cell phone app that will estimate grass% in the field, by evaluating a cell phone photograph of a mixed stand. Multiple photos will generate a representative estimate of grass%.

Meadow Fescue Potential for Mixtures

Meadow fescue (MF) is grown extensively in Canada and Europe, but dropped out of use in the USA decades ago primarily due to reduced yield, compared to other grasses. It can be grown in areas suitable for timothy, and is considerably more winter hardy than tall fescue in northern environments. Primarily grown for pasture use in recent decades, meadow fescue has considerable potential in mixture with alfalfa. Alfalfa-grass mixtures are as high or higher yielding than pure alfalfa, and have been shown to be an excellent forage for lactating dairy cattle.

Meadow fescue has higher fiber digestibility (NDFD) than most other grasses, consistently 2-4 percentage units higher than tall fescue. Feeding trials across the USA have shown that a one percentage unit increase in NDFD increases milk production by 0.5 to 1.0 lbs/cow/day, and more than 1.0 lb/cow/day for the highest producing cows. Meadow fescue in combination with new reduced-lignin alfalfa varieties has the potential to produce a very high quality forage for lactating dairy cows. A somewhat reduced yield potential for meadow fescue may actually be advantageous for alfalfa-grass mixtures, where a modest grass percentage is desirable.

2016 Trial Results

Ten grasses [meadow fescue (MF), tall fescue (TF), orchardgrass (OG) and festulolium (Fest.) varieties] were established in binary mixtures with 2 alfalfa varieties in spring 2015 in Oneida and Wyoming Counties. We thank Dave Curtin/Curtin Dairy and Dave Russell/Southview Farms for providing study sites. Optimum rainfall throughout the 2015 season resulted in abundant growth, and three seeding-year harvests were taken at both sites.

Meadow fescue headed out between May 26 and June 1, 2016, depending on variety and location. Tall fescue and festulolium had a similar heading date range, while orchardgrass varieties headed a few days earlier. About half of the grass varieties were at an early heading stage at spring harvest.

Cold spring weather in 2016 resulted in immature, very low fiber alfalfa forage under 30% neutral detergent fiber (NDF) and a little over 30% crude protein (CP) when harvested the last week of May, while NDF of grasses was generally optimum in the low 50's.

Both sites have fertile soils and, in spite of the weather conditions prior to the first two harvests of 2016,

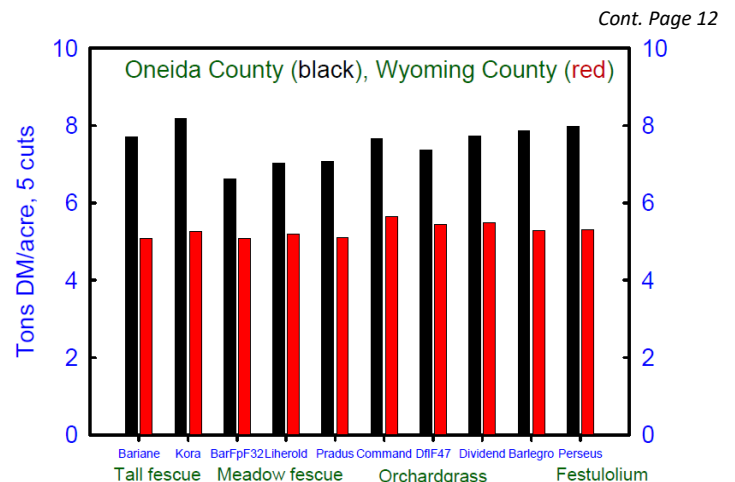


Fig. 1. Dry matter yield of alfalfa-grass mixtures at two NY sites in 2016.

averaged a total of 4 tons dry matter/acre. The last three harvests in Oneida County produced good yields, totaling an average of 7.5 tons DM/acre (Fig. 1). Some combinations exceeded 8 tons DM/acre. Severe drought in Wyoming County prevented much regrowth the rest of the year after Cut 2, and reduced total yield to an average of 5.3 tons DM/acre.

With somewhat adequate rainfall at the Oneida County site, grass% was relatively stable or increasing (Fig. 2), tending to decline in late fall, except for MF. Less rainfall on a soil with less water-holding capacity resulted in a decrease in grass% from Cut 1 to Cut 2 in Wyoming County. The relative ranking of grass% among varieties was generally consistent over locations, but environmental conditions significantly impacted all grasses. Festulolium dropped from 70% grass in Cut 1 to about 10% grass in Cut 3, possibly due to drought in Wyoming County.

Meadow fescue was relatively inconsistent, with greatly increased grass% later in the year for two of the entries in Oneida County. In Wyoming County, grass% dropped sharply for all entries after cut 1, and then increased significantly for all entries in the late fall after some rainfall returned. Overall, grass% was too high in Oneida County, except for Bariane TF and meadow fescues. Grass% dropped for all entries in the fall in Oneida County, except for meadow fescues.

