

# What's Cropping Up?

A NEWSLETTER FOR NEW YORK FIELD CROPS & SOILS

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## Western Bean Cutworm and Mycotoxin Screening 2017 New York and Vermont Corn Silage Hybrid Trials

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Mold and mycotoxin development in corn ears and the resulting corn silage continues to be a major concern for dairy producers. Mycotoxins can result in a range of problems for livestock throughout the year as they are ingested with the feed. The presence of mold does not always have a strong correlation to mycotoxin development but it does present the chance for incidence to occur.

A number of factors influence the prevalence of molds from year to year. Conducive weather conditions for mold and mycotoxin development are outside the control of management options. But hybrid characteristics and physical damage to the ears can be managed through the selection of hybrids and pest resistance traits in the hybrids.

The presence of Western Bean Cutworm (WBC) in NY corn fields continues to expand as shown in the WBC Pheromone Trap Network coordinated by the NYS

IPM program, though the insect's apparent population varies significantly across the state (Figure 1).

Where WBC populations are high, the corresponding ear damage from WBC feeding can leave wounded corn ears more susceptible to pathogen development, but a clear relationship between ear damage and mycotoxin development has not been documented. A number of mold species may develop on corn ears

### Field Crop Production

Western Bean Cutworm and Mycotoxin Screening: 2017 New York and Vermont Corn Silage Hybrid Trials ..... 21 -23

Anatomy of a Wet Year: Insights from New York Farmers ..... 24 - 27

No-Till Organic Wheat Continues to Have Low Weed Densities in Early Spring (April 9) at the Tillering Stage (GS 2-3) ..... 36 - 37

More Rapid Emergence but Lower Early Plant Densities (V1 Stage) in Organic Compared to Conventional 2018 Soybean ..... 38 - 40

### Forage Production

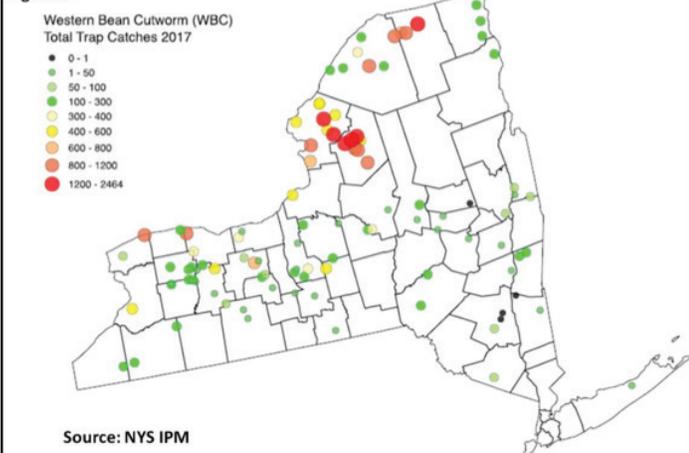
Forage Quality of Spring Growth ..... 28 - 31

### Nutrient Management

Soil Nitrate at Harvest of Forage Winter Cereals is Related to Yield and Nitrogen Application at Green-up ..... 32 - 33

Spring N Management is Important for Triticale Forage Performance Regardless of Fall Management ..... 34 - 35

Figure 1



## Field Crop Production

and a relatively few of these produce mycotoxins. Principal concern in New York is with the mycotoxins deoxynivalenol (DON or vomitoxin) and zearalenone, both produced by the fungus *Fusarium graminearum*.

While WBC damage to corn ears can be significant and may have detrimental effects on corn grain yield and quality, the economic impact on corn silage is less understood. For corn silage growers, understanding whether or not this pest significantly impacts the yield or quality of the forage is critical to their decision making for managing this pest.

Since the Cry1F protein, which has most commonly been utilized for protection against numerous corn insect pests, has been found to be ineffective against WBC, producers are left with limited management options. Currently the Vip3A trait in select corn hybrids in combination with a scout and spray program is the best option for WBC management in areas where the pest is prevalent.

The Commercial Corn Silage Testing program conducted by Cornell University in collaboration with the University of Vermont and the Northeast dairy industry offers a good opportunity to evaluate numerous hybrids for ear damage from WBC and mycotoxins. This was done in 2017 with support from both the New York Corn Growers Association and the Northern New York Agricultural Development Program.

In 2017, 49 hybrids were selected and planted in replicated plots at two locations in NY (Aurora and Madrid). Each plot was scouted prior to harvest for WBC feeding damage to the ears. Composite samples, of whole plant silage, for each hybrid were taken at harvest and submitted to the Dairy One forage laboratory for a mycotoxin screening package which included aflatoxins B1, B2, G1, G2, vomitoxin, 3-acetyl DON, 15-acetyl DON, zearalenone, and T2 toxin.

The results of the WBC and

mycotoxin screening project revealed large differences in the number of hybrids damaged by WBC, but surprisingly few hybrids tested positive for measurable mycotoxins (Table 1).

The most prevalent species of mycotoxin-producing mold found in the screening was *Fusarium graminearum* which can also infect corn ears through the silk channels at the time of pollination during favorable weather conditions and result in contamination of the grain and silage with the mycotoxins DON, 3-ADON, 15-ADON, or zearalenone. A review of the 2017 weather data at both trial sites showed wet conditions conducive to this type of infection. As expected for New York, no aflatoxins were detected.

While there are numerous ways in which molds can establish themselves in forages, this study reflects a common challenge researchers face while attempting to document the conditions where mycotoxin development is likely. Recognizing that results are specific to the growing season experienced in 2017, which was conducive for silk channel infections. A different relationship between WBC damage and mycotoxin development may be found during a growing season less conducive to silk channel infections. These results from one year of data do not provide strong evidence that WBC damage is a significant concern for corn silage growers who are worried about mycotoxins in their silage. Multiyear studies, including years of varying weather conditions, are required for further evaluating these risks and providing recommendations. It is also important to note that these results do not reflect what may occur in corn harvested for grain as the time between silage harvest and grain harvest

**Table 1.** 2017 Hybrid Screening for Western Bean Cutworm and Mycotoxins

	<b>Aurora</b>	<b>Madrid</b>
<b>WBC Trap Counts (seasonal total)</b>	<b>211</b>	<b>356</b>
<b># Hybrids</b>	<b>49</b>	<b>49</b>
<b># Hybrids with WBC Damage</b>	<b>14 (28.6%)</b>	<b>32 (65.3%)</b>
	<b>Total Hybrids</b>	<b>17 (34.6%)</b>
<b>Hybrids Positive Mycotoxins DON or zearalenone</b>		<b>19 (38.8%)</b>
	<b>NO WBC Damage</b>	<b>13</b>
	<b>WBC Damage Present</b>	<b>4</b>
		<b>13</b>

offers additional opportunities for infection and growth.

Additionally, there was no correlation between crop yield or starch content with WBC damage in this study. Growers should continue to scout for this pest and weigh the cost of control with the potential for damage.

An article addressing integrated pest management (IPM) practices for WBC has been generated by the NYS IPM team.

Integrated Pest Management for Western Bean Cutworm (*Richia albicosta*) <https://blogs.cornell.edu/ipmwpr/> .

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### Key Findings

- The 2017 heavy rainfalls and flooding impacted farms across New York State
- Crops grown on clayey soils suffered an estimated 53% loss in crop yield and crops grown on gravelly, sandy or siltier soils suffered estimated crop yield losses of 25% or less
- In addition to yield losses, 95% of farmers said the *quality* of their crop was negatively impacted
- 30% of farmers said they would have increased their drainage infrastructure, including adding tiling and drainage ditches, if they had known how wet 2017 would be

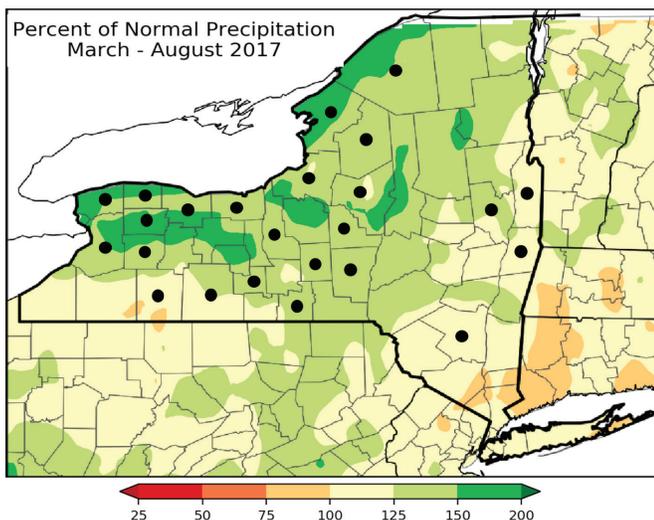
### Background

A wet spring, followed by higher than average precipitation and heavy rainfall events (e.g. the heaviest 1% of all daily rainfall events) during the 2017 growing season ([NRCC](#)) led to saturated soils and flooding on many farms throughout New York State (NY). The frequency of heavy rainfall events have already increased by 71% in NY over the last half century ([NCA 2014](#)), and this trend is predicted to continue in the future ([Wuebbles et al. 2014](#)). Given this, and to get a sense of how farmers were affected by these conditions, as well as how they coped, we surveyed farmers across NY State throughout September of

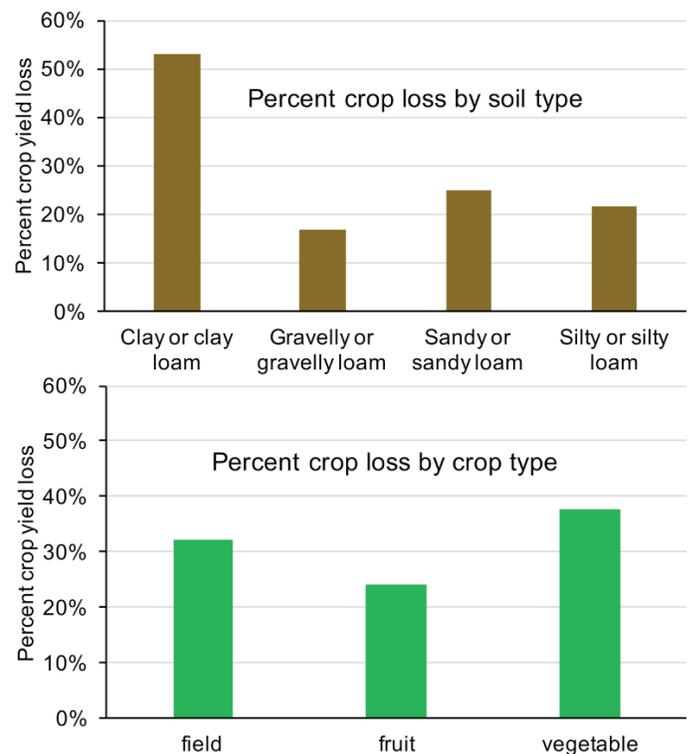
2017. The survey was distributed online and in paper format with help from Cornell Cooperative Extension, The Farm Bureau, and New York State Department of Agriculture & Markets. A majority of the 45 farms in 24 counties were in areas of the state that experienced the heaviest rainfalls, and we had fewer responses from farms in the Adirondacks region and southeastern part of the state, where heavy rains and flooding were less prevalent (Fig. 1).

