Plan now for your 2018 forage needs

The latest in forage production research
Spring Renewal
By Julie Berry

Winters in the Northeast can feel long, and the first long days of sunshine, the smell of rain and new life sprouting in the fields can help lift spirits. This spring also brings a new partnership for PRO-DAIRY, with the publication of The Manager by Progressive Dairyman. We look forward to what grows.

Cornell CALS PRO-DAIRY is celebrating 30 years of enhancing New York's dairy industry through education and applied research. This issue brings that research and education to your mailbox, with tools to make more informed decisions that may impact your business for seasons to come.

Corn silage hybrid testing was renewed at Cornell with the hire of Joe Lawrence, PRO-DAIRY Forage System Specialist. Regional partnerships across Northeast universities that conduct these trials is yielding more data across more growing conditions, and with more consistent reporting of results, which should make this even more meaningful to your farm.

Lawrence also reports on optimizing harvest schedules to optimize feed quality and offers strategies for forage storage, with the aim to maximize milk production.

New research, led by Jerry Cherney, Cornell University Soil and Crop Sciences Professor, identifies how the percent of grass in alfalfa mixtures planted can impact forage yield and forage quality.

The Cornell Nutrient Management Spear Program provides insight on corn silage monitors, both on why to use them, and how to use the data provided by them.

Growth requires the right nutrients applied at the right time. Peter Wright, an Agricultural Engineer with PRO-DAIRY, walks through considerations for new manure storage.

With best wishes to your family and farm this growing season.

Julie Berry (jrb7@cornell.edu) is Communications Manager and edits The Manager for PRO-DAIRY.
Efforts to Advance Corn Silage Hybrid Evaluation Trials in the Northeast

By Joe Lawrence, Heather Darby, Jessica Williamson and Thomas Overton

A number of independent Corn Silage Hybrid Testing Programs are conducted across the country. Over the past two years the hybrid evaluation trials conducted in New York, Pennsylvania and Vermont have come together to develop a unified testing network. These efforts have involved Cornell University, Penn State University, the University of Vermont, the Professional Dairy Managers of Pennsylvania (PDMP), and the Western New York Crop Management Association. All of these programs were offering valuable information on hybrid performance, and this new unified collaboration further enhances these programs by allowing for the evaluation of hybrids across more growing conditions, as well as consistent analysis and reporting across sites.

While yield performance is a common discussion topic, forage quality performance is a critical aspect of decision making for corn grown for silage. A growing number of traits available for corn targeted towards improvements in forage quality provide farmers with even more hybrid selection choices. In addition, recent advances in dairy nutrition related to fiber digestibility have necessitated a change in how forage quality is evaluated and what selection criteria offer producers the best insights for hybrids selection.

Recognizing the need for updated hybrid evaluation criteria, and the opportunities of regional collaboration to enhance the value of individual program results, organizers see tremendous potential in bringing more uniformity to testing programs. In addition to providing producers with valuable information for selecting hybrid, this approach can also help corn breeders focus development efforts on characteristics that bring value to corn silage.

Research in Pennsylvania and New York both focus on digestibility, but of different components of the forage. Efforts in Pennsylvania have focused on improving understanding of starch digestibility, and work to update guidance on how to best test for and use this information in hybrid evaluation. Meanwhile, in New York, the program has focused on advanced evaluation of fiber digestibility, newer laboratory measurements of fiber, and use of nutritional modeling software (the Cornell Net Carbohydrate and Protein Synthesis or CNCPS Model) to better understand how hybrids should perform as part of a complete ration for dairy cows.

Researchers at Penn State have been working to identify the appropriate grind size to achieve the best repeatability and to sort out hybrid differences to better reflect in situ starch digestibility. Starch digestibility has been analyzed in several Pennsylvania trials using a 1 mm grind, based on the results from a preliminary study conducted during the past two years. During the 2017 season, Pennsylvania trials saw an average of 57.1 percent and 60 percent starch digestibility in early and full season hybrids, respectively. Digestibility for early season hybrids ranged over 10 percent, from 51.8 percent to 62.5 percent, while full season hybrids ranged even more significantly, from 50.3 percent to 66.8 percent starch digestibility.

The understanding of neutral detergent fiber (NDF) and its role in forage quality is not new. However, the ways we measure, interpret and value NDF in a feeding program continues to evolve. For many years NDF digestibility (NDFd) has been a key parameter used to benchmark forage quality and understand how a forage would perform in an animal’s diet. NDFd can be measured at different time points and is commonly reported at 24 and 30 hours for corn silage.

It has also long been recognized that the portion of indigestible fiber in a forage impacts dry matter intake and production potential. For many years the multiplication of percent lignin by 2.4 was used to characterize indigestible fiber. In recent years the measurement of undigested NDF (uNDF) at a series of time points (30, 120 and 240 hours) has been shown to be a better indicator, leading to its adoption by forage testing laboratories and incorporation into nutritional modeling software. It is important to distinguish undigested fiber from indigestible fiber as uNDF is reporting the pool of fiber undigested at the specified time point.