Quality Analysis

For Oneida County, a weighted average over 5 cuts, Hi-Gest360 alfalfa was 4.6% higher fiber digestibility (NDFD) and 5.4% lower lignin, compared to Pioneer 55H94. For Wyoming County, Hi-Gest360 was 7.5% higher NDFD and 7.3% lower lignin, compared to Pioneer 55H94. In three seeding year cuts in 2015, Hi-Gest averaged 9.5% higher NDFD and 7.9% lower lignin (Oneida); and 5.3% higher NDFD and 3.0% lower lignin (Wyoming), compared to 55H94, using weighted averages.

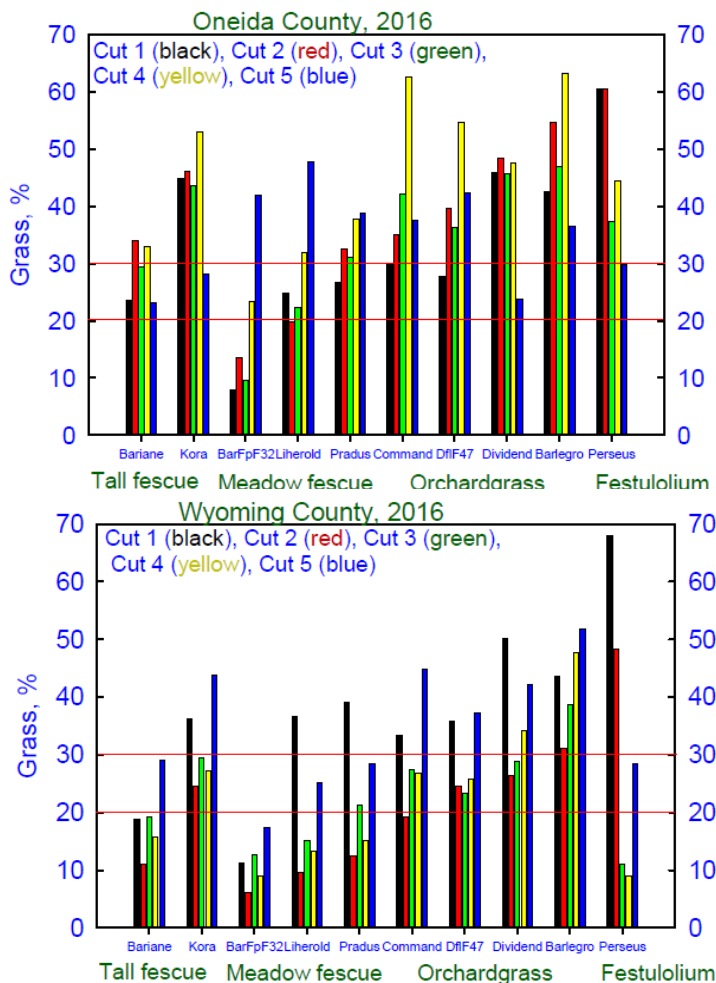


Fig. 2. Grass% over 5 harvests, 2016.

As the grass% increases in a mixed stand, there is less nitrogen available to grass from alfalfa, and also more grass requiring the limited available N. As the high-crude protein (CP) alfalfa% decreases, grass CP greatly decreases and total mixed forage CP drops correspondingly. However, CP should remain relatively high in the mixed forage up to at least 40% grass.

Alfalfa over sites averaged 57, 39, 45, 43, and 57% NDFD for the 5 cuts. Weighted average NDFD for grasses across cuts and sites for MF was 79%,

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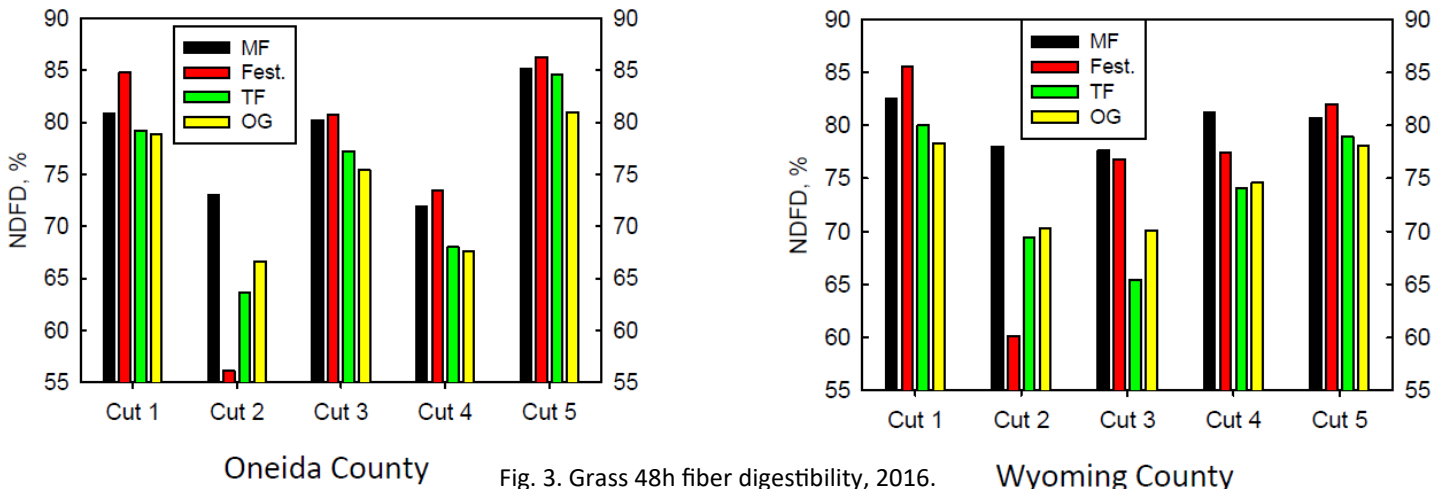


