



What's Cropping Up?



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What Do New York Corn Fields Really Yield? The Case for Using Yield Monitors

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Corn silage and grain yields have steadily increased since World War II (Figure 1) 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) 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. Does that hold true for New York? With increasing focus on the water and air quality impacts of nutrient losses from agriculture, combined with higher risk of loss when nutrient applications are in excess of plant need, these

questions are more important than ever for the future of agriculture in New York.

Before we can answer these questions, we need to know the actual yield levels for corn grown for grain and also for 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.

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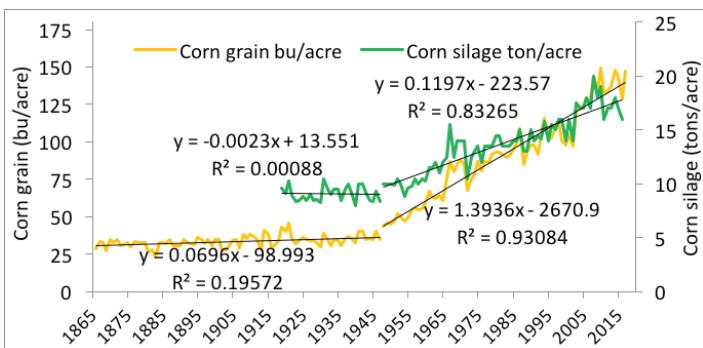
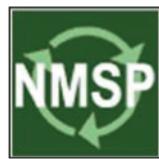
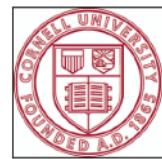


Fig. 1. New York State average corn silage and grain yields over time show a steady increase 1948 – 2015 in both silage and grain yields but also large year-to-year variation. Yield data source: New York State Agricultural Statistics Service.

Nutrient Management



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 need to be combed for obvious errors through a cleaning process, especially for silage yield monitors (Figure 2). 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 grain and silage yield data in a particular harvest year. A manual that will help producers or consulting companies do this will be released in early 2018.

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 Agricultural

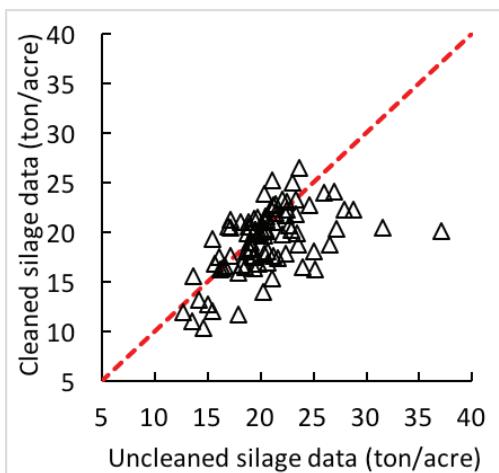


Fig. 2. A consistent data cleaning process is essential for creation of reliable multi-field and multi-year yield maps.

coming years. Once data are cleaned, we can create yield frequency histograms (Figure 3).

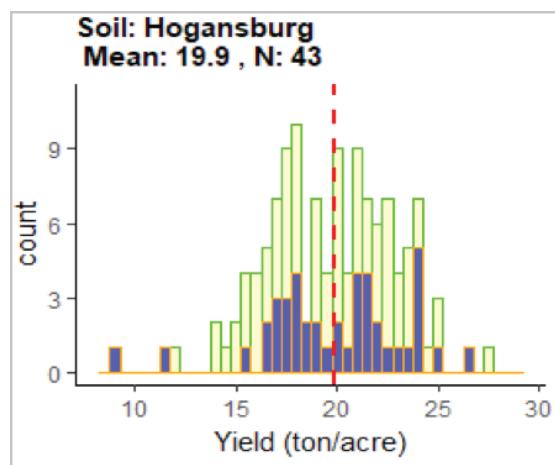


Fig. 3. Histogram of yields of Hogansburg soils (N=43) in northern New York. Blue are fields harvested in the year of reporting. In green are all fields of this soil type harvested and recorded to date, previous years included.

These types of histograms show the range of yields and how many fields with this soil type provided a certain yield. For example, in the case of 43 fields with the Hogansburg soil shown in Figure 3, the average yield was 19.9 tons/acre while 5 fields out of 43 yielded more than 25 tons/acre and one field averaged 27.5 tons/acre (maximum reported for the example shown in Figure 3). These histograms allow for determination of means, medians, ranges in yields, etc. and they can help us (1) quickly update the yield potential database for corn grain that is the foundation for the basic N guidelines; and (2) develop an independent database for yield potentials for corn grown for silage.

Stay tuned for further updates! A call for participating will be shared with farmers and farm advisors as funding to proceed at a larger scale is granted. The protocols for data sharing are available through the NMSP website (<http://nmsp.cals.cornell.edu/NYOnFarmResearchPartnership/YieldDatabase.html>). The data-processing protocol will be added to this page once completed.

Stalk Nitrate Test Results for New York Corn Fields from 2010 through 2017

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Nutrient Management

Introduction

The corn stalk nitrate test (CSNT) allows for evaluation and fine-tuning of N management for individual fields over time. It is an end-of-season evaluation tool for N management for 2nd or higher year corn fields that allows for identification of situations where more N was available during the growing season than the crop needed. Where CSNT results exceed 3000 ppm for two or more years, it is highly likely that N management changes can be made without impacting yield.

Findings 2010-2017

The summary of CSNT results for the past eight years is shown in Table 1. For 2017, 28% of all tested fields had CSNTs greater than 2000 ppm, while 19% were over 3000 ppm and 9% exceeded 5000 ppm. In contrast, 34% of the 2017 samples tested low in CSNT. As crop history, manure history, other N inputs, soil type, and growing conditions all impact CSNT results, conclusions about future N management should take into account the events of the growing season. In addition, weed

pressure, disease pressure, lack of moisture in the root zone in drought years, lack of oxygen in the root zone due to excessive rain (anaerobic soil conditions), and other stress factors can impact the N status of the crop as well. The 2017 data are consistent with 2013, another extremely wet year with 20 inches of rainfall between May and August. These data highlight the need to evaluate CSNT results in light of not only manure and fertilizer N management but also weather patterns that year. They also show the importance of multiple years of results to gain experience with on-farm interpretation.

Within-field spatial variability can be considerable in New York, requiring (1) high density sampling (equivalent of 1 stalk per acre at a minimum) for accurate assessment of whole fields, or (2) targeted sampling based on yield zones, elevations, or soil management units. Work is ongoing to evaluate targeted sampling that is expected to significantly reduce time commitment to taking CSNTs. Two years of CSNT data are recommended

Table 1. Distribution of CSNT values (low, marginal, excess) for New York State (NYS) corn fields sampled in 2010-2017. Also presented are state average yield for corn (bu/acre at 85% dry matter and tons/acre at 35% dry matter). In grey are wet years. In orange are drought years.