As overall forage quality is a combination of numerous parameters, evaluation systems that can incorporate multiple parameters offer many benefits. Common examples include the milk per ton equation from the University of Wisconsin (shaverlab.dysci.wisc.edu/spreadsheets), and more recently, total tract neutral detergent fiber digestibility (TTNDFD), also developed at University of Wisconsin and licensed to Rock River Laboratories (rockriverlab.com/file_open.php?id=119). In an attempt to incorporate numerous parameters of quality, including uNDF, as well as how the corn silage performs in the context of a complete ration, hybrids in the New York and Vermont trials are entered into a base ration (typical of a high corn silage diet fed to lactating dairy cows) in CNCPS, which provides predictions of dry matter intake and predicted energy (ME) and protein (MP) allowable milk yield.

For factors such as yield it has long been advised to look for consistent

Continued on page 4
FIGURE 1
Harvest Window by Target Animal Class

Building more unified collaboration among testing programs, both regionally and nationally, is a great opportunity to enhance the information generated by this work.

2017 New York and Vermont Corn Silage Trial results are at:
- Cornell: scs.cals.cornell.edu/extension-outreach/field-crop-production/variety-trials#corn-silage
- University of Vermont: uvm.edu/extension/cropsoil/research
- Penn State/PDMP: extension.psu.edu/2017-results-pa-commercial-grain-and-silage-hybrid-corn-tests-report

Joe Lawrence is a Dairy Forage Systems Specialist with Cornell CALS PRO-DAIRY. Heather Darby is an Extension Associate Professor at the University of Vermont. Jessica Williamson is an Assistant Professor of Forage Management at Penn State University. Thomas Overton is Director of Cornell CALS PRO-DAIRY and a Professor of Dairy Management at Cornell University.

Dynamic Harvest Schedules
By Joe Lawrence

In a whole farm context the focus on high-quality forage has shifted to the right-quality forage for each group of animals on the farm. This, however, is not an excuse to relax goals on producing high-quality forage. We all know that a number of factors, from weather to equipment breakdowns, can ruin the best of plans. While it is not possible to manage the weather, steps can be taken to help manage for the weather.

To fully capitalize on matching the right-quality forage to the right group of animals, it is necessary to align forage inventories of each feed with animal numbers. To consistently do this it is critical to characterize and organize fields in a harvest schedule that captures each field when forage quality is high. This process needs to be dynamic, not static.

STEP ONE
Have the mindset that each and every field on the farm has the potential to produce feed appropriate for high-producing, lactating cattle. Factors, such as plant species and soil drainage, will certainly influence the likelihood of capturing that high quality. In the Northeast, where grasses and grass legume mixes are common, the general order for harvest is shown in Figure 1.

While grasses require the earliest harvest timing, well managed grasses continue to prove their merit in rations for high-producing lactating animals, with harvest timing being key to quality. "While grass species and variety selection, as well as fertilization issues are important, harvest management..."
will determine the success or failure of grass silage as high-producing dairy cow forage," reported Cherney and Cherney in a “Feeding Grass to Dairy Cows” article published by Forages.

Additionally, nitrogen management is instrumental in bolstering grass performance, according to “Fertilization of Perennial Grasses” by Cherney et al. in Forages.

Harvest timing for first harvest in the spring is critical to the quality of that cutting and to set the stage for subsequent harvest. Information on timing harvest is discussed in the PRO-DAIRY Forage Management Sheet: Monitoring 1st Cut Harvest Timing, found at: prodairy.cals.cornell.edu/production-management/resources.

**STEP TWO**

Acknowledge that despite our best intentions, some fields will not be harvested at optimum timing, leading to the need for a dynamic harvest plan. If we set the goal for maximum forage quality from each field, weather, logistics and other unknowns will likely provide you with the lower quality feeds you need for non-lactating animals. Furthermore, to be in the position of selling high-quality forage and buying lower quality forage is certainly desired over the inverse.

Many farms identify fields they anticipate to harvest for “heifer feed” in advance. These fields may contain more grass or may be poorly drained, causing harvest delays many years. While these fields are more likely to be harvested at a later stage on any given year, if you have planned this in advance, you have sealed their fate before the harvest season begins. This approach certainly assures you will have adequate feed of a quality suitable for non-lactating animals, but that should not be the goal. The goal should be to assure an abundance of lactating quality feed and let the rest play out as it may.