Fig. 3. Grass 48h fiber digestibility, 2016.

while Fest, TF, and OG all averaged 74% (Fig. 3). Festulolium headed out after Cut 1, due to moisture stress, greatly reducing NDFD for Cut 2. Cuts 2 and 4 at Oneida were taken about one week too late, resulting in lower NDFD.

Summary

Mixtures can increase both yield and quality of forage stands. Grass% in mixed stands is strongly influenced by environmental conditions. Environmental conditions during the establishment phase have a great impact on the alfalfa:grass ratio in succeeding years. Average grass percentage of stands over the 2016 season was double that of the previous fall for both sites.

Grass CP content is greatly impacted by the grass percentage of stands, as a limited supply of available soil N is diluted through increased grass production. As the amount of alfalfa in a stand declines, this also reduces the total supply of available N for grasses. Nevertheless, a mixed stand with up to 40% grass is still likely to have reasonably high CP content.

Results in 2016 indicate that the optimum grass percentage in alfalfa-grass stands at the end of the seeding year may be around 5-15% grass, with about 25-30% in the first production year. A grass percentage as low as 10% can still result in a significant increase in total forage fiber digestibility. Switching from a lower quality grass to a higher quality grass such as meadow fescue may impact forage quality as much as a switch to a higher quality reduced-lignin alfalfa.

Grass has considerably higher fiber digestibility than alfalfa. To-date, selection of either a high quality grass (e.g. MF) or a high quality alfalfa (e.g. reduced lignin type) has been shown to increase NDFD of both grass and alfalfa about 7%. If less than 20% grass in a mixture, grass species/variety selection will probably not significantly influence NDFD of the total mixed forage. Conversely, if more than about 30% grass in an alfalfa-grass mixture, alfalfa variety selection will probably not significantly influence NDFD of the total mixture.

Right now our best bet is to first select a site reasonably well drained with near neutral pH and maintain high soil K to maintain alfalfa. In mixture with alfalfa at 12-15 lbs/acre, meadow fescue should be seeded at 4-5 lbs/acre in either the spring as early as possible, or late summer about 4-5 weeks prior to first freeze. Plan to manage it 4x4; 4 cuts/season with a 4" stubble height, with somewhat higher stubble height for the last cut of the season.

Meadow fescue often contains a naturally occurring endophytic fungus, but unlike the tall fescue endophyte, no harmful anti-quality alkaloids are produced. Meadow fescue cannot be infected by the

tall fescue endophytes, so there are no concerns of livestock disorders with meadow fescue.

Drones may be used in the near future to provide pictures of alfalfa-grass stands for digital analysis of grass% and possibly NIRS for forage quality analysis.

Acknowledgments: Alfalfa-grass research was made possible by funding from the New York Farm Viability Institute and the Northern New York Agricultural Development Program. ❖

If we assume 2%units NDFD in an alfalfa-grass mixture is biologically significant:

Addition of HQ alfalfa to mixture:
To see a significant difference in NDFD in mixtures, grass must be <25% of mixture.

Addition of HQ grass to mixture:
To see a significant difference in NDFD in mixtures, grass must be >25% of mixture.

As low as 10% (any) grass in a mixture will significantly increase mixture NDFD.

30% Average Grass mix vs. Pure Average Alfalfa

1/3 to 2/3 more tons/a of dry matter per season

6-7% units higher NDFD in mixture
CP ~20%

Meadow fescue **1-2%** units higher NDFD in mix (30%)
HQ Alfalfa **1-2%** units higher NDFD in mix (70%)

30% MF/HQ Alfalfa (vs. pure alfalfa) may be:
1/3 to 2/3 more tons/acre and
8-11% units higher NDFD
OR about 20% higher NDFD in mixture



Calf & Heifer Care in the Spring – Make Sure the Basics are Done Right!