### Heavy rainfall and flooding impact

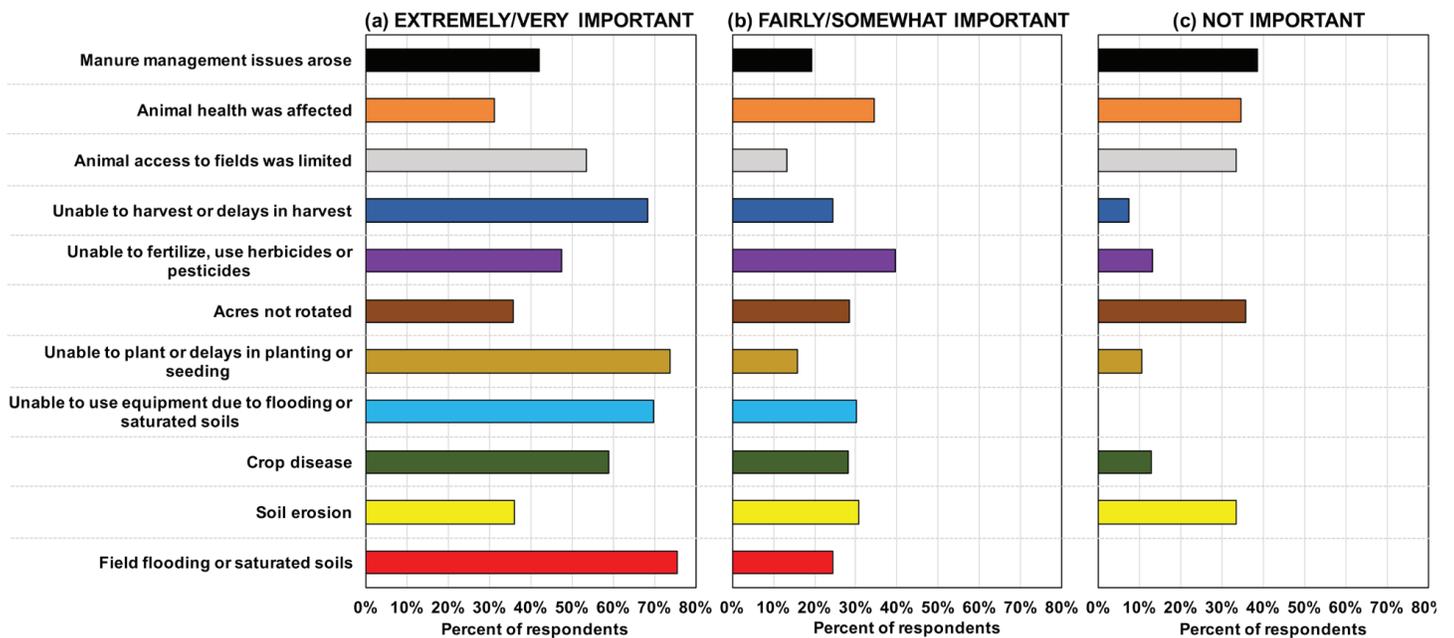
Of the farmers surveyed, those with heavier clay soils estimated crop yield losses of 53%. More gravelly soils led to lesser yield losses (17%), and for crops grown on siltier or sandier soils farmers estimated yield losses of 22 to 25%. Vegetable, field, and fruit crops suffered estimated yield losses of 38%, 32%, and 24%, respectively (Fig. 2). Importantly, 95% of farmers said the *quality* of their crop was negatively impacted by issues related to the heavy rainfalls in 2017 (see Fig. 3 for list of 'issues').



**Fig. 1.** New York State percent of normal precipitation for March through August of 2017 (map provided by the [NRCC](#)). Black dots indicate counties where farmers responded to our survey.



**Fig. 2.** Percent crop yield loss by soil type (top) and crop type (bottom).

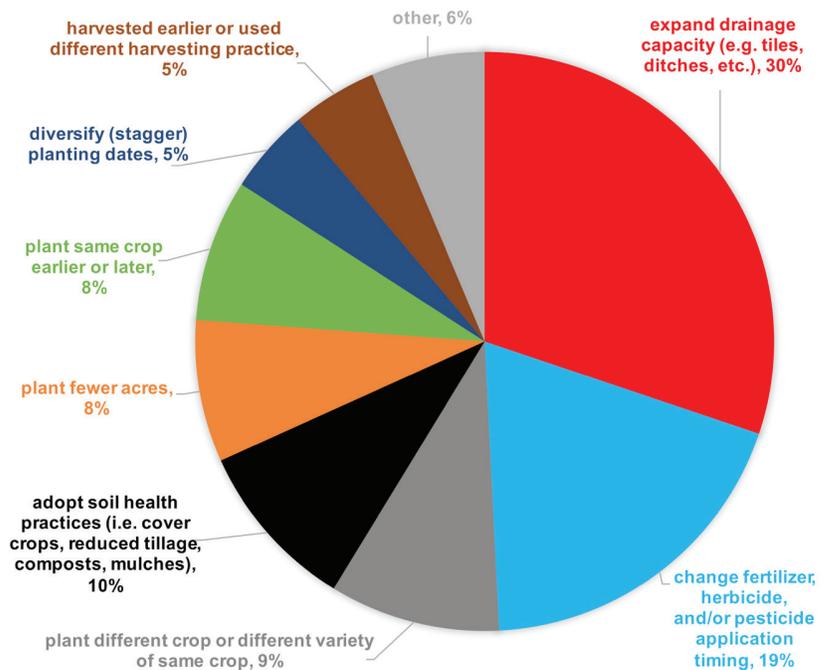


**Fig. 3.** Response to the survey question “How important are these issues {listed on figure} related to heavy rainfalls in 2017 in terms of economic impact on your farm?”. Figure shows percent of farmers rating the issues as (a) extremely + very important, (b) fairly + somewhat important, and (c) not important.

When asked what the economic impact of the heavy rainfalls was on their farm, 80% of farmers said it was either “moderate” or “severe”, 17% said it was “minor”, and 3% said the heavy rainfalls were merely a “nuisance” and had almost no economic impact. In rating the importance of various issues related to heavy rainfalls in 2017 in terms of economic impact on their farm, over half of the farmers rated saturated soils and field flooding, delays in or inability to plant or harvest, inability to use equipment, lack of field access, and crop disease as “extremely or very” important (Fig. 3).

### Adaptive capacity

82% of farmers said they use drainage ditches or drainage tile to help deal with heavy rainfalls, yet over half of farmers said they did not have enough infrastructure and/or equipment to deal with heavy rainfalls. Further,



**Fig. 4.** Response to the survey question “What might you have done differently if you had known how wet this summer would be?”. The “other” responses included: plant more acres, plant in different location, and increase greenhouse infrastructure.

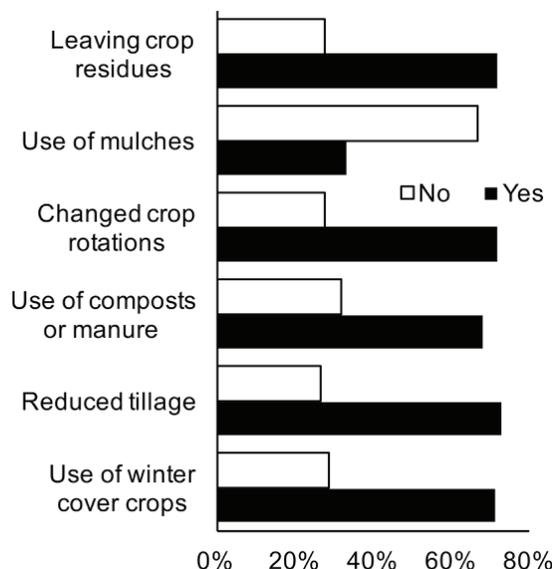
## Crop Production

70% of farmers said the 2017 heavy rainfalls led to the recognition of weaknesses or limitations in the infrastructure on their farm, particularly in relation to manure management and drainage infrastructure. And when asked what they would have done differently if they had known how wet 2017 would be there was a variety of responses (Fig. 4). Nearly 1/3<sup>rd</sup> of farmers said they would have expanded their drainage capacity (e.g. more drainage tiles and ditches, etc.). Nineteen percent would have changed their fertilizer, herbicide, or pesticide application timing, and another 10% would have adopted better soil health practices, such as using cover crops, reducing tillage, and using composts or mulches.