**TABLE 1**

Fields Ordered by Stand Comparison

<table>
<thead>
<tr>
<th>Field ID</th>
<th>Proposed Harvest Order</th>
<th>Species</th>
<th>Conditions When High Quality</th>
<th>2a. Rigid Harvest Schedule</th>
<th>2b. Dynamic Harvest Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Harvest</td>
<td>Delayed Harvest</td>
<td>Harvest</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>for Lactating Animals</td>
<td>for Non-Lactating Animals</td>
<td>for Lactating Animals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>1</td>
<td>100% Orchardgrass</td>
<td>Favorable for Harvest</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>100% Tall Fescue</td>
<td>Rain Delay</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>70% Grass, 30% Alfalfa</td>
<td>Favorable for Harvest</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>D</td>
<td>4</td>
<td>70% Grass, 30% Alfalfa</td>
<td>Favorable for Harvest</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>E</td>
<td>5</td>
<td>50% Grass, 50% Alfalfa</td>
<td>Favorable for Harvest</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>F</td>
<td>6</td>
<td>40% Grass, 60% Alfalfa</td>
<td>Rain Delay</td>
<td>*</td>
<td>X</td>
</tr>
<tr>
<td>G</td>
<td>7</td>
<td>30% Grass, 70% Alfalfa</td>
<td>Favorable for Harvest</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>H</td>
<td>8</td>
<td>20% Grass, 80% Alfalfa</td>
<td>Rain Delay</td>
<td>*</td>
<td>X</td>
</tr>
<tr>
<td>I</td>
<td>9</td>
<td>100% Alfalfa</td>
<td>Favorable for Harvest</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>J</td>
<td>10</td>
<td>100% Alfalfa</td>
<td>Equipment Breakdown</td>
<td>*</td>
<td>X</td>
</tr>
</tbody>
</table>

Table 1 illustrates a simple example of ordering 10 fields for harvest by stand composition, as well as a scenario of likely conditions at the time of harvest needed to achieve high-quality forage. In both cases the goal is to capture six fields at the desired high quality needed for lactating animals and four fields for non-lactating animals.

The Rigid Harvest Schedule in Table 2a depicts what is likely to happen when a set of fields (four fields) are predefined as non-lactating quality feed and consequently ignored at their optimum harvest timing. This leaves six fields to meet the needs of lactating animals. However, a not uncommon scenario

Continued on page 6
Strategic Forage Storage Planning
By Joe Lawrence and Ron Kuck

The dairy and livestock industries have seen continued advances in options available to improve forage management, from crop species and variety selection, to harvest management, to recognizing the class of animals on the farm that will most benefit from different forage types and qualities.

A shift away from upright silos over the last several decades has largely been driven by the need to store increased quantities of feed and to increase the speed of filling and feeding out. The tradeoff in this is storage systems that provide more efficiency and flexibility present additional challenges to preserve the forage, particularly with horizontal silos (bunks and drive-over piles). As a result, a number of resources developed focus on how to minimize storage losses. These efforts include strategies to improve packing density, use of inoculants and preservatives, options to cover, and strategies to minimize exposure to oxygen at feed out. All of these remain critical and should continue to be a high priority for every farm. However, as producers look to get the most out of recent and forthcoming advances to forage management, an area that warrants more discussion is how to store these feeds in a way that optimizes feeding programs.

The ability to develop and maintain the number of storage options necessary to adequately separate forages is a challenge, particularly for farms experiencing change. This challenge is intensified by the fact that it is also an area of the farm where implementing such changes can be very difficult. Regardless of forage storage structures used by a farm, all available options require a sizable footprint, are often capital intensive, and are fairly rigid in location and capacity. These commonalities often challenge a farm’s ability to adapt their storage options to match the advances made in forage production and feeding programs.

Fortunately, the wide-ranging approaches to operating a farm has fostered the development of many different options for forage storage. While there are inherent characteristics of certain storage systems that make sense for certain farms, the ability to consider all of the options can help overcome some of the limitations associated with each system. Regardless of farm size and management, a mix-and-match approach warrants consideration and no farm should rule out any storage options.

In developing or updating a storage plan, a number of considerations and ways to attack the planning process depend on current status. The various attributes of commonly available storage options are known by most, but a review of the main points will assist in thinking about how each option may have a place on your farm (Table 1).
ANIMAL CLASS
FEED REQUIRED FOR EACH TYPES AND QUANTITY OF desired forage qualities.

Work with your farm’s nutrition team to develop a list of forages most desirable for each group of animals and the quantities needed. Not every animal benefits from the high quality desired for lactating cows, and when these forages can be targeted to the correct group (dry cows or young stock) their value to the farm is enhanced.

In doing this, keep in mind the need to balance what crops will work best for the animals with your land base and management system. Frequently debated examples include the use of highly digestible crops, such as BMR corn and low-lignin alfalfas. Other important options include the use of grasses (alone or with alfalfa), double-cropping with winter grains for forage, and summer annuals.

The ability of the harvest team to execute the plan needed to harvest at the proper quality is also important. This question will mean different things to different farms but will include labor availability, equipment, timing with other farm activities (i.e., first cutting or manure hauling) and length of time needed to harvest. Similar to the mix-and-match approach to storage structures, utilizing custom services does not have to be an all-or-nothing strategy. The access to custom harvesting and equipment rentals can facilitate this approach while minimizing capital investments. Targeted use of custom service providers for certain tasks or times of the year can effectively reduce the effect of bottlenecks and achieve desired forage qualities.