	2010	2011	2012	2013	2014	2015	2016	2017
NYS corn grain (bu/acre)	149	133	134	137	148	143	129	147
NYS corn silage (tons/acre)	19	16	17	17	18	17	16	.
April-June rainfall (inches)	10.0	16.5	10.2	14.6	12.8	12.8	7.6	15.3
April-July rainfall (inches)	14.0	18.6	13.2	19.1	18.1	16.5	10.7	20.6
May-June rainfall (inches)	7.9	10.0	7.4	11.4	9.3	9.9	5.1	10.4
May-July rainfall (inches)	11.8	12.2	10.3	16.1	14.6	13.5	8.3	15.6
May-August rainfall (inches)	15.9	20.0	13.6	20.0	18.3	16.7	12.4	19.2
Low (<250 ppm) (%)	24	21	20	35	29	37	13	34
Marginal (250-750 ppm) (%)	17	19	17	16	16	18	12	18
Optimal (>750-2000 ppm) (%)	19	24	22	20	19	21	24	20
Excess (>2000 ppm) (%)	40	36	41	29	36	24	51	28
Excess (>3000 ppm) (%)	28	24	29	20	27	16	37	19
Excess (>5000 ppm) (%)	14	12	14	9	14	6	19	9
Total number of samples	509	765	923	1473	1175	1039	859	1180
Maximum value (ppm)	13966	16687	15671	13147	14659	13947	14959	14517

Note: Data prior to 2013 reflect submissions to the NMSP only. 2013 and 2014 data include results from NMSP and DairyOne; 2015-2016 includes samples from NMSP, DairyOne, and CNAL; 2017 includes result from NMSP and DairyOne.

Nutrient Management

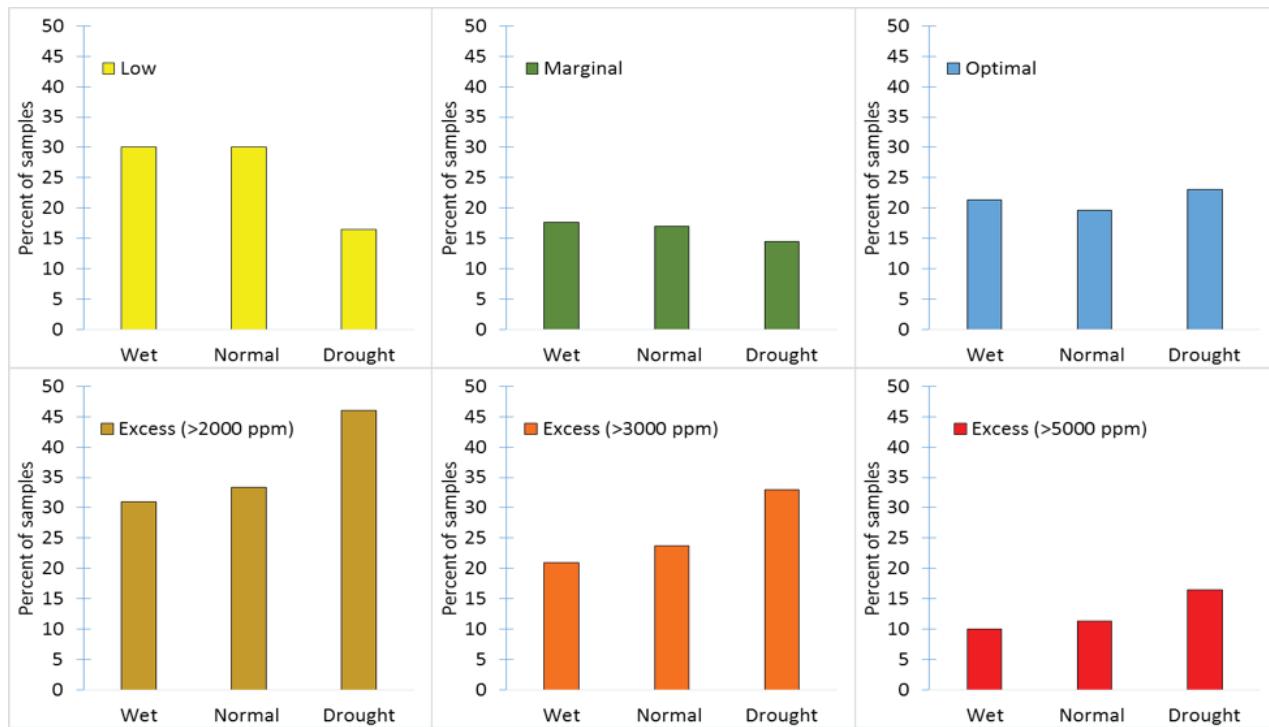


Fig. 1. In drought years (2012 and 2016), more samples test excessive in CSNT-N while fewer test low or marginal. This is consistent with reduced yields in drought years: state average corn yields were 132 bu/acre in the drought years of 2012 and 2016 versus an average of 147 bu/acre in years with a more normal precipitation (2010, 2014, and 2015). In excessively wet years (2011, 2013, and 2017) the average yield was 139 bu/acre but ranged from 135 bu/acre (average of 2011 and 2013) to 147 bu/acre in 2017. The highest CSNT-N level obtained in 2017 was a little over 14500 ppm, similar to the average of maximum values over the last eight years which is just shy of 14700 ppm.

before making any management changes unless CSNT's exceed 5000 ppm (in which case one year of data is sufficient).

Relevant References

- Instructions for CSNT Sampling; Cornell Nutrient Management Spear Program: <http://nmsp.cals.cornell.edu/projects/nitrogenforcorn/StalkNtest.pdf>.
- Agronomy Factsheets #31: Corn Stalk Nitrate Test (CSNT); #63: Fine-Tuning Nitrogen Management for Corn; and #72: Taking a Corn Stalk Nitrate Test Sample after Corn Silage Harvest. <http://nmsp.cals.cornell.edu/guidelines/factsheets.html>.

about these results contact Quirine M. Ketterings at 607-255-3061 or qmk2@cornell.edu, and/or visit the Cornell Nutrient Management Spear Program website at: <http://nmsp.cals.cornell.edu/>.



Acknowledgments

We thank the many farmers and farm consultants that sampled their fields for CSNT. For questions

Does High Quality Alfalfa Pay in Mixtures?