Betsy Hicks, Area Dairy Specialist, SCNY Dairy & Field Crops Team

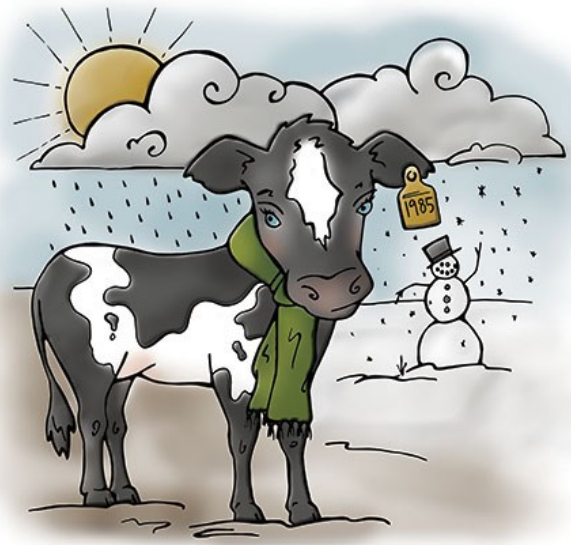
Spring showed up...and then winter came back. We had temperatures in the mid-70's, followed by bitter minus 15 degrees, plus wind to boot. Temperatures have jumped around more this winter than I can ever remember. To the calf and heifer manager, this winter has been nothing but frustrating. On top of this continually changing weather, we've also had the onset of the Veterinary Feed Directive, making feeding crumbles to heifers not an option any more. Because of these two factors, I have had a plethora of calls on ventilation questions and issues in calf and heifer facilities. While facilities certainly can make or break a heifer program, we can also make sure we are doing the basics right so that when we have a weather challenge or our heifers are stressed, they are fully able to manage through it.

Dr. Sam Leadley, calf & heifer management specialist with Attica Veterinary Associates lists his "big five" calf management areas that get overlooked in the spring. These include:

- Not enough to eat
- Not enough clean, dry bedding
- Not enough coccidiostat consumed
- Not chilling colostrum quickly enough
- Not using effective cleaning procedures

The first bullet point—not enough to eat—is one that frustrates me so much as a nutritionist! The industry did a huge disservice to itself when we made 2 quart bottles. Even now, when many farms don't even use bottles to feed calves anymore, so many are stuck on the 2-quart feeding. In 70 degree weather, this is just about enough nutrients at twice a day feeding, to sustain that calf. Toss in any cold, damp weather, respiratory challenge, wet bedding or missing a feeding because she spilled her milk and you've got a calf that isn't growing, or worse, a sick calf. Your calves can consume a gallon of milk a feeding and be just fine. Remember - manure from a liquid diet is not the same as scours from a sick calf! Many farms have gone to adding a third feeding in the winter to get additional calories into calves, and never stopped after spring comes. Calves that get additional nutrients will outperform calves that are limited on intake. Consult your nutritionist and call your local extension educator about feeding your calves more milk – you'll be glad you

did.



Moving on to not enough clean, dry bedding – spring can be a challenge in this aspect. We've so many things in the spring to deal with - melting snow, mud, rain showers that turn to snow and back again – you name it, we see it (oftentimes all seasons in one week around here!). If we're raising calves in hutches, let's make sure that the inside of the hutch truly is dry and doesn't have water seeping in from nearby snow melting. If we're in a three-sided calf barn – let's make sure we have curtains to keep blowing snow and rain off of their beds or pack, and we bed frequently to keep calves dry. If she's laying on a wet bed, it takes more energy to keep her warm – which means she gets to grow less and is more susceptible to getting sick.

Not enough coccidiostat used – this third point has so many facets to think about. Are the heifers eating the proper amount of grain that the coccidiostat is formulated for intake? Do the heifers weigh the correct size for the formulation? Do you know how much the heifers truly weigh? Taking this a step further back – are we taking the proper steps to minimize the chances of coccidiosis in our heifers? This includes minimizing weaning stress, cleaning pens frequently, cleaning waterers frequently and appropriately grouping heifers. The less stress we put calves through at weaning (i.e., only one change at a time) the less likely we will have coccidiosis problems in our heifers.

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The last two points - not chilling colostrum quickly enough and not using effective cleaning procedures – go hand in hand. We can do an awesome job collecting colostrum, but if we're feeding it to calves in containers that haven't been properly cleaned, how good of results can we really expect? Conversely, we may have the cleanest feeding tools in the county, but if we collect the colostrum and let it set on the milk house floor for half the day, we'll be feeding bacteria soup in a clean bottle.

So how do we clean? Dr. Don Sockett, DVM with the Wisconsin Veterinary Diagnostic Laboratory outlines six steps to properly sanitize calf feeding equipment. I'll give you a hint – if you don't have a thermometer, you're probably not doing it right.

1. *Rinse* - using about 90 degree water, rinse both the outside and inside of feeding equipment
2. *Soak* – equipment should be soaked for 20-30 minutes in 130 degree water plus 1% chlorinated alkaline clean-in-place (CIP) detergent (note: 130 degrees is too hot for you to put your hand in!)
3. *Wash* – thoroughly wash both outside and inside of equipment with a brush. Water temperature needs to be maintained above 110 degrees – fats will come out of solution under this temperature and form back on the equipment. (note: bottles can be washed in an industrial dishwasher, but nipples should be manually washed with a brush) Pay special attention to equipment that is worn or has deep scratches or grooves on them – these should be replaced. Think about how we maintain our milking system: why would we do anything different with our calf milk equipment?
4. *Rinse again* – using about 100 degree water with 50 ppm chlorine dioxide, thoroughly rinse outside and inside of equipment. Once or twice a week, rinse equipment with acid that contains 50 ppm of chlorine dioxide.
5. *Dry* – allow equipment to drain and dry. Stacking on a concrete floor or boards will not allow buckets or bottles to fully dry. When fully dry, you should not feel any greasy film or see droplets of water stuck to the sides. This indicates that the equipment still has deposits where bacteria can grow.
6. *Final preparation* – spray the inside and outside of equipment with a 50 ppm solution of chlorine dioxide two hours or less before use. Allow 60 seconds of contact with the equipment. Allow to dry before using.