MAPPING OUT STORAGE OPTIONS AND NEEDS

A useful exercise for all farms is to evaluate current storage options and strategize what modifications or additions could enhance their storage system. While this exercise is often prompted by the need for additional space, modifications to better meet current needs can pay large dividends.

When considering modifications or additions, look at the feed system in the context of the whole farm layout.

Is this crop a good fit on my soils? How many tons of this will I need, keeping in mind shrink and carryover needs? Do I have enough acres to support these needs and at what cost?

The following table outlines the opportunities and challenges of various storage structures for the dairy manager. The table is designed to help you evaluate your current storage needs and consider potential modifications or additions.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Opportunities</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upright Silos</strong></td>
<td>• Small footprint</td>
<td>• Cost per unit of storage</td>
</tr>
<tr>
<td></td>
<td>• Ease of maintaining feed quality in storage</td>
<td>• Inflexibility once built</td>
</tr>
<tr>
<td></td>
<td>• Repurpose existing facilities for classes of animal or feeds needed in smaller quantities</td>
<td>• Stuck feeding whatever is in that layer of silo</td>
</tr>
<tr>
<td><strong>Wrapped Bales (Baleage)</strong></td>
<td>• Flexibility at feed out</td>
<td>• Wildlife damage</td>
</tr>
<tr>
<td></td>
<td>• Can be moved to and from remote locations</td>
<td>• Feed variability from bale to bale</td>
</tr>
<tr>
<td></td>
<td>• Ease of maintaining feed quality in storage</td>
<td>• Requires specific equipment that is only applicable to certain forages</td>
</tr>
<tr>
<td></td>
<td>• Less capital cost</td>
<td></td>
</tr>
<tr>
<td><strong>Silo Bags</strong></td>
<td>• Flexibility in segregating different quality forages at harvest</td>
<td>• Footprint</td>
</tr>
<tr>
<td></td>
<td>• Flexibility at feed out</td>
<td>• Best used with a good base under bags</td>
</tr>
<tr>
<td></td>
<td>• Ease of maintaining feed quality in storage</td>
<td>• Annual cost</td>
</tr>
<tr>
<td></td>
<td>• Expandability</td>
<td>• Wildlife damage</td>
</tr>
<tr>
<td></td>
<td>• Less capital cost</td>
<td>• Small face leads to variability in forage at feed out</td>
</tr>
<tr>
<td><strong>Bunk Silos</strong></td>
<td>• Cost efficiency per unit of forage</td>
<td>• Matching filling equipment to bagger options for larger acreage</td>
</tr>
<tr>
<td></td>
<td>• Potential for segregation of different quality forages at harvest</td>
<td>• Capital cost</td>
</tr>
<tr>
<td></td>
<td>• Potential for flexibility at feedout</td>
<td>• Ability to adapt once built</td>
</tr>
<tr>
<td></td>
<td>• Uniformity of feed nutrient profile at feedout</td>
<td>• Maintaining feed quality in storage</td>
</tr>
<tr>
<td></td>
<td>• Ability to access target feeds at certain times of the year</td>
<td>• Ability to access target feeds at certain times of the year</td>
</tr>
<tr>
<td><strong>Drive-over Piles</strong></td>
<td>• Cost efficiency per unit of forage</td>
<td>• Require a good base</td>
</tr>
<tr>
<td></td>
<td>• Expandability</td>
<td>• Footprint</td>
</tr>
<tr>
<td></td>
<td>• Ability to segregate different quality forages at harvest</td>
<td>• Maintaining feed quality in storage</td>
</tr>
<tr>
<td></td>
<td>• Flexibility at feed out</td>
<td>• Controlling face size at feedout</td>
</tr>
<tr>
<td></td>
<td>• Uniformity of feed nutrient profile at feedout</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 1
Storage Opportunities and Challenges

**continued on page 8**
Alfalfa-Grass Mixtures – 2017 Update

By Jerry Cherney, Debbie Cherney and Ken Paddock

While almost 90 percent of alfalfa acreage in New York is sown with a perennial grass, alfalfa acreage in the rest of the U.S. may average more than 90 percent pure alfalfa. Interest appears to be growing in alfalfa-grass mixtures across the northern tier of states. Until recently, little research has been conducted on grass species selection or management of mixtures. 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.

MEADOW FESCUE POTENTIAL FOR MIXTURES

Although meadow fescue was promoted by a USDA Bulletin as early as 1909, it dropped out of use in the U.S. decades ago primarily due to reduced yield, compared to other grasses. It can be grown in areas suitable for timothy, and it 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 feeding trials in New York and Wisconsin show that mixtures can be an excellent forage for lactating dairy cattle.