We also gave farmers a list of soil health practices and asked them to tell us if, for the ones they use on their farm, any of them lessened the impact of heavy rainfalls in 2017 (Fig. 5). Aside from “the use of mulches”, which 67% of farmers said did not help them, a vast majority said other soil health practices did help. Over 70% of farmers said that practices such as “use of winter cover crops”, “reduced tillage”, “use of composts or manure”, “leaving crop residues”, and/or “changing crop rotations” did lessen the impact of the very wet 2017 season. To learn more about soil health check out <https://blogs.cornell.edu/soilhealthinitiative/>.

### Insights for extension educators, researchers and policy makers

Over half of the farmers reported experiencing issues on their farm related to heavy rainfalls or flooding every 1 to 4 years. The other 46% reported this occurrence rarely or only every 5 to 6 years. While climate projections for NY indicate that we are likely to expect more heavy rainfall events, as well as more short-term summer droughts in the future (NCA 2014, Wuebbles et al. 2014, Sweet et al. 2017), our survey results suggest that, though farmers were concerned about the impacts of these events in the future, they are not as convinced that these events will occur more frequently in the future. For instance, 49% of farmers said they were “extremely or very” concerned that heavy rainfalls and flooding will negatively impact their farms in the future. Yet, only 38% said they were similarly concerned that such events may occur more

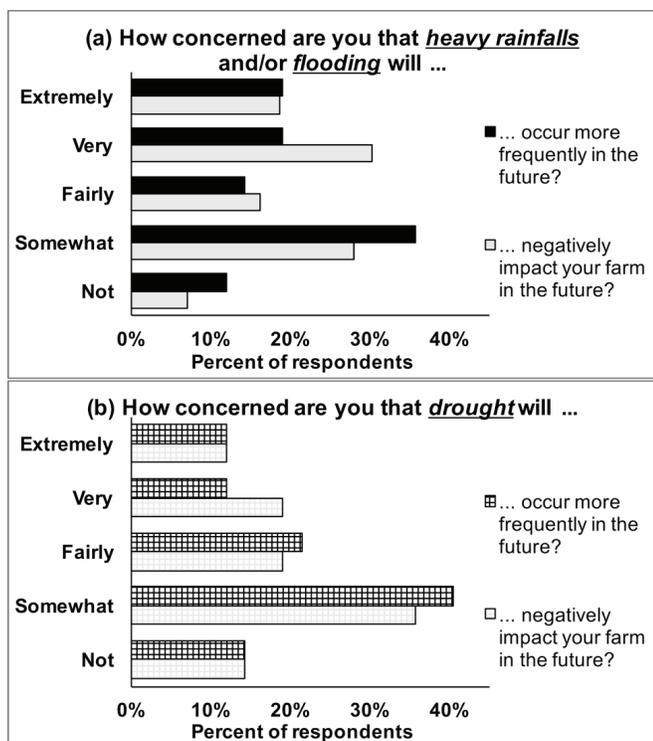


**Fig. 5.** Response to the survey question “Did any soil health practices you have adopted on your farm lessen the impact of heavy rainfalls in 2017?”.

frequently in the future (Fig. 6). Also, given the drought in 2016 (Sweet et al. 2017), we asked farmers a similar series of questions pertaining to drought. Though 31% of farmers were “extremely or very” concerned that drought may negatively impact their farm in the future, only 24% were concerned that drought may occur more frequently in the future.

With climate change, NY farmers are likely to continue facing unique challenges related to both increased heavy rainfall events as well as short-term summer droughts. Resource managers and planners, engineers, researchers, extension agents, NGO’s and other farm-support organizations need to prepare to help farmers adapt to and become more resilient to an uncertain future. Information collected from farmers about how they might adapt to future climatic events suggests there could be potentially dramatic consequences not only for farmer livelihoods and food production, but also for NY natural resources. For example, certain adaptation practices could impact downstream water quality and availability.

Based on our survey results, here are some ideas farmers had on how these various organizations might



**Fig. 6.** Level of concern by farmers of the frequency of occurrence and impact of (a) heavy rainfalls/flooding and (b) drought.

help them better prepare for and cope with heavy rainfalls events in the future:

- Low-cost loans or 'in kind' grants to help with costs of improving drainage (e.g. drainage ditches and tiles)
- Continued education on nutrient management planning
- Advice on how to increase soil organic matter for improved drainage capacity
- Information about cropping options and strategies to cope with heavy rainfalls
- Lower cost and better fungicides for wet years
- Increased town drainage (e.g. more funding for ditch digging and for clearing debris out of ditches)

## References

NRCC – Northeast Regional Climate Center. URL: <http://www.nrcc.cornell.edu/regional/monthly/monthly.html>.

NCA - National Climate Assessment (2014). URL: <https://nca2014.globalchange.gov/report/our-changing-climate/heavy-downpours-increasing#graphic-16693>.

Sweet et al. (2017). URL: <https://www.sciencedirect.com/science/article/pii/S0168192317302800>

Wuebbles et al. (2014). URL: <https://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-12-00172.1>

This project was funded by Cornell University's Atkinson Center for a Sustainable Future and The Nature Conservancy. For more information, contact Shannan Sweet: 126 Plant Science Bldg., Ithaca, NY 14853; 607 255 8641, [sks289@cornell.edu](mailto:sks289@cornell.edu).

As we are rapidly approaching another spring season of forage growth, it may be useful to consider some of the issues that affect the assessment of spring forage growth. Since most of the forage in NY is alfalfa-grass mixtures, and most of the forage becomes dairy cattle feed, we are focusing on the optimum timing for harvest of mixtures for high quality dairy feed. High quality alfalfa and grass forage will significantly increase milk production and increase the proportion of homegrown feeds in rations. Fiber digestibility (NDFD) is the most important forage factor affecting milk production.

For high producing dairy cows, an increase of one-percentage unit NDFD may increase milk production as much as one pound of milk per cow per day. Higher NDFD in forages can be achieved by harvesting earlier, or by selecting higher NDFD alfalfa and grass varieties. Almost all alfalfa seed companies have a “high quality” alfalfa variety, although there is likely a considerable range in quality among “high quality” varieties. There have been very few attempts to breed grass varieties for high quality, but there are some differences among grass species.

Optimum spring harvest should not be based on NDFD, however, but needs to be based on the optimum total fiber content (NDF) of the forage. Rations can be easily balanced for protein and energy, not so easy to balance for fiber.

### Spring 2017 Sampling of Forage Quality

We monitored first production year spring growth of alfalfa and grass in 2017. Alfalfa varieties sown were: HarvXtra-1, HarvXtra-2, Hi-Gest 360, LegenDairy HXD, N-R-Gee, SW315LH, and Pioneer 55H94. Grass varieties sown were: Driftless meadow fescue, Bariane tall fescue, Barlegro orchardgrass, Dividend VL orchardgrass, sparse-heading orchardgrass, Fojtan festulolium, and Perseus festulolium. Alfalfa and grass were grown separately with three field replicates, and grass was fertilized with 100 lbs N at spring green up.

### Protein

Alfalfa quality does not appear to be affected by the presence of grass in the stand, such that evaluation of alfalfa in pure stands should produce similar results to

evaluating alfalfa grown in mixtures. In general, grass quality also is not greatly affected by alfalfa in a mixed stand, with one exception. From previous studies, we conclude that grass crude protein (CP) content in alfalfa-grass mixtures is directly proportional to the percent alfalfa in the mixed stand.

In a pure stand, grass CP will decline linearly (Fig. 1). In a mixed stand that is predominantly alfalfa, grass CP will not decline as quickly as in a pure grass stand, because of a continuous supply of N from alfalfa. In several previous alfalfa-grass studies in NY conducted on dairy farms, a spring harvest around May 25 consistently resulted in grass with over 17% CP, when the stands were 30% grass. Total alfalfa+grass CP in a 30% grass stand generally exceeds 20% CP at spring harvest.

Note: Beware, this article contains differences between varieties sometimes expressed as a percentage unit change (e.g. NDFD difference of 54% to 50% = 4 percentage unit drop in NDFD) and sometimes appropriately expressed as a percent change (e.g. lignin difference of 6% to 5% = 17% drop in lignin).

### Pattern of Forage Quality in Spring

In a normal spring, forage quality of both alfalfa and grass will generally fluctuate until around May 10.

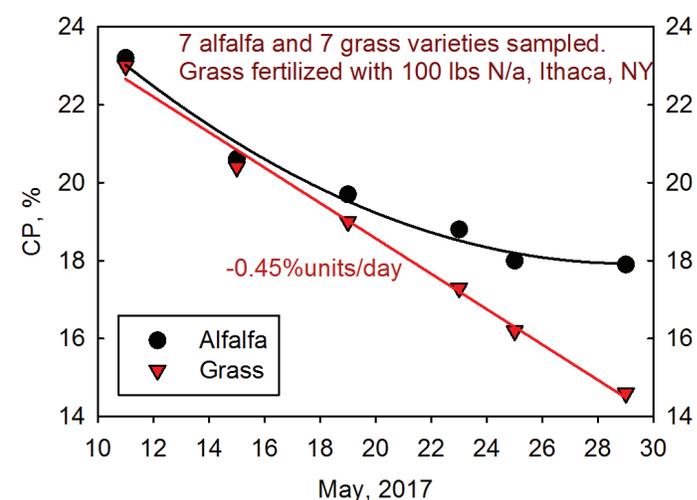
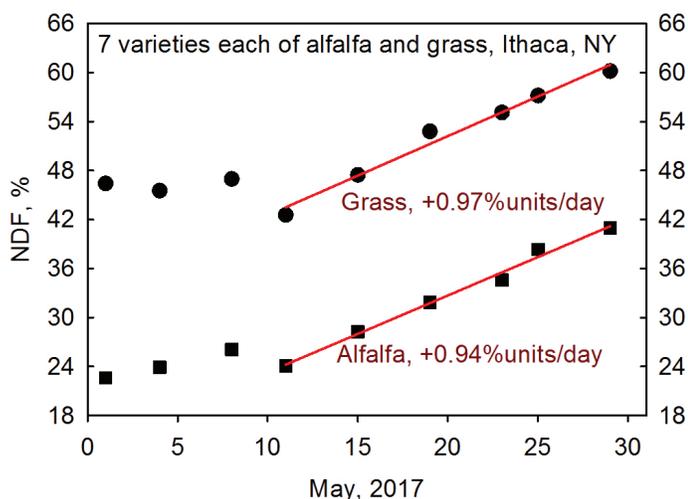
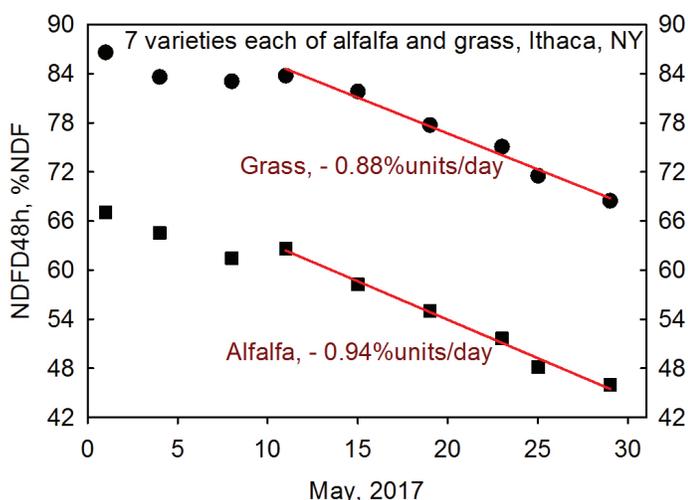