So what about water and starter pails? At a minimum, they should be clean and sanitized between calves or any time they are contaminated with manure. Many farms are on a schedule of washing a set number of these pails every day so that every week, each calf has a clean set of water and starter pails to use. This is also a good time to evaluate what condition these buckets are in and get new ordered.

If we break down each of these areas and really focus on them during the changeover to spring weather, I guarantee your heifer program will be more successful. We cannot control the weather, but we can control aspects of our heifer program. More often than not, a close eye on doing the basics right will improve the success in your heifer program. ☘

Considerations for Raising Calves in Spring Weather:

- **Calf jackets** – put them on! Young calves experience cold stress below 70 degrees, so until the nights are warmer you still probably will need them! Make sure the calf and coat are both clean and dry when you put them on the calf.
- **Calf jackets** – take them off! If it warms up, make sure you take them off in time so that calves aren't experiencing undue heat stress.
- **Plenty of bedding** – we live where there is ample precipitation and humidity. To make sure your pens are adequately bedded so that calves aren't laying in wet, do the knee test. Get in the hutch, pen, stall and kneel. If you've got wet knees – you need more bedding, or clean it out and start over!
- **Ventilation** – fresh air that isn't drafty. While you're at calf level, what is the air like? Call your extension educator – we can help design a system to keep fresh air to your calves.
- **Calories** – feed calves ample nutrients! They'll be better able to fight off sickness during weather fluctuations.
- **Clean equipment** – take stock of your calf feeding equipment now. Replace anything with grooves, scratches or that is worn out.



Cornell University
Cooperative Extension
South Central New York Dairy & Field Crops Team

Grass: It does the Heifers Good

Fay Benson, Small Dairy Extension Educator, SCNY Dairy & Field Crops Team

When I approached a dairy farmer about the possibility of having his heifers custom grazed he asked how the animals get back to the barn to get their TMR. I replied that the heifers would be eating the grass in the pastures. "Grass" he replied "My heifers need more than just grass". This attitude is changing as more dairy farmers learn that pasture forage can be a complete feed for heifers since it is high in energy from the digestible fibers in the young plants. Grazing can reduce the cost of raising a heifer for the 6 months it is on pasture by \$0.70 - .90/ day. Studies have shown that grazing will also support heifer growth to achieve a 22 – 24 month freshening date. There are other benefits for the heifers but the two most important factors for a dairyman's heifer program are: Targeted Growth Goals and Cost per Day.

Dairy replacement programs within dairy farms are one of the largest expenses for the farm. A 2008 study by Cornell's Department of Applied Economics and Management (AEM), 17 above average herd size farms with high levels of management, showed dairy replacements entering the herd with a total investment of \$1,884 per animal. These animals were calving at 22.9 months of age and weighing 1290 pounds. The animals averaged 1.73 pounds of gain per day at a total cost to raise of \$2.49 per day per heifer, or \$1.45 per pound of gain. Feed costs were the most significant cost, followed by labor. The study used \$30/ton as the cost to produce corn silage and \$40/ton for haylage. Production costs for both of these forages have gone up approximately 20% in recent years or \$36/ton of silage and \$48/ ton of Haylage. (Table 1)

The Cost Savings of Grazing

The biggest cost savings for moving the animals out to a grazing system is for feed. This forage cost for pasture is much lower since the animals do the harvesting and feeding of the forage and there is no storage cost. Labor is also reduced. Using the Cornell study figures for Feed and Labor and assuming these cost would be charged to the grazing system and all other cost for buildings and machinery are still the same since they are needed for the winter housing.

In Table 1 the costs are listed for the feed and labor per day for different sizes of heifers. A grazing cost either on the owner's farm or with a custom grazer less than these figures would be a savings to the heifer owner. Typical Custom Grazing costs in New York range from \$1/day/head to \$1.40/ day /head.

Targeted Growth Goals with Grazing Forage Alone

Through a NE Sustainable Agriculture Research and Extension Grant (NE SARE) regular forage samples were taken from pastures being grazed by dairy heifers. The samples were entered into Cornell's NCP (Net Carbohydrate & Protein) model, it showed grazing forage varied throughout the

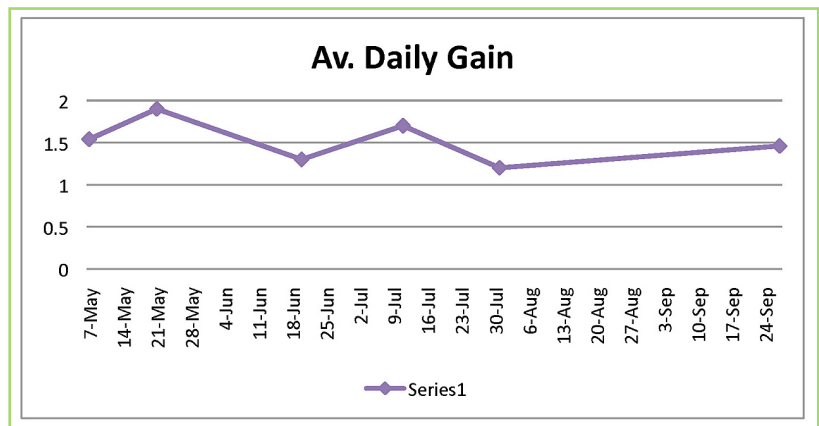
South Central NY Dairy & Field Crops Digest

season, this meant that the ADG (Average Daily Gain) varied as well. See ADG Table below.