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Forage Production

Many alfalfa varieties currently on the market have claims of higher forage quality such as: fine stemmed, lower lignin, higher neutral detergent fiber digestibility (NDFD), higher relative forage quality (RFQ), high multifoliolate leaf expression, superior digestibility, higher feed intake, improved milk production, and superior forage quality. Higher quality alfalfa and grass varieties have the potential to significantly increase milk production and increase the proportion of homegrown feeds in rations. Increased fiber digestibility is the most important quality improvement.

Improvements in alfalfa forage quality

Changes in plant architecture (fine stems, multifoliolate trait, etc.) can lead to modest improvements in alfalfa forage quality. HarvXtra-type alfalfa varieties have reduced lignin content due to a genetic modification in lignin production. There are at least two varieties conventionally bred for reduced lignin. Reduced-lignin content by itself is of little benefit, unless it impacts NDFD. Reduced lignin could lead to increased lodging, although increased lodging has not been observed in low-lignin alfalfa varieties. Increased NDFD without large reductions in lignin also is a reasonable option, if possible.

Comparing alfalfa varieties in alfalfa-grass mixtures

While alfalfa can significantly impact grass CP content in mixtures, grass has little impact on any alfalfa quality traits in these mixtures. This means we can compare alfalfa varieties in mixtures and expect similar results as if they were in pure stands. Alfalfa-grass trials harvested in NY in 2017 included HarvXtra, Hi-Gest 360, LegenDairy XHD, WL 356HQ, WL 355RR, and Pioneer 55H94. Each individual trial contained 2-3 alfalfa varieties, with from 3-7 grasses, including meadow fescue, tall fescue, orchardgrass, festulolium, timothy, and reed canarygrass. All 2017 NDFD data here for alfalfa and grasses was based on weighted means over a 3 or 4-cut season (so higher yielding spring-cut forage counts more in the NDFD averages). How does grass affect any delay in harvest?

One of the advantages for HarvXtra is the potential to delay harvest and end up with higher yields of similar

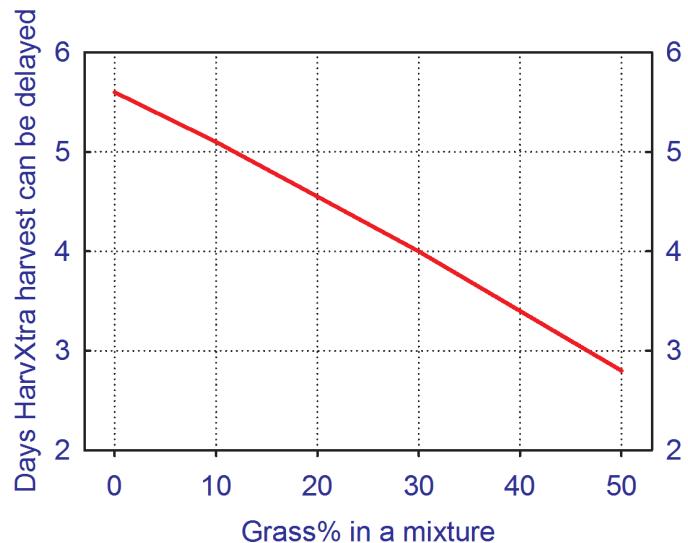


Fig. 1. Influence of grass on overall forage quality. Number of days that HarvXtra harvest can be delayed and maintain total forage NDFD similar to a conventional check variety on a normal harvest schedule. Based on 5.3% increase in NDFD for HarvXtra in NY in 2017, and an estimated loss in NDFD of 0.5% units/day for alfalfa and 1.0% units/day for grass.

quality, compared to conventional varieties under standard harvest regimes. University trials indicate that HarvXtra harvest can be delayed somewhere between 5 to 10 days and still have similar NDFD (48-hour) as a conventional variety harvested under a standard regime. Delayed harvest for HarvXtra could result in one less harvest per season, with similar or higher yields combined with less stress on the stand. But those estimates are for pure alfalfa stands, almost 90 percent of the alfalfa acreage in New York is sown with a perennial grass.

Grass in a mixture will dilute the high NDFD effect of improved alfalfa varieties. Based on NY 2017 data, pure HarvXtra harvested 5.5 days later provides similar NDFD as conventional varieties on a normal cutting schedule, but that interval shrinks as more grass is found in mixtures (Fig. 1). If a mixed stand is 30% grass, the HarvXtra advantage will be reduced to 4 days, and to less than 3 days at 50% grass.

Advantage of HarvXtra or Meadow fescue in mixtures
For this discussion, we are assuming that a one-percentage unit increase in NDFD likely results in significantly increased milk production. Our 2017

Forage Production

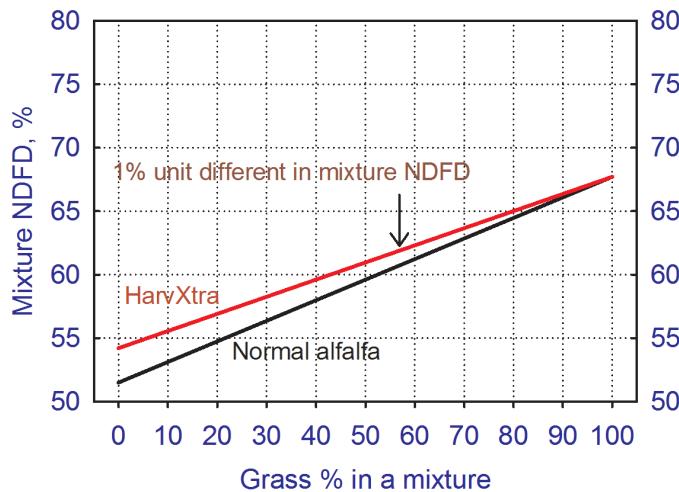


Fig. 2. Effect of alfalfa variety on NDFD of an alfalfa-grass mixture. Based on average of 5.3% higher NDFD for HarvXtra over other alfalfa varieties in NY 2017 trials.

results on average showed a 5.3% increase in NDFD for HarvXtra over other alfalfa varieties. Replacing a conventional alfalfa variety with HarvXtra should result in a significant increase in mixture NDFD (one percentage unit) for a stand that is up to almost 60% grass (Fig. 2). Replacing a lower quality grass with meadow fescue, however, results in a significant increase in mixture NDFD down to as low as 15 percent grass in a mixture (Fig. 3). This is because