Meadow fescue has higher fiber digestibility (NDFD) than most other grasses grown with alfalfa in the northern U.S. Feeding trials across the U.S. show 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.

2017 TRIALS

Alfalfa-grass studies were conducted at several sites across New York in 2017.
taking three to four cuts per season. Alfalfa comparisons included HarvXtra with one or more other higher quality alfalfa varieties. Alfalfas were sown with from three to seven grass varieties in binary mixtures, including meadow fescue, tall fescue, orchardgrass, festulolium, reed canarygrass and timothy.

**YIELD ANALYSIS**

Alfalfa–grass yield differences in first production year stands ranged across trials from 4.1 to 5.2 tons DM/acre in 2017. In mixtures, HarvXtra yielded less than other alfalfas at one site, more than other alfalfas at a second site, and similar to other alfalfas at a third site. However, these yield differences were primarily due to differences in grass percentage in mixtures.

Orchardgrass–alfalfa mixtures often yield more than other grass mixtures with alfalfa. This is because the grass percentage usually is higher for orchardgrass–alfalfa mixtures. On average, seasonal DM yield has increased from 0.1 to 0.4 tons/acre for every 10 percentage unit increase in grass percentage in the mix, assuming soil fertility is relatively high.

While tall fescue almost always yields higher than meadow fescue in pure stands, meadow fescue often yields higher than tall fescue in mixtures with alfalfa. Again, this is primarily due to grass percentage. In 2017 at three sites, meadow fescue averaged 9 percentage units higher grass percentage than tall fescue sown with alfalfa.

One exception to this was Tetrax tetraploid meadow fescue, which was 7 percentage units lower in grass percentage than tall fescue at the one site that included both of these fescues. In general, grass percentage was excessive in 2017, averaging over 50 percent. A relatively wet growing season favored grass growth over alfalfa, especially on fertile soils.

**QUALITY ANALYSIS**

Across three trials in 2017 HarvXtra averaged 4.8 percent higher NDFD (48-hour digestion) and 12 percent lower lignin, compared to other alfalfa varieties in these trials. Over the past two years HarvXtra has been consistently between 10 and 15 percent lower in lignin than other alfalfas, but NDFD differences are smaller and more variable. For individual harvests, HarvXtra occasionally is not significantly higher in NDFD than other alfalfas, although it has always been significantly higher than other alfalfas when averaged over the season.

Meadow fescue is consistently higher quality than other commonly used grasses in mixture with alfalfa. At two sites where grass lignin was measured, meadow fescue averaged 21 percent lower lignin than other grasses. Across three first production year sites, meadow fescue averaged 8.8 percent higher NDFD than other grasses. Tetrax meadow fescue was significantly higher in NDFD at one site where it was compared with two other meadow fescues.

As the grass percentage increases in a mixed stand, less nitrogen is available for grass from alfalfa, and also more grass competes for the limited available N. Soil fertility also impacts crude protein (CP) content of grass in mixtures (Figure 1). As the high CP alfalfa percentage decreases, grass CP decreases and total mixed forage CP drops correspondingly. However, CP remains at a sufficiently high level in the mixed forage, up to at least 40 percent grass.

**EVALUATING THE BENEFIT OF HARVXTRA VERSUS MEADOW FESCUE**

It is possible to calculate the increase in NDFD from adding either HarvXtra or meadow fescue to an alfalfa–grass mixture (Figure 2). For three sites in 2017, average alfalfa and grass NDFD (without HarvXtra or meadow fescue included) was 53 percent and 68 percent. With a 30 percent grass mixture (optimum mix), using HarvXtra increases total forage NDFD from 57.5 to 61 percent, or a 6 percent increase. Average NDFD over three to four cuts per season in 2017 was determined by weighting NDFD for yields, so higher yielding spring-cut forage counts more in the NDFD averages.

**SUMMARY**

Mixtures can increase both yield and quality of forage stands. Ideally we would like 20 to 30 percent grass, but grass percent in mixed stands is strongly influenced by environmental conditions. Average grass percentage of stands in the spring can be double

Continued on page 10

**FIGURE 1**

Grass CP in mixtures is influenced by soil fertility and by grass percentage in the mixture

**FIGURE 2**

The benefit of using HarvXtra alfalfa or meadow fescue in alfalfa-grass mixtures is influenced by the grass percentage of the mixture.
Alfalfa-Grass Mixtures – 2017 Update, cont’d from page 9

that of the previous fall.

Grass CP content is 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 percent grass is still likely to have an acceptably high CP content.

Grass has considerably higher fiber digestibility than alfalfa. If less than 15 percent grass in a mixture is anticipated, grass species/variety selection will probably not significantly influence NDFD of the total mixed forage. Conversely, with more than about 60 percent grass in an alfalfa-grass mixture, alfalfa variety selection will likely not significantly influence NDFD of the total mixture.