Fig. 1. Crude protein content of alfalfa and grass grown separately in spring 2017.



**Fig. 2.** Below normal temperatures in early May, followed by average and above average temperatures, resulted in alfalfa maturing faster than normal in the second half of May.

There may not much to be gained by collecting forage samples for analysis (e.g. scissors-cut samples) the first week of May. After about May 10, NDF and NDFD often show linear patterns of increase or decrease (Fig. 2 & 3). Grass typically gains about 1 percentage unit of NDF per day in the spring, and was relatively normal in 2017 in spite of somewhat abnormal temperatures. Alfalfa, on the other hand, matured faster than normal the last half of May. Alfalfa typically gains about 0.6 to 0.7 percentage units of NDF per day prior to spring harvest.



**Fig. 3.** Grass NDFD declined at a relatively normal rate in spring 2017, while alfalfa NDFD declined much faster than normal.

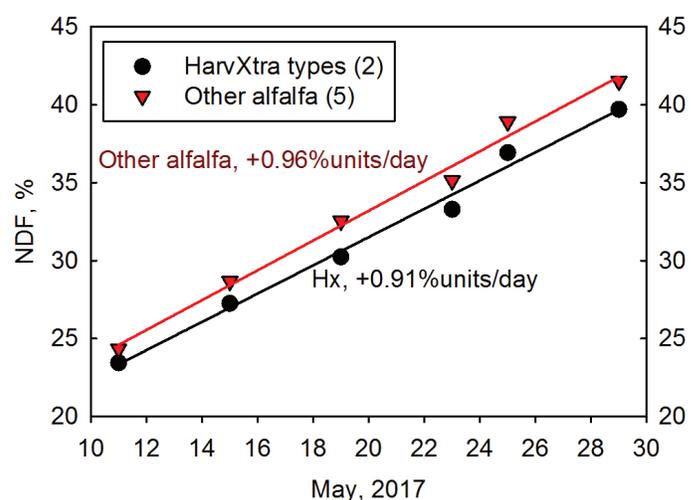
Although alfalfa was maturing at a faster rate than normal in late May, maturity at spring harvest was similar to a normal year. On May 25, a typical spring harvest date for alfalfa-grass in central NY, alfalfa averaged 37% NDF, compared to 57% for grass. NDFD on May 25 averaged 49% for alfalfa and 72% for grass. High NDFD in grass is the primary reason that alfalfa-grass mixtures can result in an excellent forage for high producing dairy cows.

### Alfalfa Variety Differences

We have found in other studies that HarvXtra (Hx) types tend to be slightly later in maturity than other alfalfas, when measuring mean maturity stage. This leads to a slightly lower NDF content in Hx on any given date (Fig. 4). Hx also has a slightly lower rate of NDF accumulation. On May 11, Hx is about 1 percentage unit lower, while on May 29 it is a little over 2 percentage units lower than other alfalfas.

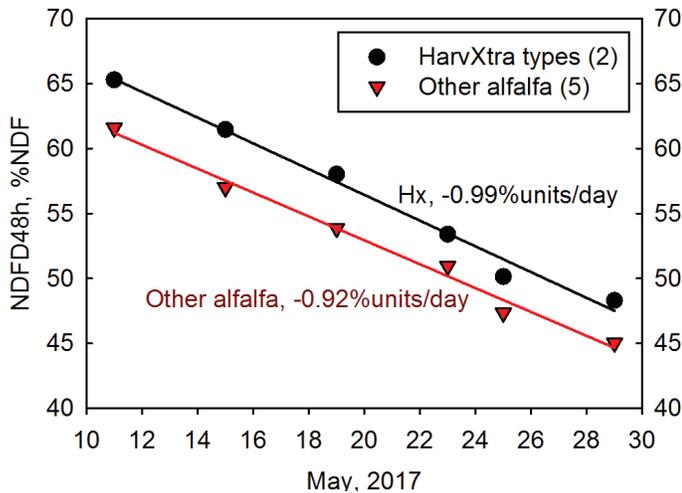
NDFD of Hx types was consistently higher than other alfalfas (Fig. 5), with a slightly faster rate of decline in NDFD/day. On May 11, Hx was 4 percentage units higher, and on May 29 it was 3 percentage units higher in NDFD than the average of other alfalfa varieties.

As we have found in a number of other trials, Hx is consistently much lower in lignin content than other



**Fig. 4.** NDF accumulation in HarvXtra types, compared to other alfalfa varieties.

# Forage Production

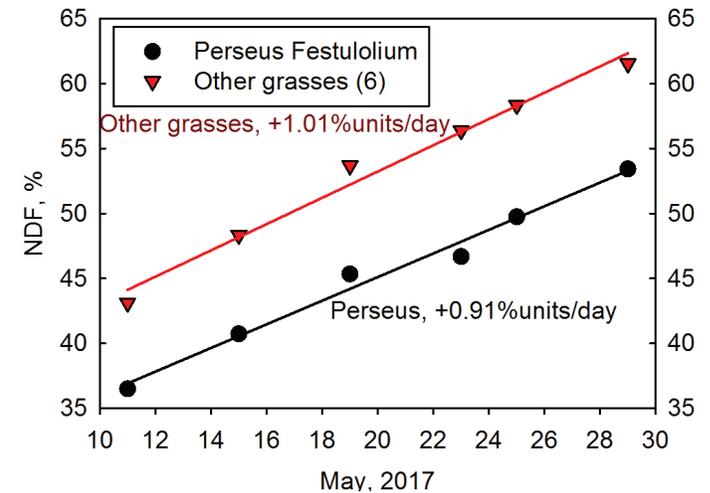


**Fig. 5.** Fiber digestibility of HarvXtra type alfalfa, compared with other varieties.

alfalfa varieties (Fig. 6). Hx also had a slightly lower rate of lignin accumulation. On May 11, Hx was 12% lower, and on May 29 it was 14% lower in lignin than the average of other alfalfa varieties.

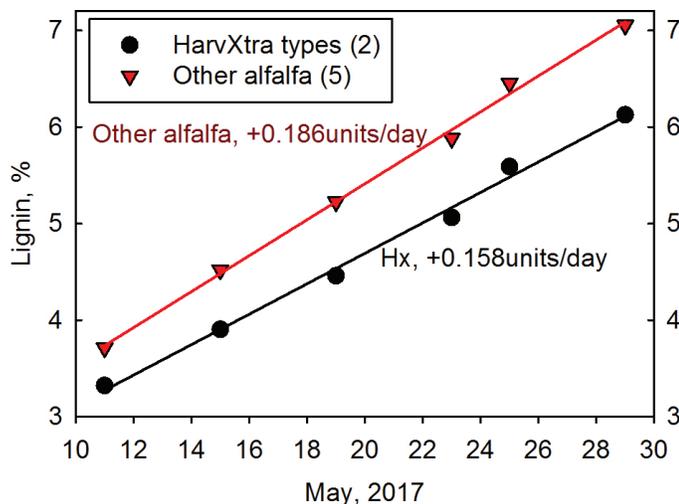
## Grass Species Differences

In grasses, NDF typically accumulates around 1 percentage unit/day in spring growth (Fig. 7). Grass species in this trial were all similar in NDF content and rate of NDF accumulation with one exception. Perseus festulolium is a ryegrass-type of festulolium

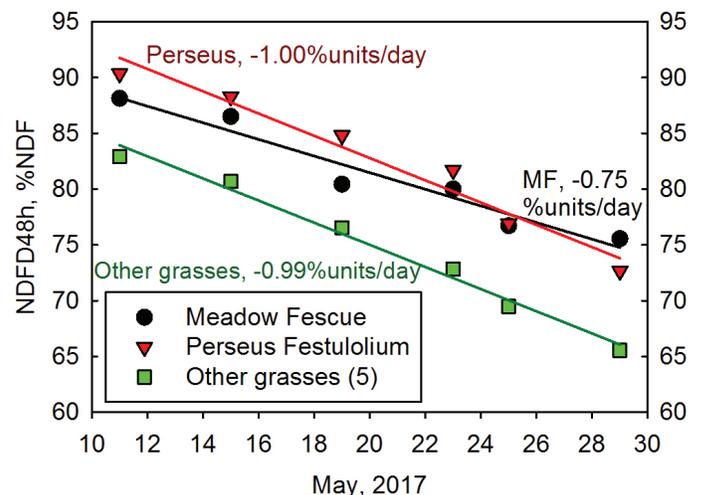


**Fig. 7.** Rate of NDF accumulation in grasses in spring growth.

very different from fescue-type festuloliums (e.g. Foitan). Total fiber content is very low in Perseus spring growth, and NDF accumulates at a slightly lower rate in Perseus compared to other grasses. A May 25 spring harvest of Perseus was over 9 percentage units lower in NDF than other grasses. The serious problem with Perseus and probably all festuloliums, however, is the tendency to head out quickly in regrowth, making second harvest festulolium forage much lower in quality than other grasses. Festuloliums are not a particularly good option as a companion crop with alfalfa for dairy cow forage for that reason.