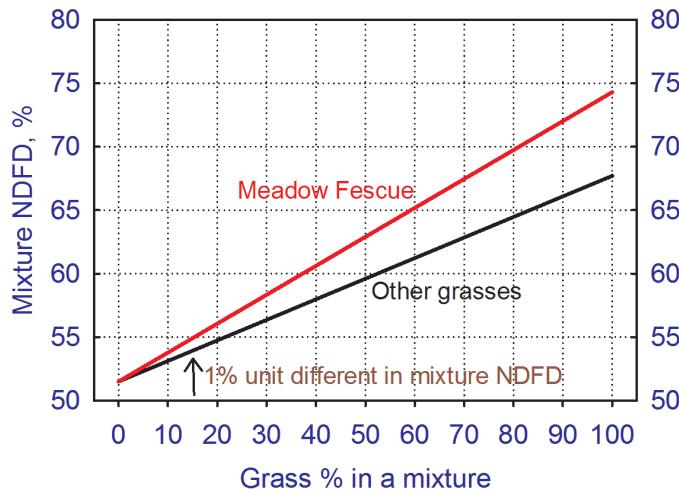


Fig. 3. Effect of grass species on NDFD of an alfalfa-grass mixture. Based on average of 9.7% higher NDFD for meadow fescue over other grass species in NY 2017 trials.

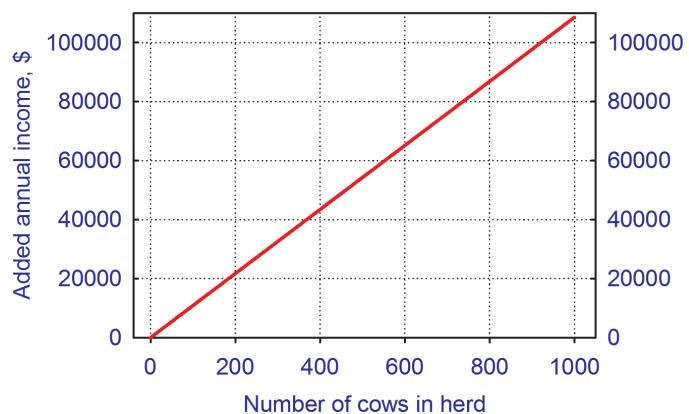


Fig. 4. Annual increase in milk income by using HarvXtra alfalfa and meadow fescue mixtures instead of normal alfalfa and other grasses. Based on 3.5% unit increase in NDFD in NY in 2017, and assuming 1% unit increase in NDFD = 0.5 lb milk/cow/day. Assumes a milk price of \$17/cwt.

grass NDFD is much higher than alfalfa NDFD. Our results in 2017 show that replacing a lower quality grass with meadow fescue increased grass NDFD an average of 9.7%. In a stand of 30% grass, the exact same increase in mixed forage NDFD is obtained by the addition of either HarvXtra or meadow fescue. As low as 5% of any grass in a mixture with alfalfa will significantly increase mixture NDFD (one percentage unit).

Economics of high quality alfalfa and grass

If we assume that HarvXtra seed costs about \$6/lb more than other high quality alfalfa varieties, and is seeded at 14 lbs/acre, then over the average life of a stand (4 years) HarvXtra would cost about \$20 more per acre due to seed costs. Meadow fescue does not cost significantly more than other grasses for seed, so there is no added seed costs for switching to meadow fescue.

An increase of one percentage unit NDFD (neutral detergent fiber digestibility) has been shown by feeding trials to increase milk production about 0.5 pound per cow per day. For high producing cows, the increase may be as high as 1 pound of milk per cow per day for every one percentage unit increase in NDFD. Based in NY 2017 trial results, the addition of HarvXtra and meadow fescue increased NDFD an average of 3.5 percentage units. Assuming a milk price of \$17/cwt, a 1000 cow herd could increase annual milk income by \$100,000

by planting HarvXtra/meadow fescue mixtures (Fig. 4). The added seed costs for using HarvXtra are not significant. Also, changing varieties or species planted is relatively farm-size neutral, with equal benefits per cow with small or large herds.

Summary

Planting HarvXtra alfalfa plus meadow fescue may increase milk income an average of \$100/cow/year. Other varieties recently released with potentially higher NDFD have not been adequately evaluated. Any alfalfa or grass variety with significantly higher NDFD than conventional varieties is going to be worth the price of admission (higher seed costs). Switching from a lower quality grass to meadow fescue can impact forage quality of mixtures just as much as a switch from an average alfalfa to HarvXtra. The greatest challenge for alfalfa-grass mixtures is getting and keeping a reasonable amount of grass in the mixture (20-30% grass).

For alfalfa-grass producers, there is the added issue of having to pay for the roundup-ready trait in HarvXtra, without a practical way of utilizing that trait in mixtures. Roundup-Ready has been bundled with reduced-lignin, with no intention of ever separating these two GMO traits. The recent interest in production of "GMO-free milk" (produced with a very small amount of GMO-type feeds in a cow's ration) could impact the success of GMO reduced-lignin alfalfa varieties, if the general public embraces this product.

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

Crop Production

SHOCKER: Organic Corn 206 bushels/acre and Conventional Corn 175 bushels/acre when following Wheat/Red Clover with High Inputs (but 191 and 199 bushels/acre, respectively when following Soybean)

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Conventional corn on the left received 140 lbs. N/acre and the corn on the right received 90 lbs. N/acre side-dressed. Usually 90 lbs. N/acre side-dressed + 25 lbs. N/acre in the starter suffices for corn following soybean but not in 2017, as indicated by the firing of the leaves, when ~10 inches of precipitation occurred from side-dressing until a week after silking (July 27).

We initiated a 4-year study at the Aurora Research Farm in 2015 to compare different sequences of the corn, soybean, and wheat/red clover rotation in conventional and organic cropping systems under recommended and high input management during the 36-month transition period from conventional to an organic cropping system. We provided a detailed discussion of the various treatments and objectives of the study in a previous news article at the onset of the study (<http://blogs.cornell.edu/whatscroppingup/2015/07/23/emergence-early-v4-stage-and-final-plant-populations-v10-psnt-values-v4-and-weed-densities-v12-in-corn-under-conventional-and-organic-cropping-systems/>). 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, corn followed soybean as well as wheat/red cover in 2017 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 corn yields while also providing supporting plant density, weed density, and grain N data.

The red clover green manure crop (~2.5

Organic corn on the right received an additional 50 lbs. N/acre as composted manure before plowing and the organic corn on the left did not. Evidently, the plowed-down clover provided some (as indicated by its 18 bushel/acre higher yield than conventional corn with recommended inputs) but not enough as indicated by the firing of some of its leaves and its 26 bushel/acre lower yield than the high input treatment.

dry matter tons/acre and ~3.85% N in the organic plots but only 1.25 tons/acre and ~3.0% N in conventional plots), which was inter-seeded into the 2016 wheat crop, was mowed on May 16. Organic corn in the high input treatment following wheat/red clover received a broadcast application before plowing of ~50 lbs. N/acre of Kreher's composted manure (5-4-3) but none in the recommended input treatment; and ~100 lbs. N/acre in the recommended input and ~140 lbs. N/acre in the high input treatment following soybean.