	COST OF FEED AND LABOR /DAY FOR DIFFERENT SIZES OF HEIFERS IN CONFINEMENT		
	201 – 700 LBS	701 – 850 LBS	851 - Calving
2007 ~	\$1.30	\$1.50	\$1.60
2013	\$1.50	\$1.70	\$1.80

Table 1-Confinement Feed & Labor Costs taken from "Dairy Replacement Programs: Costs & Analysis" AEM - EB 2008-16

The forage grazed by the heifers varied throughout the season. This was due to the changes to the forage plants and the maturity of the pastures given to the heifers. The computed ADG if pasture was the only feed was 1.54 lbs/day. The actual result for ADG for the group of heifers in this study was 1.7 lbs/day. To achieve this, select feeding of concentrate was used to offset the transition to grazing. The heifers were fed 2 lbs of concentrate the first 2 weeks, and 2lbs again during the final 3 weeks to compensate for the declining pasture quality. These changes increased the ADG to 1.7 lbs/ day for the group of heifers on pasture.



The points in the table above indicate the ADG for heifers fed pasture forage alone. These results can be manipulated to reach desired goals by careful grazing management or additional grain being fed.

To achieve targeted growth goals with the use of grazing, active management is required due to the changing nutrient, digestibility and rate of regrowth of the forage during the grazing season.

Once these variables are accounted for dairy farmers can take advantage of the costs savings which are associated with grazing. ●

For a copy of a series of fact sheets on grazing dairy heifers compiled by Fay Benson and Dr. Sam Leadley of the Attica Vet Clinic, go to our website: https://nvdairyadmin.cce.cornell.edu/uploads/doc_439.pdf

Now Enrolling Herds

Linking Lameness and Lying Times in Tie Stall Facilities

Betsy Hicks, Area Dairy Specialist with the South Central NY Dairy & Field Crops Team is enrolling herds that house their milking string in tie-stall facilities in a project evaluating the effect of tie-stall housing upon lameness and lying times.



Q: What does it involve?

A: Betsy will meet with you to over the project and assessment in detail

On assessment, 40 cows will be assessed for body size and lameness and have data loggers attached to the leg for 1 week to measure lying behavior

Q: What do you get out of the project?

A: You will receive data from your initial assessment on lameness, lying behavior and facility and management factors, and form an action plan with changes specific to your dairy to positively impact lameness

Reassessment of lying time after changes are made if desired

Betsy will follow up with you periodically throughout the next 12 months to help implement and monitor changes

Q: Cost?

A: Free

Project funding made possible through NY Farm Viability Institute

Enrollment is limited to 5 farms in the SCNY region this round.

There will be a second round of enrollments that will be opened up to more farms in the next year.

Please contact Betsy Hicks to enroll at bjh246@cornell.edu or 607.391.2673

We Need Your Help!

First Cutting Updates – Utilizing Alfalfa Heights as a Predictor for Quality

Betsy Hicks, Extension Dairy Specialist

The SCNY team is going to monitor alfalfa heights this spring to help predict quality and %NDF. Alfalfa height has been proven to be a reliable indicator of NDF values in the field for alfalfa, alfalfa/grass mixed and all grass stands. The team wants to identify fields that can be measured on a weekly basis. If you have fields that we can come out and measure, please let Janice or Betsy know! Results will be compiled on a weekly basis – to receive weekly email/text updates, please contact us at 607.391.2673 with your email address/cell phone number.

The numbers that are indicators for using alfalfa heights for NDF content are as follows:

100% grass stands should be cut when nearby alfalfa is 14 inches tall, to achieve 50% NDF

Begin cutting 50/50 mixed alfalfa/grass stands when

nearby alfalfa is 22 inches tall, to achieve 44% NDF

Begin cutting 100% alfalfa stands when alfalfa is 28 inches tall, to achieve 40% NDF

Predicted days to cut are based on daily NDF increases for grasses of 1.0% point, 50/50 mixed alfalfa/grass stands of 0.8% points, and alfalfa of 0.5% points. Predictions are adjusted for the coming week's weather.

Typically NDF increases about 0.8 to 1.2 per day for grasses, with cooler weather being the lower end of the range and warmer weather being the higher end.

For alfalfa, NDF increases about 0.4 to 0.7 per day, also dependent upon warm/cool weather.