**Fig. 6.** Pattern of lignin accumulation in spring alfalfa growth.



**Fig. 8.** Fiber digestibility of grasses in spring growth.

As it is less mature and much lower in NDF, Perseus is also considerably higher in NDFD than most grasses in spring growth, except for meadow fescue (Fig. 8). Perseus is significantly lower in NDFD than other grasses in regrowth, however, due to rapid heading in regrowth. Meadow fescue NDFD appears to decline at a slower rate than with other grasses. At the time of a typical spring harvest, meadow fescue is similar in NDFD to Perseus festulolium, and is 11% higher in NDFD than other grasses.

Lignin content of meadow fescue and Perseus festulolium did not differ, but both were significantly lower than all other grasses (Fig. 9). Also, lignin accumulates at a slower rate for meadow fescue and Perseus, compared to other grasses. On May 20, meadow fescue was 22% lower in lignin than other grasses, excluding Perseus.

We have collected 19 meadow fescue varieties from North America and Europe that will be sown as pure grass stands in Ithaca, NY and Burlington, VT this spring. Heading dates and quality data will be gathered in 2019. We will also plant these meadow fescue varieties in binary mixtures with one alfalfa variety in Ithaca, to evaluate competition and grass percentage of mixtures.

## Summary

On May 25, 2017, a typical central NY date for spring harvest, grass averaged 20 percentage units higher NDF than alfalfa, but also averaged 23 percentage units higher NDFD. Among alfalfa varieties, HarvXtra types were slightly lower in NDF, somewhat higher in NDFD, and much lower in lignin content than other alfalfa varieties. Being a predominantly ryegrass-type of festulolium, Perseus was very low in NDF and high in NDFD in spring growth, but typically heads out in regrowth, resulting in relatively low quality regrowth forage.

Meadow fescue is high in NDFD and the decline in NDFD per day is not as great as with other grasses. On May 25, this resulted in meadow fescue NDFD being 11% higher than other grasses, except Perseus. While meadow fescue is consistently higher quality than other grasses commonly sown in the Northeast, it is not necessarily better in some other regions of the country, particularly if the location is near the southern limit of meadow fescue's productive range. The relatively rapid decline in forage NDFD in spring growth (nearly 1 percentage unit/day) makes a timely spring harvest critical for high forage quality.

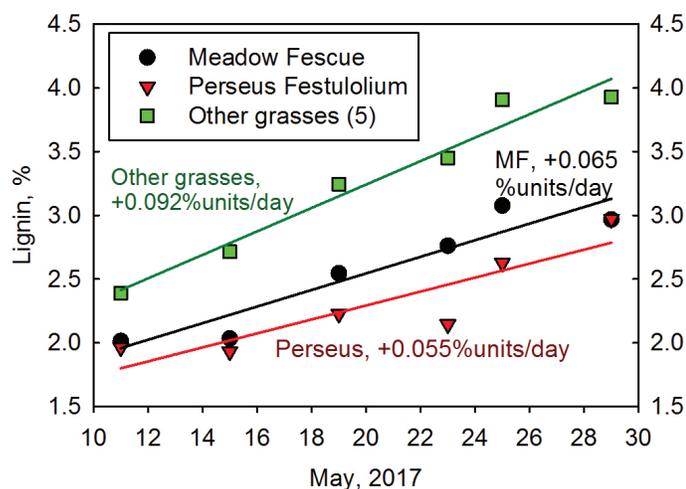


Fig. 9. Lignin content of grasses in spring growth.

## Soil Nitrate at Harvest of Forage Winter Cereals is Related to Yield and Nitrogen Application at Green-up

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### Introduction

Double cropping with winter cereals provides many benefits to forage rotations, including soil erosion control, addition of soil organic matter, nutrient recycling, and boosting home-grown forage inventory. Previous work on winter cereal cover crops (green manure, not harvested for forage) in New York suggested that, in most cases, 20-30 lbs nitrogen (N)/acre can be credited to the next crop (see Ort et al., 2013). When the winter cereal is harvested for forage instead of terminated as a cover crop, about 50 lbs N/acre is removed for every 1 ton DM/acre harvested, but some N remains in the crop stubble and roots. For a winter cereal yielding about 2 tons DM/acre there will still be an estimated 0.7 tons DM/acre in the root and stubble biomass (see Long et al., 2013), meaning about 20-30 lbs N/acre could become available over the growing season as the residue decomposes. Due to the time it takes to decompose this biomass, residual N from winter cereal roots and stubble is not likely sufficient to offset starter N needs if the next planting occurs shortly after the winter cereal is harvested. However, when fertilizer N is applied to winter cereals at dormancy break, there is usually some nitrate remaining in the soil as it is likely that not all of the N applied is taken up by the winter cereal. In some situations, the residual nitrate from a spring topdress fertilizer application may meet early season corn needs and substitute for a starter N application. This summary aims to address how to credit N to the next corn crop from fertilized winter cereals harvested as forage.

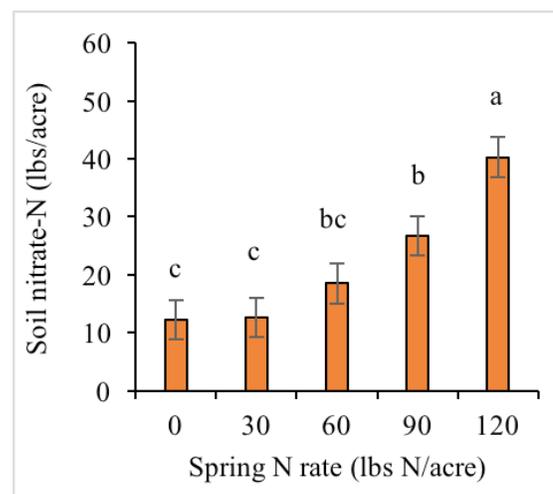
### Field Research

As part of a state-wide study investigating spring N needs of winter cereal forages, 63 on-farm trials were conducted in New York from 2013-2016. Trials had five rates of N (0, 30, 60, 90, and 120 lbs N/acre) applied to farmer-managed forage triticale, cereal rye, or winter wheat at green-up in the spring to determine the most economic rate of N (MERN). The forages were harvested at flag-leaf stage in May each year. For seven of these trials in central New York (in 2015 and 2016; two cereal rye, five triticale) we took soil samples (0-8 inches) at green-up and at harvest and analyzed them for soil NO<sub>3</sub>-N (KCl extractable NO<sub>3</sub>-N). While nitrate exists in the soil as NO<sub>3</sub><sup>-</sup>, we measure it

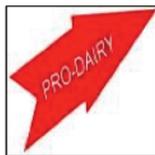
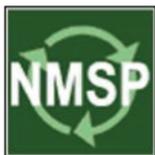
in the lab as nitrate-N, or NO<sub>3</sub>-N, which represents the total amount of N in the nitrate molecules, not the total nitrate in the sample. Planting dates for the seven trials ranged from September 15 to October 10, and harvest dates ranged from May 11 to 21. All seven sites had a manure history and were in corn prior to planting of the winter cereal. Winter cereals were drilled at seeding rates ranging from 100 to 125 lbs/acre. Here we report on the NO<sub>3</sub>-N levels in the soil at harvest of the winter cereal as an indicator of spring starter N needs for corn.

### Results

Across all seven trials, soil NO<sub>3</sub>-N following harvest increased with fertilizer N applications at green-up (Figure 1 and Table 1). On average, NO<sub>3</sub>-N levels at harvest were 12, 13, 18, 27, and 40 lbs NO<sub>3</sub>-N/acre for the 0, 30, 60, 90, and 120 lbs N/acre treatments, respectively. For the two trials that had yields of 1 ton DM/acre or less (#58 and #62), left-over soil NO<sub>3</sub>-N was considerably higher, especially when N was applied above the MERN (Table 1). The trial that had the highest yield at 3.1 tons DM/acre (#63) had the lowest residual soil NO<sub>3</sub>-N at harvest for all N rates even though the MERN for this site was 0 lbs N/acre (crude protein increased with N addition). These data suggest that residual soil NO<sub>3</sub>-N is related to yield; the higher the yield, the lower the left-over soil NO<sub>3</sub>-N at



**Fig. 1.** Nitrate-N at harvest of two cereal rye trials and five triticale trials in New York (2015-2016). Nitrogen fertilizer at the indicated rates was applied at dormancy break. Different letters indicate significant differences between N rate treatments.



# Nutrient Management

**Table 1.** The most economic rate of N (MERN), yield at the MERN, and soil nitrate-N (NO<sub>3</sub>-N) at the MERN, green-up, and harvest for seven winter cereal N rate trials from 2015-2016. Nitrate-N at the MERN was interpolated from sample values along the spring N rate response curve.