The fields were plowed on May 17, then cultimulched on the morning of May 18, the day of planting. We planted a treated (insecticide/fungicide seed treatment) GMO corn hybrid, P96AMXT, in the conventional system; and its isolate, the untreated non-GMO, P9675, in the organic cropping system at two seeding rates, ~29,600 kernels/acre (recommended input treatment)

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.

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

Crop Production

Table 2. Plant densities at the 9th leaf stage (V9), weed densities at the V14 stage, grain yield, and grain N% under conventional management (P9675AMXT-GMO hybrid treated with insecticide and fungicide and a Roundup application at the V4-V5 stage) and organic management (P9675-non-GMO hybrid with one rotary hoeing, a close cultivation, and three in-row cultivations) at recommended inputs (~29,600 kernel/acre seeding rate) and high input (~35,500 kernels/acre plus the organic seed treatment in the organic cropping system).

TREATMENT/Previous crop	PREVIOUS CROP (2014)		
	SPRING GRAIN	CORN	SOYBEAN
	Plant Densities (plants/ m ²)-V9 stage		
CONVENTIONAL			
Recommended-wheat/RC	26800	25781	27377
Recommended-soybean	26633	25708	27351
High Input-wheat/RC	31381	30719	31642
High Input-soybean	31185	29777	30924
ORGANIC			
Recommended-wheat/RC	24804	24619	24110
Recommended-soybean	24608	22172	24108
High Input-wheat/RC	28244	28831	28419
High Input-soybean	29117	28250	27015
LSD 0.05	2400	2250	2520
Weed densities (weeds/m ²)-V14 stage			
CONVENTIONAL			
Recommended-wheat/RC	2.01	0.95	0.74
Recommended-soybean	1.55	0.70	1.19
High Input-wheat/RC	1.50	0.51	0.72
High Input-soybean	1.07	0.90	1.00
ORGANIC			
Recommended-wheat/RC	0.81	1.15	0.09
Recommended-soybean	1.76	3.01	2.68
High Input-wheat/RC	0.82	0.67	0.12
High Input-soybean	1.83	2.84	2.18
LSD 0.05	0.60	0.87	0.75
Yield (bushels/acre)-15.5% moisture			
CONVENTIONAL			
Recommended-wheat/RC	164	159	160
Recommended-soybean	168	164	172
High Input-wheat/RC	181	168	176
High Input-soybean	203	197	198
ORGANIC			
Recommended-wheat/RC	188	174	177
Recommended-soybean	173	167	153
High Input-wheat/RC	208	204	205
High Input-soybean	198	191	185
LSD 0.05	19	22	20
Grain N-%			
CONVENTIONAL			
Recommended-wheat/RC	1.33	1.31	1.34
Recommended-soybean	1.36	1.33	1.34
High Input-wheat/RC	1.36	1.31	1.35
High Input-soybean	1.43	1.43	1.42
ORGANIC			
Recommended-wheat/RC	1.40	1.34	1.36
Recommended-soybean	1.28	1.25	1.24
High Input-wheat/RC	1.47	1.42	1.41
High Input-soybean	1.39	1.40	1.36

and 35,500 kernels/acre (high input). The high input organic treatment also received the organic seed treatment (in-hopper), Sabrex.

Conventional corn received ~250 lbs./acre of 10-20-20 as starter fertilizer, whereas organic corn received about ~315 lbs./acre of Kreher's composted manure through the planter. Conventional corn was side-dressed on June 15 (V3-4 stage) with ~50 lbs. N/acre in the recommended input and ~90 lbs. N/acre in the high input treatment following wheat/red clover; and ~90 lbs. N/acre in the recommended input and ~140 lbs. N/acre in the high input treatment following soybean.

We applied Roundup (Helosate Plus Advanced) for weed control in conventional corn (V4-V5 stages) under both recommended and high input treatments. We used the rotary hoe to control weeds in the row in recommended and high input organic corn at the V1-2 stage (June 2). We then cultivated close to the corn row in both recommended and high input organic treatments at the V3 stage (June 12) with repeated cultivations between the rows at the V4-V5 stage (June 22), the V5-V6 stage (June 28), and the V7-8 stage (July 5).

We estimated corn densities at the V1-2 stage by counting all the plants along the 100 foot plot in the two middle harvest rows, just hours before the rotary hoeing operation. We then estimated corn densities again at the V3 stage, 10 days after rotary hoeing but before the first cultivation; and again at the V9 stage after completion of all in-row cultivations. We will provide just the V9 data in this article

Crop Production

because we already provided corn density data at all three growth stages in a previous article (<http://blogs.cornell.edu/whatscroppingup/2017/07/26/close-cultivation-followed-by-three-in-row-cultivations-reduce-organic-corn-plant-densities-by-another-3-5-or-1000-plantsacre>). We estimated weed densities (greater than ~2 inches in size) at the V14 stage (July 20) by counting all the weeds along the 100 foot plot between the two harvest rows. We harvested corn with an Almaco Plot Combine on October 19, when grain moistures were in the 17-19% range. We collected ~1000 gram samples from each plot to determine grain moisture, test weight, and grain N.

Organic corn had 9% lower plant densities compared with conventional corn at the V9 stage (Table 2). As mentioned in previous articles, plant densities were similar between organic and conventional corn 12 days after planting (<http://blogs.cornell.edu/whatscroppingup/2017/06/05/organic-and-conventional-corn-have-similar-emergence-and-early-plant-densities-in-2017/>). The rotary hoeing operation, however, reduced plant densities in organic corn by 5.5%, and the repeated cultivations, including the close cultivation at the V3 stage, reduced plant populations an additional 3.5% (<http://blogs.cornell.edu/whatscroppingup/2017/07/06/rotary-hoe-operation-at-the-v1-2-stage-decreases-organic-corn-plant-densities-by-5-5-but-has-limited-effect-on-organic-soybean-plant-densities/>). Consequently, the recommended treatment in organic corn had final plant densities of only 22,000-24,000 plants/acre, too low for optimum yields on most soils in New York.