Regardless of the grass species used, a grass percentage as low as 5 percent can still result in a significant increase in total forage fiber digestibility (one percentage unit NDFD) of a mixture. Switching from a lower quality grass to a higher quality grass such as meadow fescue can impact forage quality as much as a switch from an average alfalfa to a higher quality reduced-lignin alfalfa.

ACKNOWLEDGMENTS

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

Jerry Cherney (jhc5@cornell.edu) is a Soil and Crop Sciences Professor at Cornell University. Debbie Cherney (djc6@cornell.edu) is an Animal Science Professor at Cornell University. Ken Paddock (kmp6@cornell.edu) is a Soil and Crop Sciences Research Support Specialist at Cornell University.
Especially for corn silage yield data, use of raw data without proper cleaning can lead to substantial over and underprediction of actual yield, depending on the field and harvest conditions. Figure 1 shows this in more detail for a number of fields. Look at a 20 ton/acre corn silage yield (cleaned yield) for the fields in this figure, and you will see that the raw data corresponding to this cleaned yield can range from 15 to 37 tons/acre! The raw data for many of the fields in this figure overpredicted yield, while for some fields it actually underpredicted. Thus, data cleaning is absolutely necessary.

In the past months the Cornell Nutrient Management Spear Program, in collaboration with colleagues at the University of Missouri and the Iowa Soybean Association, evaluated cleaning protocols to develop a standardized and semi-automated procedure that allows cleaning of datasets for whole farm yield data recording. The protocol developed for whole farm data cleaning calls for unfiltered or “raw” harvest data files that are downloaded from the yield monitor with corresponding field boundary files. These files are read into the Ag Leader Technology Spatial Management System (SMS) software to preview the yield map and reassign any harvest data that might show up in the wrong field. Next, the individual field harvest data are exported as an Ag Leader Advanced file format. The yield map files are then imported into Yield Editor (ars.usda.gov/research/software/download/?softwareid=370) for cleaning. Yield Editor is a software developed by the United States Department of Agricultural Research Service (USDA-ARS). The software allows for use of different filters to remove the errors mentioned above. After cleaning of the data in Yield Editor, the cleaned datasets are exported to MS Excel and data points with zero moisture (for grain) and 45 percent moisture or less (for forage) are deleted. This final step is particularly important to obtain accurate corn silage yield data.

A step-by-step protocol for cleaning individual field datasets and batch processing of harvest data from growers with large numbers of corn silage or grain fields will be described in a manual that will be available to download from the Cornell Nutrient Management Spear Program website (nmsp.cals.cornell.edu). For a training session in New York on the cleaning protocol, contact Quirine M. Ketterings at qmk2@cornell.edu.

Quirine Ketterings, Tulsi Kharel and Sheryl Swink are with the Cornell Nutrient Management Spear Program. Karl Czymmek is with the Cornell Nutrient Management Spear Program and Cornell CALS PRO-DAIRY.

What Do New York Corn Fields Really Yield? The Case for Using Yield Monitors
By Quirine Ketterings, Karl Czymmek, Tulsi Kharel and Sheryl Swink

Corn silage and grain yields have steadily increased since World War II (Figure 1 on next page) with a slightly greater increase per year for corn grain than for corn silage, possibly reflecting an emphasis on corn grain improvement by plant breeders in the past decades.

With an increase in yield comes the question: Has the ability of improved crop varieties to explore the soil for nutrients kept up with higher yield or do we need to supply more N fertilizer to meet N needs? Further, we need to look at what differences in field traits (within and between fields) affect yield beyond the hybrid selected and the N fertilizer or manure that was applied. Nationwide evaluation of N use shows that overall farmers are using the same average fertilizer N rates, even while yields have been increasing. How are
Forage Production and Storage

What Do New York Corn Fields Really Yield? cont’d from page 11

we doing in silage production areas such as New York State?
Before we can answer these questions, we need to know the actual yield levels for corn grown for grain and corn grown and harvested for silage. We also need to know how stable yields are from year to year as fields that deliver stable yield results will likely require different management from fields that yield low one year and high the next, depending on the growing season.

With a growing number of choppers joining the fleet of combines with yield monitors we now have the opportunity to summarize large yield datasets to help update several important issues. These include the ability to generate an updated general yield potential database, the opportunity for farms to develop and maintain their own yield potential database, and the ability to more quickly test if higher yielding fields, zones within fields, or specific varieties, need higher N applications to meet or exceed potentials.

The first requirement when working with yield monitors is to make sure they are calibrated regularly. However, even with well-calibrated equipment, yield data from monitors will need to be combed for obvious errors through a cleaning process. An example is shown in Figure 2, where data cleaning changed the reported yield by more than five tons of corn silage per acre. To ensure we use the best possible data, cleaning protocols were developed recently for both grain and silage that now allow for fairly quick checking and cleaning of data for all corn yield data on a farm in a particular harvest year. A manual that will help producers or consulting companies do this will be released in early 2018 (See page 11 for more information.)