Site	MERN	Yield at MERN	NO <sub>3</sub> -N at green-up	NO <sub>3</sub> -N at MERN	NO <sub>3</sub> -N at harvest				
					Spring N rate (lbs N/acre)				
					0	30	60	90	120
	lbs N/acre	tons DM/acre	lbs NO <sub>3</sub> -N/acre	lbs NO <sub>3</sub> -N/acre	-----lbs NO <sub>3</sub> -N/acre-----				
57	51	1.5	5	11	10	10	12	17	26
58	51	1.0	9	34	13	19	40	47	85
59	53	1.4	17	18	16	16	18	37	37
60	0	1.4	15	19	19	18	19	25	45
61	90	1.4	2	10	10	9	9	10	11
62	< 30	0.7	13	14	15	14	28	46	71
63	0	3.1	4	4	4	3	4	5	7
<b>Averages:</b>				<b>16</b>	<b>12</b>	<b>13</b>	<b>19</b>	<b>27</b>	<b>40</b>

harvest. Applying N at rates above the MERN can also result in elevated soil nitrate concentrations.

### Conclusions and Implications

Nitrate as represented by NO<sub>3</sub>-N in the soil at harvest ranged (averaged across sites) from 12 lbs NO<sub>3</sub>-N/acre for the 0 lbs N/acre treatment to 40 lbs NO<sub>3</sub>-N/acre for the 120 lbs N/acre treatment. Based on the results here, when N applications are close to the MERN for the site, soil NO<sub>3</sub>-N at harvest is approximately 10 lbs NO<sub>3</sub>-N/acre, the level typically measured at the start of the growing season at sites without winter cereals in the rotation. Left-over NO<sub>3</sub>-N in the soil is related to yield of the winter cereal; higher yield means lower residual soil NO<sub>3</sub>-N at harvest, while low yield (less than 1 ton DM/acre) can result in high soil NO<sub>3</sub>-N levels. The basic recommendation for corn is to apply a small amount of starter fertilizer at planting (20-30 lbs N/acre). This is under the assumption that there is not a significant amount of NO<sub>3</sub>-N available from other sources at that time. This winter cereal research suggests that there can be a sufficient amount of soil nitrate at harvest that could be available to the subsequent corn crop, especially when winter cereals are fertilized at green-up at levels that exceed crop needs and/or where yields are depressed for other reasons. The most direct way of determining soil nitrate at winter cereal harvest is to soil sample for NO<sub>3</sub>-N. Fields that will be planted to corn where soil nitrate levels exceed 20 lbs NO<sub>3</sub>-N/acre following a winter cereal forage harvest may not

respond to starter N. Test strips can help improve these decisions over time.

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### Acknowledgements

This work was supported by Federal Formula Funds, and grants from the Northern New York Agricultural Development Program (NNYADP), the USDA-NRCS, and Northeast Sustainable Agriculture Research and Education (NESARE). We would also like to thank participatory farmers and farm advisors for assisting with the trials, including Cornell Cooperative Extension educators, consultants, NRCS staff, and SWCD staff. For questions about these results, contact Quirine M. Ketterings at 607-255-3061 or [gmk2@cornell.edu](mailto:gmk2@cornell.edu), and/or visit the Cornell Nutrient Management Spear Program website at: <http://nmsp.cals.cornell.edu/>

## Spring N Management is Important for Triticale Forage Performance Regardless of Fall Management

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### Introduction

Including a cool-season crop like triticale in a forage rotation can be a rewarding enterprise for dairy farms in the Northeast. Double cropping with winter cereals can provide environmental advantages such as reduced risk of erosion and nutrient loss, enhanced soil fertility, and improved rotation diversity, in addition to increased total season yields. Planting before September 20<sup>th</sup> was shown to increase nitrogen (N) uptake and biomass in the fall (see Lyons et al., 2017), but the impact of fall management on spring performance was unclear. To evaluate the effect of planting date and fall N availability on triticale forage yield and quality, three trials were conducted from 2012-2014.

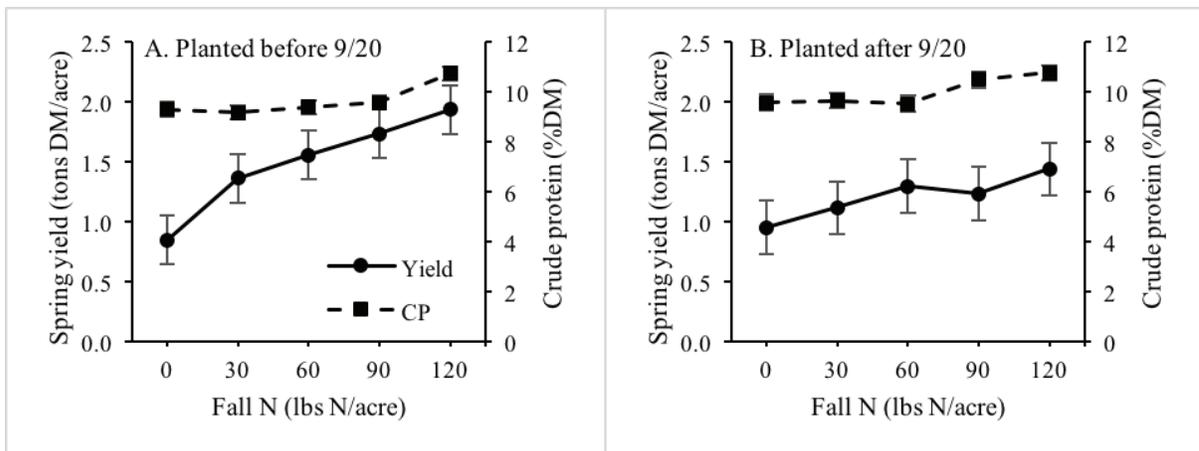
### Trial Set-Up

The three trials were planted with triticale (King's Agri-Seeds Trical 815 variety) from late August to early October on research farms in eastern NY (Valatie) and central NY (Varna). None of the fields had a recent manure history. Each trial had two planting dates (one before and one after September 20). Triticale was planted at a 1-inch seeding depth and 7.5-inch row spacing (120 lbs/acre seeding rate). To create a range in soil nitrate availability, 5 N rates were applied at planting in the fall (0, 30, 60, 90, and 120 lbs N/acre; main plots). Biomass was sampled in the fall (see Lyons et al., 2017). In the following spring, the same 5 N rates were applied at dormancy break (0, 30, 60, 90, and 120) for each fall N rate (sub plots).

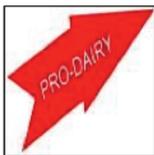
All plots were harvested at flag leaf stage in May of each year (from May 14-21) at a 4-inch cutting height. Measurements included dry matter yield, crude protein (CP), the most economic rate of N (MERN), the ratio of fall biomass to spring yield at the MERN to see if fall biomass can predict spring yield, and "Nitrogen Use Efficiency" (NUE). The NUE is the measure of N taken up in relation to yield, and is calculated by subtracting the yield when no N was applied in the spring from the yield when N was applied (at 30, 60, 90, or 120 lbs N/acre), and dividing that value by the N rate applied:  $NUE (\text{lbs DM/lbs N}) = (\text{Triticale yield}_{N \text{ rate}} - \text{Triticale yield}_{0N}) / N \text{ rate}$ . A higher NUE means that more of the N that was applied was taken up by the triticale.

### Results

We found that when no N was applied in the spring, N applied at planting the previous fall increased spring yield only when triticale was planted by September 20 (Figure 1a). Across all trials, yields with no fall or spring N applications averaged 0.8 tons DM/acre. With fall N applications ranging from 30-120 lbs/acre (no spring N), yields ranged from 1.4 to 1.9 tons DM/acre. Yields trended upward with increasing fall N rates, but the only significant yield response to N was at the 30 lbs N/acre treatment. Where triticale was planted after September 20, fall N did not significantly increase spring yield (1.2 tons DM/acre average) (Figure 1b). Crude protein at spring harvest followed a similar trend as yield, but it took a fall application of 120 lbs N/acre



**Fig. 1.** Effect of fall N application on triticale yield and crude protein concentrations in the spring. Triticale was seeded on two planting dates: before September 20 (A), and after September 20 (B). No N was applied at green-up in the spring N. Data are averages for three locations.



# Nutrient Management

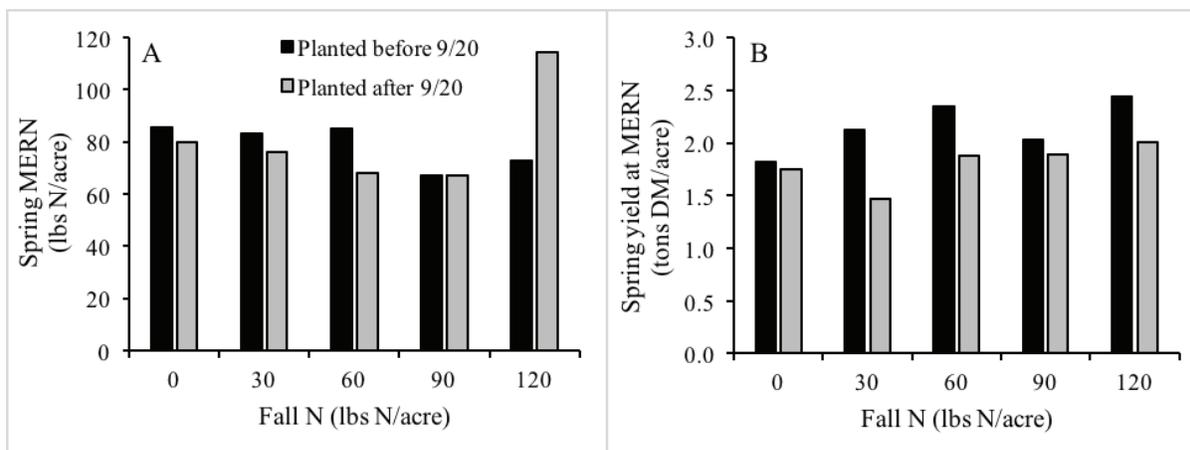


Fig. 2. Spring most economic rate of N (MERN, A) and yield at the MERN (B) for different fall N fertilizer rates and planting dates of triticale.

to see a significant difference in CP (9.4 versus 10.7%) in the spring (no N applied at green-up) and that occurred with early planting only. Because fall uptake of N does not seem to greatly influence forage protein content in the spring, these results suggest that proper spring fertilization management for optimal nutritive performance is most important.