The repeated cultivations in organic corn provided satisfactory to excellent weed control, depending upon the previous crop in 2016 (Table 2). As mentioned in a previous article (<http://blogs.cornell.edu/whatscroppingup/2017/08/10/wheatred-clover-provides-n-and-may-help-with-weed-control-in-the-organic-corn-soybean-wheatred-clover-rotation/>), weed densities in organic corn following the 2016 wheat/red clover crops were similar or lower compared with conventional corn. Weed densities in organic corn when following soybean in the rotation, however, were consistently greater than weed densities in

conventional corn or organic corn following wheat/red clover. As mentioned in the previous article, it is not completely clear why weed densities were so much lower in organic corn following wheat/red clover compared with following soybean (separated only by a 10 foot border row) across all three fields with different 2014 previous crops.

Corn yield showed a cropping system x input treatment interaction (Table 2). **In a true shocker, organic compared with conventional corn with high inputs following wheat/red clover yielded a stunning 31 bushels/acre greater (206 bushels/acre vs. 175 bushels/acre average yields, respectively, Table 2).** As mentioned in the weed control article, organic corn with high inputs following wheat/red clover was poised to yield as well as conventional corn in 2017 because final stands averaged ~28,500 plants/acre, pre-sidedress nitrogen (PSNT) values averaged ~30 ppm, and weed densities averaged only ~0.55 weeds/m². We did not expect it to yield 18% higher, however.

What happened? We mentioned that red clover, frost-seeded into organic winter wheat in early March of 2016, averaged 2.25 tons/acre of dry matter with 3.85% N compared with only 1.25 dry matter tons/acre with a 3.0% N concentration in conventional wheat. For some unknown reason, the ammonium nitrate applied to conventional wheat in April of 2016 resulted in poor red clover growth. Consequently, we side-dressed 50 lbs. N/acre to the recommended conventional treatment and 90 lbs. N/acre to the high input conventional corn treatment following wheat/red clover (instead of the intended 0 and 50 lbs. N/acre, respectively). Nevertheless, conventional corn following wheat/red clover in the recommended treatment (50 lbs. N/acre) yielded an average 18 bushels/acre lower than the recommended organic corn treatment, which received no additional N and relied totally on plowed in red clover for its N supply. Apparently, the red clover crop provided essentially zero N to conventional corn as indicated by the 14 bushel /acre increase in the high input treatment, which received 50 lbs./N/acre side-dressed. Conventional corn following soybean, which received 90 and 140 lbs. N/acre sided-dress N, compared with organic corn following soybean, which

Table 3. Correlations (*r* values, *n*=88) among grain yield, plant density at the 9th leaf stage (V9), weed density at the V14 stage, and grain N% of corn at harvest at the Aurora Research Farm in 2017.

Variable	Plant density-V9	Weed density-V14	Grain N%
Grain Yield	0.46***	-0.20*	0.68***
Plant density-V9	-	-0.19	0.32**
Weed density-V14	-	-	-0.41***
Grain N%	-	-	-

*** Significant at the 0.001 probability level

received comparable organic N rates, yielded similarly (numerically higher) in both the high and recommended input treatments (Table 2).

Both organic corn and conventional corn responded to high inputs in 2017. When averaged across the three previous crops and two rotations, conventional corn showed an average 23 bushel/acre yield increase with high inputs; whereas organic corn showed a 27 bushel/acre increase. The experimental site received about 10 inches of precipitation from side-dressing (June 15) until the end of July, which probably resulted in considerable leaching of side dress liquid N, but much less of the slowly released organic N from plowed-down red clover. We believe that lack of available soil N in the recommended input treatment probably resulted in the yield response to high inputs in conventional corn. In organic corn, however, the lack of available soil N, especially when following soybean, as well as final plant densities of only 22,000-24,000 plants/acre probably resulted in the yield response to high inputs.

Grain N% showed a cropping system x input treatment interaction (Table 2). Grain N% showed a consistent 0.06 to 0.12% grain %N increase in the high vs. recommended input treatments in both organic and conventional systems (even with the significant yield increases), except in the conventional system when following red clover (average 1.33 and 1.34% N, respectively). Critical grain N concentrations vary greatly according to growing conditions and are difficult to detect. Some studies have suggested that a grain

N concentration of 1.31% N separates sufficiency from deficiency. Only the high input conventional treatment following soybean and the high input organic treatment following red clover, the highest yielding treatments, were clearly above the 1.31% grain N threshold, consistently in the 1.41 to 1.43% N range.

Correlation analyses indicated highly significant correlations between grain yield and grain N% ($r=0.68$, *n*=88) as well as grain yield and plant densities at the V9 stage ($r=0.46$, Table 3). Grain yield and weed densities at the V14 stage had a weak negative correlation ($r=0.20$). Apparently available soil N and plant densities were the major drivers of corn yields in 2017, when excessively wet soil conditions persisted through the end of July.

Organic corn is eligible for the organic premium this year so with similar or greater yields, organic compared with conventional corn would be more profitable in 2017. Costs, however, would be greater for organic corn, especially with high inputs, because of the 10x more expensive N fertilizer, associated with the cost of Kreher's composted manure (many organic growers, however, use a far cheaper source of organic N than composted manure). Likewise, weed control costs in organic corn would be higher because of the five trips across the field for rotary hoeing and cultivation. In addition, seed costs for organic corn, although lower than conventional seed costs, would increase because of the apparent need for higher seeding rates to account for the 5,000 plant/acre plant loss incurred during rotary hoeing and cultivation operations. (We will increase our recommended seeding rate recommendation for organic corn to 35,000 kernels/acre in the 2019 Cornell Guide for Field Crops). Nevertheless, the organic premium will offset the additional costs for 2017 organic corn production.

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

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We initiated a 3-year study at the Aurora Research Farm in 2015 to compare different sequences of the corn, soybean, and wheat/red clover rotation in conventional and organic cropping systems under recommended and high input management during the 36-month transition period (2014-2017) from conventional to an organic cropping system. This article will focus on days to emergence, early plant densities, and fall weed densities of wheat in the fall of 2017.



Organic wheat on the right (two 10-foot passes) was planted at 1.2 M seeds/acre, the same rate as the conventional wheat in the left. The variety is the same (P25R46) in both cropping systems but the conventional wheat on the left received a fungicide-insecticide seed treatment, whereas the organic wheat on the right received no seed treatment.