The email will have a table of the locations around the region where we have measured the alfalfa height, as well as the elevation, and target date for harvest. Even if your fields aren't measured, you can use the location and elevation as a guide to conditions that may be similar to your own. ☘

Ah, springtime. Soon the sun will be warming the earth and a gentle breeze will be drying it out. It won't be long now before you'll be able to hit the fields. Some fields need to be plowed while those that were plowed last fall need only to be disked. Then there is the planting. Every year schedules seem to get more hectic, fields seem to get farther away and machinery gets bigger and faster. We rely more and more on hydraulic systems to accomplish the work we have to do in a shorter amount of time.

Not only do our tractors have hydraulic power brakes and hydrostatic power steering, but also hydraulic (wet) clutches and even hydraulically actuated diff locks, PTOs and direction reversers. The greater concern, though, are the hydraulically raised and lowered implements. Drawn and semi-mounted plows, disks with folding wings and planters with hydraulically operated markers rely heavily on highly pressurized oil being directed to remote locations to exert tremendous forces on mechanical parts. We seldom consider the consequences of something going wrong in this system. Maybe we should.

Hydraulic systems operate at pressures of 2200 to 3000 pounds per square inch (psi) and can get as hot as 180°. When hoses get chafed and seals get worn very serious injuries can result. Careless checking of a hydraulic fluid dipstick can result in an ordinary burn but a pinhole leak in a hose can inject oil under the skin. This may not sound serious but if it is not surgically removed it can cause gangrene and lead to loss of the limb!

Nearly every year we hear of a farmer who was crushed when a raised implement or loader he was under unexpectedly dropped on him. Sometimes a hose bursts or an o-ring or seal breaks, and sometimes someone accidentally bumps the control lever. Gravity ensures that implements drop faster than they are raised hydraulically. In any case, hydraulic systems cannot be trusted with your life.

Here are some safety reminders to help keep you safe this spring around your tillage and planting equipment.

- Never look for hydraulic leaks with your hand. Hold a piece of cardboard or wood near hoses with a gloved hand. Look for oil spray on the cardboard to detect a leak. An accumulation of dust often signals oil seepage.
- Never work under a machine held up only by a hydraulic system. Always support it on blocks, jack-stands or with the built-in mechanical safety locks.
- Don't transport a raised or folded implement over the road without locking the mechanical transport locks.
- Keep hoses away from moving parts such as the nearby PTO shaft. Tie hoses away from harm where they won't be kinked in a tight turn, either.

- Don't leave loaders or implements in the raised position when unattended. Release pressure on the hydraulic system before dismounting the tractor by operating the hydraulic control levers in every position with the engine off.
- Worn O-rings and seals can cause system failure. Guard against dirt entering the hydraulic system by cleaning around the fill port before opening it to check or add oil. Store hoses with the ends off the ground and away from dirty machine parts. Clean off couplers before connecting hoses. If you paint older machines, retract hydraulic cylinders so no seal-damaging paint gets on the piston rods.
- Proper maintenance always promotes safe operation. Keep fluid levels in the recommended range for the equipment being operated, change filters at recommended intervals, keep oil coolers clean, clean off couplers before connecting or disconnecting and replace hoses with questionable cracks or worn spots.
- If raised equipment doesn't hold its position, consider it a warning that there is a leak in the system. Get it fixed before the seal or O-ring fails completely.

Hydraulic systems, like the tractors they are a part of, are very helpful and magnify the work we do, but they can be deadly if we ignore their hazards. Review the warnings in the operator's manuals that came with your tractor and hydraulically operated implement. Follow the safe practices mentioned above and your hydraulic system won't let you down unexpectedly. For more information about farm health or safety concerns, call NYCAMH at 1-800-343-7527. *



Quality is Key for High Forage Diets

John Himba, Hay & Forage Grower

Forage is an indispensable part of dairy cow diets. However, due to its bulkiness and the inherently low levels of fiber digestibility, cows are limited in how much forage they can consume every day and still keep feed dry matter intakes at high enough levels to support peak milk production. Even though cows are biologically designed to digest forages, their improved genetic potential requires that they digest far more feed and nutrients than an all-forage diet can supply. Getting cows to milk on high-forage diets requires keeping the forage quality high and consistent and making it available throughout the year.

As we attempt to maximize forage in diets, it proves to be very challenging to get forage intakes over 80 percent of the total diet without compromising milk production. At the heart of the forage limitation is the amount and digestibility of the fiber fraction of the forage. The fibrous fraction of all forages is referred to as neutral detergent fiber (NDF), the term coming from the laboratory procedure developed to analyze fiber. More recently, an updated lab procedure has been developed that accounts for the excessive presence of ash (primarily dirt and/or minerals) that may be present in forage samples. This analysis has been coined aNDF. For the purposes of this article, the term NDF will be used.

NDF dictates intake

The amount of forage a cow can consume is almost totally dependent on the NDF level of that forage. Forages that test high in protein usually have low levels of NDF. Protein and NDF tend to be inversely proportional. Several studies have determined that daily NDF intake from forages for dairy cows is limited to about 1.1 to 1.2 percent of their body weight (BW). As an example, using the maximum value of 1.2 percent of BW for a cow weighing 1,500 lbs, her maximum NDF intake from forage would be 18 lbs.