Although fall N application and planting date had some impact on spring yield, neither treatment affected spring MERN (Figure 2a), yield at the MERN (Figure 2b), or NUE at the MERN (17.6 lbs DM/lbs N average). Additionally, the ratio between fall biomass and spring yield was not impacted by the treatments. The earlier planted sites had higher ratios (closer to 1) because with earlier planting there was more fall biomass and the relative gain in yield in the spring was smaller.

### Conclusions and Implications

Winter cereals like triticale grown for forage in double crop rotations can provide environmental benefits and additional harvestable forage for dairy producers in the Northeast. When no N was applied in the spring, a small fall N application at planting (30 lbs N/acre) increased yields in the spring if the stand had been planted before September 20. There was no benefit of fall N when the stand was planted later in the fall. Crude protein was only increased when a large amount of fall N (120 lbs N/acre) was applied at a planting date before September 20 and when no spring N had been applied. The MERN and yield at the MERN for each trial were

not influenced by fall N or planting date, suggesting that spring N management is by far the most important management consideration for achieving optimum yields. A larger sample size than just three locations may be needed to detect any differences but this research suggests that on fields without recent manure histories, triticale forage requires 60-90 lbs N/acre at dormancy break to achieve optimum yields. Work is ongoing to determine N needs for forage winter cereals under a variety of management scenarios, including manured fields.

### Reference

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### Acknowledgements

This work was supported by Federal Formula Funds, and grants from the Northern New York Agricultural Development Program (NNYADP), New York Farm Viability Institute (NYFVI), and Northeast Sustainable Agriculture Research and Education (NESARE). For questions about these results, contact Quirine M. Ketterings at 607-255-3061 or [gmk2@cornell.edu](mailto:gmk2@cornell.edu), and/or visit the Cornell Nutrient Management Spear Program website at: <http://nmisp.cals.cornell.edu/>.

## No-Till Organic Wheat Continues to Have Low Weed Densities in Early Spring (April 9) at the Tillering Stage (GS 2-3)

Bill Cox and Eric Sandsted, Soil and Crop Sciences Section, School of Integrative Plant Science, Cornell University

We initiated a 4-year study at the Aurora Research Farm in 2015 to compare the corn-soybean-wheat/red clover rotation in different sequences under conventional and organic cropping systems during and after the transition to an organic cropping system. This article will discuss weed densities in conventional and organic wheat.

We provided the management inputs for wheat in both cropping systems under high and recommended input treatments in a previous article (<http://blogs.cornell.edu/whatscroppingup/2017/12/01/organic-compared-with-conventional-wheat-once-again-has-more-rapid-emergence-greater-early-season-plant-densities-and-fewer-fall-weeds-when-following-soybean-in-no-till-conditions/>), but we will briefly review them. We used a John Deere 1590 No-Till Grain Drill to plant a treated (insecticide/fungicide seed treatment) Pioneer soft red wheat variety, 25R46, in the conventional cropping system; and an untreated 25R46, in the organic cropping system on September 27 at two seeding rates, ~1.2 million seeds/acre (recommended management treatment for a September planting date) and ~1.7 million seeds/acre (high input treatment). The wheat was no-tilled in both cropping systems because of the paucity of visible weeds after soybean harvest (9/23). We also applied Harmony Extra (~0.75 oz/acre on 10/27) to the high input conventional treatment at the tiller initiation stage (GS 2-October 27) for control of winter annuals (chickweed, henbit, and common mallow) and winter perennials (dandelion).

We also reported in the above article that we walked along the entire wheat plot (~100 feet X 10 feet) to count all the weeds on 10/27 just prior to the Harmony Extra application to the high input conventional wheat plots. As in 2015, organic compared with conventional wheat generally had lower weed densities in the fall, especially in the field in which corn was the 2014 crop (Table 1). Weed densities, however, were very low so we speculated that yields would probably not be compromised. Dandelion was the dominant weed species in the fall in all plots. Apparently, the last cultivation of soybean on July 20 removed existing or late-emerging dandelions, whereas the observed weeds in the conventional cropping system apparently



**Fig. 1.** From left to right: Organic wheat with high inputs, organic wheat with recommended inputs, 10 foot border, conventional wheat with recommended inputs, and conventional wheat with high inputs.

emerged after the June 21 Roundup application.

Weather conditions were extremely warm in October (6 degrees above normal) so wheat (and weeds) got off to an excellent start. Ensuing weather conditions, however, were much colder than normal with November, December, January, March, and April averaging more than 2.5 degrees below normal. In fact, March 1-April 30, was the 3<sup>rd</sup> coldest period on record at the Aurora Research Farm (34.2° average temperature) (<http://climod.nrcc.cornell.edu/runClimod/cb248220aa6e4a42/10/>), only eclipsed by the infamous 1975 and 1978 early springs (average temperatures of 34.1°). Consequently, winter wheat greened up about 2 weeks later than normal in 2018. It is not clear on how the cold winter and early spring conditions affected winter annual and perennial weed development but probably it was delayed.

Early spring weed densities were taken at the GS2-3 stage on 04/10, about 10 days after green-up, again by counting all the weeds along the entire length of the plots. Dominant weeds included dandelion, common mallow, and chickweed. As in the fall, weed densities were extremely low and probably would have no significant effects on yield (Table 1). There was a cropping system by input interaction in the field with corn

as the 2014 crop because of very low weed densities in conventional wheat with high inputs (Harmony Extra application) and higher weed densities in organic wheat with high inputs (seeding rates and N rates).

High input management in organic wheat did not reduce weed densities, which agrees with the 2016 data (<http://blogs.cornell.edu/whatscroppingup/2016/04/05/no-till-organic-wheat-continues-to-have-low-weed-densities-in-early-spring-march-31-at-the-tillering-stage-gs-2-3/>). Some organic growers believe that wheat should be planted at a higher seeding rate to

reduce weed densities, but our study does not support that speculation. Our data does support the idea that if weed densities are low in organic soybean (<2.5 weeds/m<sup>2</sup>), organic wheat growers can no-till wheat into soybean stubble without fear of high weed densities. More research, however, should be conducted to compare no-till and conventional tillage organic wheat.

In conclusion, no-till organic and conventional wheat had very low spring weed densities about 10 days after green-up. The cool conditions in April prevented rapid shading by the wheat canopy so perhaps the weeds that

were present in early April may interfere with wheat yields, but impacts should be minimal because of the low densities. On April 15, organic wheat looked as good as conventional wheat (picture). It remains to be seen, however, if Kreher's composted chicken manure, the N source for organic wheat (60 lbs. /acre of actual N pre-plant +50 lbs. /acre of actual N on 3/21 in high input and the single 75 lbs. /acre of actual N as a spring application in recommended management) can provide enough available N for maximum yield in organic wheat.

Table 1. Weed densities at the early tillering stage in the fall (GS2-October 27) and again in the spring (GS2-3-April 10) in the conventional and organic cropping systems, planted on September 27 at 1.2 million seeds/acre in the recommended input treatment and 1.7 million seeds/acre in the high input treatment.

2014 CROPS			
TREATMENTS	BARLEY	CORN	SOYBEANS
<b>Fall Weed densities-GS 2 stage (weeds/m<sup>2</sup>)</b>			
<b>CONVENTIONAL</b>			
Recommended	0.22	0.54	0.19
High Input	0.08	0.48	0.13
<b>ORGANIC</b>			
Recommended	0.05	0.19	0.08
High Input	0.05	0.18	0.05
LSD 0.05	0.12	0.28	NS
<b>Spring Weed densities-GS 2-3 stage (weeds/m<sup>2</sup>)</b>			
<b>CONVENTIONAL</b>			
Recommended	0.06	0.26	0.11
High Input	0.01	0.02	0.01
<b>ORGANIC</b>			
Recommended	0.05	0.18	0.06
High Input	0.14	0.44	0.10
LSD 0.05	NS	0.22	NS

## More Rapid Emergence but Lower Early Plant Densities (V1 Stage) in Organic Compared to Conventional 2018 Soybean

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<sup>1</sup>Soil and Crop Sciences Section, School of Integrative Plant Science, Cornell University, <sup>2</sup>New York State Seed Improvement Program



**Fig. 1.** Organic soybean emerged in about 8 days after planting in 2018.

**Fig. 2.** Conventional soybean emerged in about 9.5 days after planting in 2018 so is further behind organic soybean 11 days after planting.

We initiated a 4-year study at the Aurora Research Farm in 2015 to compare different sequences of the corn-soybean-wheat/red clover rotation in conventional and organic cropping systems under recommended and high input management during the transition period (and beyond) to an organic cropping system. Unfortunately, we were unable to plant wheat after soybean in the fall of 2016 because green stem in soybean, compounded with very wet conditions in October and early November, delayed soybean harvest until November 9, too late for wheat planting. Consequently, soybean followed corn as well as wheat/red cover in 2018 so we are now comparing different sequences of the corn-soybean-wheat/red clover rotation with a corn-soybean rotation (Table 1). This article will focus on soybean emergence (days) and early plant densities (% early plant establishment) at the early 1<sup>st</sup> node stage (V1 stage) in 2018.

The fields were plowed on May 17 and then cultimulched on the morning of May 18, the day of planting. We used the White Air Seeder to plant the treated (insecticide/fungicide) GMO soybean variety, P22T41R2, and the non-treated non-GMO variety, 921A20, at two seeding rates, ~150,000 (recommended input) and ~200,000 seeds/acre (high input). P21A20 is a not an isolate of P22T41R2 so only the maturity of the two varieties and not the genetics are similar between the two cropping systems. We treated the non-GMO, 921A20, in the seed hopper with the organic seed treatment, Sabrex, in the high input

treatment (high seeding rate). We used the typical 15” row spacing in conventional soybean and the typical 30” row spacing (for cultivation of weeds) in organic soybean. Consequently, the soybean comparison is not as robust as the corn or wheat comparisons in this study because of the different row spacing and genetics between the two cropping systems.