Soybeans were harvested on September 26. We no-tilled wheat into the soybean stubble on the following day, September 27, because of the paucity of winter annual and winter perennial weeds. We used a John Deere 1590 No-Till Grain Drill to plant the treated (insecticide/fungicide seed treatment) soft red wheat variety, Pioneer 25R46, in the conventional cropping system; and the untreated 25R46 in the organic cropping system at two seeding rates, ~1.2 million seeds/acre (recommended input) and ~1.7 million seeds/acre (high input treatment). Soil conditions were dry so we planted ~2.0 inches deep to get into moisture. We applied about 200 lbs. /acre of 10-20-20 as a starter fertilizer to conventional wheat in both input treatments. In the organic cropping system, we applied the maximum amount of Kreher's composted manure (5-4-3 analysis) that would flow through the drill, or about 100 lbs. of material/acre, as a starter fertilizer

in both organic input treatments. We also broadcast Kreher's composted manure to provide ~60 lbs. of actual N /acre (assuming 50% available N from the composted manure) in the high input treatment in the organic cropping system. In addition, we also added Sabrex, an organic seed treatment with Trichoderma strains, to the seed hopper of 25R46 in the high input treatment in the organic cropping system. Finally, we also applied Harmony Extra (~0.75 oz. /acre) to the high input conventional treatment at the early tillering stage (GS 2-October 27) for control of winter perennials (dandelion in particular).

We estimated plant emergence (>50% emergence) on October 6 and 7. We estimated plant densities on October 13 by counting all the plants in the four middle rows along a 1-m long meter stick in five different regions in the 100 foot long plots. We estimated weed densities on October 28 by counting all the visible winter weeds (there were a few summer annuals but numbers were low) along the entire 100 foot plot in the immediate 8 rows (on the way up) and the more distant 8 rows (on the way back). We also noted the dominant weeds in the plots (95% or more of the winter weeds were dandelions).

Organic compared to conventional wheat emerged 1.0 to 1.75 days earlier, had much better stands 2 weeks after planting, and fewer weeds 5 weeks after planting (Table 1), similar to our 2015 results (<http://blogs.cornell.edu/whatscroppingup/2015/11/23/wheat-emergence-early-plant-populations-and-weed-densities-following-soybeans-in-conventional-and-organic-cropping-systems/>). The experimental site received only 1.48 inches of precipitation in August and 2.55 inches in September so soil conditions were generally dry after soybean harvest. More specific to planting time, only 0.18 inches of precipitation were recorded in the 10-day period before planting to the 10-day period after planting. Dry soil conditions, the 2-inch planting depth, and the considerable soybean stubble (55-60 bushel/acre crop) undoubtedly contributed to the relatively long emergence time (8 to 10 days), despite warm conditions for the 8 to 10 days after planting (58.6 vs. 55.7 OF, average since 1980). As in 2015 wheat, we speculate that the seed treatment in the conventional

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Table 1. Days to emergence, wheat densities at the 1-shoot stage (GS 1-October 7), and weed densities at the early tillering stage (GS2-October 27) of treated (insecticide/fungicide) 25R46, a soft red winter wheat variety, in the conventional cropping system and untreated 25R46 in the organic cropping system, 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. In addition, 25R46 in the high input treatment in the organic cropping system was treated with Sabrex, an organic seed treatment, in the seed hopper at planting time.

TREATMENTS	2014 CROPS		
	BARLEY	CORN	SOYBEANS
	Emergence (days)		
CONVENTIONAL			
Recommended	9.0	10.0	9.5
High Input	9.0	10.0	9.0
ORGANIC			
Recommended	8.0	8.25	8.0
High Input	8.0	8.25	8.0
LSD 0.05	0.75	1.0	0.875
Wheat densities-GS 1 stage (plants/acre)			
CONVENTIONAL			
Recommended	800,000	871,930	822,368
High Input	1,034,845	1,024,411	1,005,287
ORGANIC			
Recommended	1,346,895	1,142,105	1,349,343
High Input	1,562,477	1,777,192	1,738,816
LSD 0.05	3,568	4,027	3,430
Weed densities-GS 2 stage (weeds/m²)			
CONVENTIONAL			
Recommended	0.22	0.54	0.19
High Input	0.08	0.48	0.13
ORGANIC			
Recommended	0.05	0.19	0.08
High Input	0.05	0.18	0.05
LSD 0.05	0.12	0.28	NS

wheat made the seed somewhat more impermeable to soil water imbibition under the relatively dry soil conditions, resulting in delayed emergence in the conventional cropping system by 1 to 1.75 days. We also noted more rapid emergence for organic compared with conventional corn in 2016 under very dry soil conditions. It would be interesting to test if seed treatment actually delays emergence of crops under dry soil conditions because of the consistency of observations across crops and dry years at planting in our study.

Organic compared to conventional wheat had greater plant densities (37%) 2 weeks after planting in part

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because of the delayed emergence of conventional wheat (Table 1). More conventional wheat emerged after our observations but we could not do another wheat density count because the earlier emerging wheat began to initiate tillers, which made counting too problematic. Another factor that may have influenced our results is that seed size differed between the untreated 25R46 (~11,000 seeds/lb.) and the treated 25R46 (~12,000 seeds/lb.) so drill settings were not consistent between the two plantings. Organic compared with conventional wheat also had 10 to 25% greater early plant densities 2 weeks after planting in the fall of 2016. Organic and conventional wheat, however, had a similar number of spikes or heads/m² at harvest (~525 heads/m²) in 2016 so conventional wheat compensated for the lower plant densities with increased tillering, contributing in part to its 7.5% greater yield (<http://blogs.cornell.edu/whatscroppingup/2016/09/26/organic-wheat-looked-great-but-yielded-7-5-less-than-conventional-wheat-in-20152016/>).

Once again, organic compared with conventional wheat generally had fewer weed densities, especially in the field in which corn was the 2014 crop (Table 1). Weed densities, however, were very low so yields will probably not be compromised except in a couple of the plots in the conventional cropping system under recommended inputs (no herbicide) when corn was the 2014 crop. Dandelion was the dominant weed specie 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 emerged after the June 21 Roundup application.

In conclusion, organic compared with conventional wheat, no-tilled into soybean stubble, once again got off to a better start in the fall of 2017, as it did in the fall of 2015. Despite the better fall start in 2015, organic wheat yielded 7.5% lower. We could only apply ~100 lbs. /acre of Kreher's compost to the organic wheat through the drill at planting in both years, due to flow problems of the composted manure, which may be a yield constraint (very little P or K applied). We will top-dress the recommended input treatment with ~75 lbs. N/acre of Kreher's material at green-up time in the

early spring, and add an additional ~50 lbs. of N/acre with Kreher's to the high input treatment at the end of tillering, as we did in the spring of 2016. The organic wheat, however, had much lower kernel N (1.66% N) compared with conventional wheat (2.03% N) at harvest in 2016, indicating that lack of available soil N in organic wheat probably contributed to the 7.5% lower yield in 2016. Wheat fertility and not stand establishment nor weed control appears to be the major challenge to successful organic wheat production under conditions in our study.