With this new data cleaning process, the Nutrient Management Spear Program in partnership with farmers and consulting firms, is now analyzing data from test farms located in northern New York through a grant supported by the Northern New York Agriculture Development Program. The hope is to expand this beyond the farmers currently involved, and thus, over the coming years create a statewide database for corn grain and/or corn silage yields per soil type. Once data are cleaned, we can create yield frequency histograms (Figure 3). This type of histogram shows the range of yields and how many fields with this soil type provided a certain yield. For example, in the case of the Hogansburg soil shown in Figure 3 (N=43), the average yield was 19.9 tons/acre while five fields out of 43 yielded more than 25 tons/acre and one field averaged 27.5 tons/acre (maximum reported for the example

FIGURE 1
New York State average corn silage and grain yields over time show a steady increase from 1948 to 2015 in silage and grain yields, but also large year-to-year variation.
Yield data source: New York State Agricultural Statistics Service

FIGURE 2
A consistent data cleaning process is essential to create reliable multi-field and multi-year yield maps

Knowing yield is key

Mean raw wet yield: 22.05 ton/acre. This became 16.75 tons/acre with data points > 40 tons/acre removed.

Original data from yield monitor (no filters, only set maximum yield at 40 wet tons/acre to eliminate extreme yield errors) – raw data contained points with up to 3,393 tons/acre!
More Manure Storage? Consider Your Operation and Your Neighbor’s Concerns

By Peter Wright

Recycling dairy nutrients back to the land needs to be timely to preserve nitrogen and to avoid environmental losses. Manure storages are an integral part of the manure management system on the farm to make sure this is possible. Nutrients, particularly nitrogen, should be applied as close to the plant’s use as possible to reduce the potential for emission, runoff and leaching losses. Fall, winter and wet weather manure spreading have the potential for significant losses to the environment. Manure storage until right before the growing season, with a premium on storage locations that allow quick and efficient spreading when the time is appropriate, should be part of every manure management system.

Additional storage either at the farmstead or convenient to fields needs to be evaluated carefully. Many farms already have some manure storage. The site selection needs to consider how the storage will be loaded and unloaded. Pumps and pipe systems add versatility to where manure storages can be located. Powerful pump systems are available that can increase the effective range in locations where manure storages can be placed on the farm or on neighboring farms. If manure is pumped, manure and bedding consistency, as well as potential treatment systems, need to be planned for and considered. Sand-laden dairy manure (SLDM) has an impact on pumped and gravity flow systems. Bedding amount and type influences how far and how high manure can be easily pumped. Solid liquid separation (SLS) systems may need to be considered as part of the system. Manure at less than 4 percent solids is much easier to pump than dairy manure as produced at 12 percent solids. Plans for additional treatment for nutrient concentration, energy sharing are available through the NMSP website (nmsp.cals.cornell.edu/NYOnFarmResearchPartnership/YieldDatabase.html). The data-processing protocol will be added to this page once completed.

ACKNOWLEDGEMENTS

We thank the farmers and farm consultants who participated in the yield potential evaluation project. For questions about these results contact Quirine M. Ketterings at 607.255.3061 or qmk2@cornell.edu. Visit the Cornell Nutrient Management Spear Program website at: nmsp.cals.cornell.edu.

Quirine Ketterings, Tulsi Kharel and Sheryl Swink are with the Cornell Nutrient Management Spear Program. Karl Czymmek is with the Cornell Nutrient Management Spear Program and Cornell CALS PRO-DAIRY.
production, and/or odor control may also be considered. Route any pipes so that they can be monitored during pumping. Locate pumps so they can be monitored if automatic safety equipment fails.

The size of the storage should be determined with the help of your nutrient management planner and/or engineer. It should be sized to meet the production of the cows and the land base on which the nutrients will be utilized. Consider the possibility of increased manure production in the future. Satellite storages for more remote field complexes need to have enough storage for the manure to be spread, plus any precipitation for the storage period. If they will only be emptied once a year, the year’s precipitation will need to be added.

Use the Natural Resources Conservation Service (NRCS) Standard for Waste Storage Facilities as a minimum for design. In general, a square (or round) and deep storage will have the most volume for the least construction cost. A shallow storage will collect more precipitation and have a larger perimeter. The design for the storage should include more than the average precipitation. During wet years additional storage is often needed. Extreme events need to be planned for so the potential for overtopping is reduced. Capacity for at least the 25-year event is often required. Preparations for a 100-year-event capacity will give additional peace of mind. Preparations for a 100-year-event capacity will give additional peace of mind. Alternatively a floating cover may be considered to prevent additional precipitation from entering the storage. Covers should only be considered in conjunction with SLS. They also can mitigate for odors and trap greenhouse gases.