Warm conditions (64.7 F average temperature and 0.81 inches of precipitation) during the 10 days following planting resulted in fairly rapid emergence. Organic soybean required about 8 days for emergence but conventional soybean required about 9.5 days (Table 2). The more rapid soybean emergence in the organic system is similar to previous years (<http://blogs.cornell.edu/whatscroppingup/2017/06/06/soybean-emergence-and-early-plant-densities-v1-v2-stage-in-conventional-and-organic-cropping-systems-in-2017/>). In previous years, however, variety differences rather

Table 1. Amended crop rotations in a 4-year crop rotation study at the Aurora Research Farm because of the inability to plant wheat after soybean in the fall of 2016 (green stem in soybean compounded with excessively wet conditions in October and early November prevented a timely soybean harvest and wheat planting). Consequently, we will now compare a corn-soybean-wheat/red clover (RC) rotation (without wheat in the first transition year, 2015) to a corn-soybean rotation in conventional and organic cropping systems in fields that had a spring grain, corn, or soybean as the last conventional crops in 2014.

	CROP ROTATIONS		
<b>2015</b>	<b>RED CLOVER (RC)</b>	<b>CORN</b>	<b>SOYBEAN</b>
<b>2016</b>	<b>CORN</b>	<b>SOYBEAN</b>	<b>WHEAT/RC</b>
<b>2017</b>	<b>SOYBEAN</b>	<b>CORN</b>	<b>CORN</b>
<b>2018</b>	<b>WHEAT/RC</b>	<b>SOYBEAN</b>	<b>SOYBEAN</b>

than cropping system differences probably influenced days to emergence with P92Y21, the variety used in the organic system from 2015-2017, with a higher field emergence score (8 out of 10 rating) compared with P22T41R2 (7 out of 10). In 2018, however, we had to switch to P21A20 (P92Y21 no longer available), which had the same field emergence rating (7 out of 10) as P22T41R2. So variety differences probably did not contribute to emergence differences between the two cropping systems. The organic cropping system also was planted in 30 inch rows so there were 8.5 to 11.5 seeds emerging per 1 foot of row in the organic system compared with 4.25 to 5.75 seeds emerging in 1 foot of row in the conventional system. In 2018, however, there was no real soil crust because of intermittent rains after planting so seed spacing within the row was probably not a factor. The final factor to consider is that the insecticide/fungicide seed treatment may have delayed emergence in conventional soybean, as it seemed to delay wheat emergence (<http://blogs.cornell.edu/whatscroppingup/2017/12/01/organic-compared-with-conventional-wheat-once-again-has-more-rapid-emergence-greater-early-season-plant-densities-and-fewer-fall-weeds-when-following-soybean-in-no-till-conditions/>).

We estimated soybean plant densities at the early V1 stage (June 1), about a week after the rotary hoeing operation in organic soybean. Conventional soybean generally had higher plant establishment rates (78-91%) compared with organic soybean (67 to 76%, Table 2). In previous years, conventional vs. organic soybeans had greater early plant establishment (2016), lower early plant establishment (2017), or similar early plant establishment rates (2015). We did note some damage, but relatively low damage, to organic soybean from the rotary hoe operation, which occurred 6 days after planting. Based on

previous data, however, we do not think that rotary hoe damage was totally responsible for the 10 to 15% lower plant establishment rate in organic soybeans. The higher compared with recommended input treatment of organic soybean had higher early plant establishment rates in fields with corn and soybean as the 2014 crops so perhaps the use of the Sabrex seed treatment

Table 2. Days to emergence and % plant establishment of soybean at the 1<sup>st</sup> node stage (V1) following either wheat/ red clover (RC) or corn under conventional management (P22T41R2, treated with insecticide and fungicide) and organic management (P21A20-non-treated) after the rotary hoe operation in organic soybean at recommended inputs (~150,000 seeds/acre) and high input (~200,000 seeds/acre plus the organic seed treatment, Sabrex, in the organic cropping system). Red highlighted values are significantly higher for comparisons within a column (i.e. previous crops), based on the interaction LSD.

TREATMENTS	PREVIOUS CROP (2014)		
	SMALL GRAIN	CORN	SOYBEANS
<b>Emergence (days)</b>			
<b>CONVENTIONAL</b>			
Recommended-wheat/RC	9.25	<b>9.67</b>	<b>9.5</b>
Recommended-corn	<b>9.50</b>	<b>9.67</b>	<b>9.5</b>
High Input-wheat/RC	<b>9.50</b>	<b>9.67</b>	<b>9.75</b>
High Input-corn	<b>10.0</b>	<b>10.0</b>	<b>9.5</b>
<b>ORGANIC</b>			
Recommended-wheat/RC	8.0	8.0	8.0
Recommended-corn	8.25	7.75	8.25
High Input-wheat/RC	8.0	8.0	8.0
High Input-corn	8.0	8.25	8.25
LSD 0.05	1.0	1.0	1.0
<b>Plant densities-V4 stage (plants/acre)</b>			
<b>CONVENTIONAL</b>			
Recommended-wheat/RC	127,457 (85%)	116,625 (78%)	126,735 ( <b>85%</b> )
Recommended-corn	136,657 ( <b>91%</b> )	121,599 (81%)	133,999 ( <b>89%</b> )
High Input-wheat/RC	174,445 ( <b>91%</b> )	159,866 (80%)	172,853 ( <b>86%</b> )
High Input-corn	179,996 (85%)	178,399 ( <b>90%</b> )	173,954 ( <b>87%</b> )
<b>ORGANIC</b>			
Recommended-wheat/RC	112,662 (75%)	103,538 (69%)	101,749 (68%)
Recommended-corn	105,864 (71%)	104,533 (70%)	100,367 (67%)
High Input-wheat/RC	146,864 (73%)	152,533 (76%)	150,367 (75%)
High Input-corn	142,025 (71%)	147,733 (74%)	141,163 (71%)
LSD-% 0.05	3.8%	3.7%	4.1

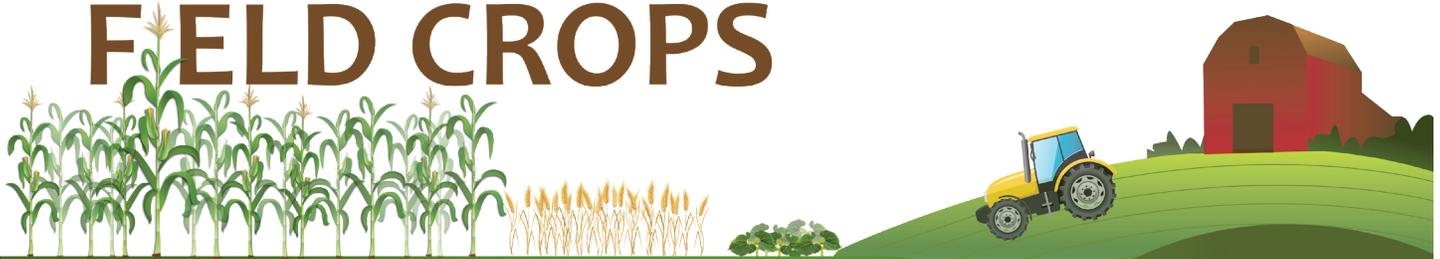
improved early plant establishment.

In conclusion, early plant populations in conventional soybean (15-inch rows) in the recommended input treatment exceeded the 114,000 plant/acre threshold limit for maximum soybean yields in NY. Consequently, both high and recommended input treatments in conventional soybean have similar yield potential at this stage of development. We have not really established a plant/acre threshold limit for organic soybeans in New York (because very few soybeans are grown in 30-inch rows) so it is not clear if early plant stands of 100,000 to 105,000 plants/acre are adequate for maximum yield. Conceivably, more plants will emerge after our stand counts to increase early plant establishment rates in organic soybean. On the other hand, future cultivations, especially the close to the row cultivation, could decrease organic soybean stands by another 5%. Furthermore, lower stands in the recommended input treatment of organic soybean may allow for increased weed interference, which has the potential to reduce yields. Ironically, the year that organic compared with conventional soybean had greater early plant establishment rate was the only year (2017) that organic soybean yielded lower. It will be interesting to see how the 2018 soybean growing season plays out.



T h i s   p a g e   i n t e n t i o n a l l y   l e f t   b l a n k .

# Cornell FIELD CROPS



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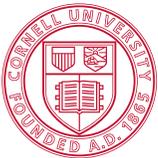
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## Calendar of Events

JUN 7	<a href="#">2018 Small Grains Management Field Day</a> - Aurora, NY
JUN 8	<a href="#">Organic Valley Dairy Profitability Workshop</a> - Cortland, NY
JUL 3	<a href="#">2018 Cornell Seed Growers Field Day</a> - Ithaca, NY
JUL 12	<a href="#">2018 Aurora Farm Field Day</a> - Aurora, NY

*Have an event to share? Submit it to [jnt3@cornell.edu](mailto:jnt3@cornell.edu)!*



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**Cooperative Extension**  
Soil and Crop Sciences Section  
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***What's Cropping Up?*** is a bimonthly electronic newsletter distributed by the Soil and Crop Sciences Section at Cornell University. The purpose of the newsletter is to provide timely information on field crop production and environmental issues as it relates to New York agriculture. Articles are regularly contributed by the following Departments/Sections at Cornell University: Soil and Crop Sciences, Plant Breeding, Plant Pathology, Animal Science and Entomology. **To get on the email list, send your name and address to Jenn Thomas-Murphy, 237 Emerson Hall, Cornell University, Ithaca, NY 14853**

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