If a particular grass hay crop tests 60 percent NDF, the maximum forage intake for our 1,500 lb cow would be 30 lbs ($18/0.6=30$). If we expect this cow to produce 100 lbs of milk, her total dry matter intake should be near 60 lbs/day. The forage will only make up half of the diet dry matter intake. If, on the other hand, the NDF of the grass hay crop tested 50%, the cow could consume 36 lbs of forage ($18/0.5=36$). That's an additional 6 lbs of forage the cow can eat, which brings the total up to 60% of the diet. The only way to feed higher levels of forage is for those forages to be lower in NDF.

In Ancramdale, N.Y., Jim Davenport milks about 65 cows and has spent many years focusing on growing and feeding as much forage as possible. The herd's average milk production is in the high 70 lbs/cow range most of the year with a rolling herd average over 25,000 lbs/year. Along with the brown midrib corn silage that's now a staple for many New York dairy diets, Davenport feeds hay crop forages that are high in protein and low in NDF.



He grows primarily endophyte-free tall fescue and reed canarygrass harvested mostly as haylage and stored in cement bunks that are sized appropriately for good face management. He works diligently to keep the NDF levels as close to 50 percent as possible for all cuttings, which means he closely monitors temperatures and degree days in determining when to mow - not a specific date on the calendar. With many years of experience behind him, he can hit his goal most of the time.

Focus on milk per acre

In the crop-growing business, there's always the trade off between quality and tonnage. Farmers are inclined to maximize yield per acre.

High yields, of course, equates to advanced plant maturity, which in turn equates to lower rumen digestibility and less metabolizable nutrition. Dairy farmers shouldn't focus on how many tons of feed they get from a field - they should be focusing on pounds of milk per acre.

Davenport has found that compromising quality and allowing NDF levels to climb over 50% will cost him more milk production than what he may get in extra tonnage per acre. He's found that, for his farm and the local growing conditions, the optimal yield tends to be about 1.5 tons of dry matter per acre per cutting. That's the place where he feels he gets the most milk per acre. This past season, he harvested over 5 tons of dry matter in four cuttings.

This is a key concept that must be well understood when making the most out of raising your own forages. Unless aggressively managed, homegrown forage can quickly become heifer and dry cow hay. As tempting as it is to grow your own feed to offset the rising cost of grains and by-products, forages are completely unforgiving when it comes to low quality, and the drop in milk production will more than offset any savings on purchased feeds.

A herd producing close to 80 lbs of milk per cow per day, all year long, consumes a lot of feed, and Davenport strives to get his cows to eat as much forage as possible and still keep milk production up. His goal has been to get them to 80% forage - but that has yet to happen. He's had years where he's had his cows up to 75% of their diet — and had the average daily milk production per cow over 80 lbs.

Fiber digestibility important

Every year is different, Davenport notes. At the end of 2015, his cows were consuming less than 70% forage and the average milk production was down to 76 lbs/cow. Davenport believes that the NDF digestibility may be down in the 2015 crops due to sporadic rainfall during the earlier part of the season. He surmises this might have stressed plants, resulting in higher lignification of the fiber - but that's just a guess.

Grain prices and markets also influence how much forage should be fed. Several years ago when grain prices went through the roof, it made sense to focus on trying to maximize forage intakes. As grain prices have moderated more recently, it may make more sense to increase grain and by-products to make more milk, especially if the forage quality has diminished.

With a renewed interest in the economic value of feeding forages to dairy cows, researchers and nutritionists recognize the importance of being able to more accurately model and predict how any given forage will digest and what level of nutrition can be expected from it. The NDF digestibility varies among forages as well as within forages. As it turns out, fiber consists of rapidly digested pools of NDF, along with slower digesting pools, and finally an indigestible fraction.

And while the cows ultimately will tell the story of whether the forage they consume is good or bad, nutritionists would like to know beforehand how a forage will behave in the digestive system before a dairy farmer puts it in front of his cows. Ongoing industry and university research will eventually unlock the secrets still not known about the different digestibility fractions of NDF.

Meanwhile, dairy farmers who focus on feeding forages that are low in NDF, plant cultivars/hybrids that have been proven to be more digestible such as BMR, will be able to feed more forage and keep the grain bill down. Higher forage diets usually mean healthier and more profitable cows. •

This article appeared in the January 2016 issue of *Hay & Forage Grower* on pages 18 and 19.

Cornell University Cooperative Extension
SCNY DAIRY & FIELD CROPS TEAM

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Spring 2017
NYSDEC Region 7
*Promoting a Toxic Free Future
for New York State*

The Spring 2017 CleanSweepNY collection event will happen during the week of May 8th.
The collections will take place on the following dates and at the following locations.

Pre-registration is necessary by April 21, 2017

- May 9th – N. Syracuse, NY
- May 10th – Castle Creek, NY

The targeted counties in Region 7 are: Broome, Cayuga, Chenango, Cortland, Madison, Onondaga, Oswego, Tioga, and Tompkins Counties.

In order to participate, **pre-registration is required.**

Registration packets can be requested by telephone or e-mail at the following:

- Telephone - 877-793-3769
- Email - info@cleansweepny.org

Visit <http://www.cleansweepny.org> for more information