Safety concerns include limiting access and protecting from the potential of harmful gas concentrations. Fences and warning signs to prevent people, equipment and animals from accidentally entering the storage or confined spaces are needed. Protect against vandalism by limiting access to valves and pumps. Access road entrances should have enough sight distance to allow traffic to adjust to farm equipment and hardened enough to prevent mud from tracking into the roadway. Work with local authorities to take steps to protect high-traffic and frequent-turn areas.

Gravity out systems bring an additional safety concern as valve failures have allowed the release of large flows of manure. With the improvement and prevalence of pumps (and the need to homogenize the storage to get a uniform nutrient application), the usefulness of gravity flow for unloading has declined. Pumped loading to a higher storage has the same potential if the valves fail (unless there is a designed air gap in the system as it enters the storage). The stored manure can flow back down catastrophically. Locate the storage to provide room and/or facilities so that unintentional minor or major spills can be intercepted and mitigated before they enter a water course or a floodplain. Unloading areas should be graded back to the storage so that any spillage will not escape or contaminate the clean water drainage around the storage.

Storing solid or frozen manure requires access to the storage over the top, and this needs to be built into the design. Use of SLM and other settling solids in the bedding (or even a large storage that agitators can’t stir completely) need access to the bottom for solids removal. Ramps that will be traveled in and out of the storage by manure hauling equipment should be at least 8:1 and roughened for traction. Ramps that are used occasionally to move pumps, agitators
or solid handling equipment should be at least 4:1 for safety. If the pumping and agitating equipment is just lowered down the sides, the hardened area can match the side slopes.

Test pits are needed to determine the soil characteristics and the presence of ground water or bedrock to properly design the storage. The test pits should go at least two feet deeper than the bottom of the storage. Bedrock should be two feet lower than the bottom of the storage and even deeper (or use an impermeable bottom) if the bedrock is fractured and has solution channels. Groundwater control is very important. If groundwater enters the storage, it will fill the storage prematurely, and will add to time and cost of hauling to fields. Groundwater movement through the banks of the storage can collapse the bank and make channels for manure water to leak out. Seepage layers need to be identified and a drainage system needs to be designed to keep the groundwater out.

Soil samples should be taken to test the soil for adequate impermeability. If the soils are too permeable, it may be possible to find suitable material nearby. If testing confirms, material for a borrow pit can be hauled to the site to construct an earthen liner. Some earth materials can be modified by adding a specific amount of bentonite to decrease the permeability. An impermeable high-density plastic liner can be placed at an additional cost if the existing or modified earth cannot be made impermeable enough. Plastic-lined storages will need concrete agitation areas or a concrete floor to remove solids. Concrete or metal structures will be needed if the site requires.

Select a site that is compatible with the community. Work with your nutrient management planner and engineer to find the best location. Follow all local zoning regulations. Avoid sensitive environmental areas. Keeping the storage out of sight goes a long way to reduce community objections. Use a long access road, locate it behind a view screen of trees or buildings, or have the berm or wall high enough to prevent the manure from sight of road or houses. Consider the prevailing winds. Locate the storage to get the greatest downwind distance from occupied structures that is practical. Adjusting the dimensions of the surface area to reduce the exposure to any odor receptor reduces odor potential. The surface area of the storage can be minimized by making it deeper. Air drainage needs to be considered as well. During low-wind conditions, heavier-than-air odorous gases can flow much like water, down from a storage to surround a low-lying area. This can be particularly unpleasant when it permeates residences.

Properly planned and designed manure storages will improve the efficiency of recycling manure back to the land for optimum nutrient benefit. Placing the manure storage where the neighbors can’t see or smell it will help keep good neighbor relations. Determining the soil conditions that don’t require extra modification or structural components can keep costs lower. Finding the right site is so important that some farmers might actually buy the land with these conditions so a satellite storage can be installed to benefit the dairy enterprise.

For information on funding assistance for the engineering of manure storages in New York State visit: prodairy.cals.cornell.edu/dairy-acceleration.

For more information on resources for construction of manure storages, contact your local Soil and Water Conservation office and USDA NRCS office or visit: agriculture.ny.gov/FAQ-manure_storage.pdf#_blank.

Peter Wright (pew2@cornell.edu) is an Agricultural Engineer with Cornell CALS PRO-DAIRY.
DECREASED GROWTH PERFORMANCE, DIGESTIVE UPSETS, CALVES OFF FEED...

The underlying cause may be silent and deadly; large numbers of Clostridium perfringens type A have been isolated from calves affected by these syndromes.

Prepare now with Baciflex®-Calf, a non-antibiotic direct-fed microbial that uses proprietary strains of Bacillus to defend against clostridia.

THE BACIFLEX-CALF ADVANTAGE

- Targets C. perfringens type A
- Fewer calves off feed
- Improves intestinal balance
- Nutritional benefits enhance immune function
- Increases performance as well as Neo-Terra
- Deliverable through milk, milk replacer, and milk supplements

BACIFLEX®
Clostridial Defense
Calf

1-800-888-3688 • BACIFLEX-CALF.COM