Corn Rootworm Management Strategies for 2018

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Pest
Management

The excessive wet soil conditions during the 2017 corn rootworm (CRW) hatching period during late May – early June caused a major reduction in corn rootworm adult populations during the 2017 growing season. Adult surveys in most fields during early August showed a scarcity of adult beetles during the egg-laying period. As a result, most fields in NY will have a reduced risk for CRW damage during the 2018 growing season. In these lower risk fields, CRW management costs can be reduced by growing non-Bt-CRW corn and using either a reduced rate of soil insecticide or the 1250 rate of seed treatment. First year corn is never at risk from CRW and therefore Bt-CRW corn, a soil insecticide or the 1250 rate of seed treatment is an unnecessary expense. This includes any application of Capture in the pop up fertilizer. Well drained fields which did not experience the typical periods of water logged soils during late May – early June 2017 will be at higher risk from CRW injury in 2018 and should be managed accordingly. These higher risk fields may benefit from planting Bt-CRW corn varieties. In “normal” years, the risk of economic damage from CRW is 0% – 1st year corn, 25%-35% – 2nd year corn, 50%-70% – 3rd year corn and 80%-100% for 4th year and longer continuous corn.

Status of Bt-CRW resistance in the US:

CRW Bt resistance continues to build across the corn growing regions of the US with multiple localized resistant populations identified for each of the Bt-CRW traits. Cross resistance has been identified within the Cry3 family (Cry3Bb1-Yieldgard Rootworm, eCry3.1Ab-Duracade, mCry3A-Agrisure RW) and if one of the Cry3 traits are failing in your field, the planting of another toxin within the Cry3 family may lead to disappointing CRW management results. Resistance has also been reported in several states to Cry 34Ab1/Cry35Ab1. There has been no reported cross resistance between the Cry3 family of toxins and Cry34Ab1/Cry35Ab1 toxin combination.

The rootworm Bt-toxin pyramids consist of two different Bt-RW toxins in the same plant. Some seed companies have included two different toxins from the Cry3 family where cross resistance has been reported where other seed companies utilize the pyramid mix of a toxin from

the Cry3 family and Cry34Ab1/Cry35Ab1 where no cross resistance has been reported. If control failures have been reported in your fields/region to any one of the Cry3 family of toxins, planting a pyramid composed of two different Cry3 toxins is not recommended. Instead, it is a better CRW resistance choice to plant a pyramid consisting of a Cry3 toxin with the Cry34Ab1/Cry35Ab1 toxin.

A very handy resource to identify the Bt traits in your corn varieties is the annually updated Bt trait table. **The 2018 Handy Bt Trait Table for US Corn Production** is made available by Dr. Chris Difonzo, MSU, Dr. Pat Porter, Texas A&M and Dr. Kelley Tilmon, OSU can be found at the following URL:

[https://lubbock.tamu.edu/files/2018/01/
BtTraitTableJan2018.pdf](https://lubbock.tamu.edu/files/2018/01/BtTraitTableJan2018.pdf)

As Bt –CRW traits are failing to resistance by corn rootworm, the promise of the next effective trait is ever appealing. The development of the RNAi technology against CRW has been touted as the next effective plant incorporated toxin with a very slim chance of resistance development by CRW. However, it only took about 20 million individuals from a single Illinois continuous corn field and a few generations to generate an RNAi resistant laboratory population. In addition, field results with RNAi containing corn varieties suffer a noticeable amount of root feeding damage before the slow-killing toxin kills the insect larvae. As a result, the new RNAi technology will not be the “silver bullet” everybody has hoped for. Stewardship of the Bt technology has become increasingly important in areas where Bt resistance has not been reported because the next technology needs effective Bt toxins to help it out.

Bt Trait Stewardship Suggestions:

A few simple management adjustments can go a long way in preserving the efficacy of the Bt-CRW traits in NY.

- Long-term corn fields need to be rotated to a non-corn crop on a regular basis. Continuous corn matched with a long-term use of same Bt-CRW trait promotes the development of a resistant

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population.

- Rotate toxins between the Cry3 family and Cry34Ab1/Cry35Ab1 toxins. There is no recorded cross resistance between these two groups of toxins.
- Use the Bt-CRW technology only in fields of 3rd and longer continuous corn fields. Rotate the toxin groups and rotate the long-term corn to at least 1 year away from corn to break the CRW cycle.
- Plant some fields to non-Bt-CRW varieties and use either a granular soil insecticide or the 1250 rate of seed treatment. Liquid insecticides in the popup fertilizer are not effective and not recommended.

Cover Crop Induced Insect Problems

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Pest Management



The increased adoption of cover crops as a soil conservation and soil health building strategy is not without increased risk from insect pest problems. Increased insect pest risk can be managed with a combination of timely killing of the cover crop, pest scouting, and additional timely application of insecticide.

The best-case scenario for the management of the cover crop to reduce insect risk is to kill the cover crop far enough in advance that the cover crop is completely dead prior to the planting of the crop. Foliar feeding insects often can survive on the dying cover crop, and if the new crop emerges before the cover crop is completely dead, the foliage feeding insects simply move from the dying cover crop onto the newly emerged and tender crop plants. This is termed a green bridge.

The worst-case scenario for insect risk is to plant into a green cover crop which has been rolled prior to planting and then sprayed with an herbicide to kill it after the crop has been planted. This provides an excellent green bridge for the insects, like black cutworm larvae and armyworm larvae, to move directly onto the newly emerging crop.

Cover Crop Bridging Insects:

Black cutworm: Black cutworm is a long-ranged migrant which overwinters in the southern US. Moths typically arrive in NY during mid-April to early-May on the early weather systems. Moths are attracted to

grassy areas, grassy cover crops, grass waterways, and fields with grassy weed problems. Eggs are laid on these plants and larvae begin feeding on these plants. In the situations where producers kill the cover crops or grassy weed areas with herbicide or tillage, the black cutworm larvae continue to feed on the dying plants for 1-2 weeks. When corn seedlings start emerging, the existing larvae then move from the dying plants onto the growing corn. Since black cutworm larvae do not start their cutting behavior until mid-size (L-4), the early larval development on the grassy weeds is a critical association with the economic association of black cutworm to seedling corn. In the situations where eggs are laid on emerging corn, corn development to V6, a stage where black cutworm has difficulty cutting occurs before the black cutworm develops to the larval stage where they begin cutting (L4).

Since black cutworm larval development on existing plants in the field prior to the planting and emergence of the corn is a critical component in the development of economic infestations, the management of the green plants prior to corn planting is important. Elimination of the green bridge between the cover crop and/or grassy weed cover at least 2 weeks before the emergence of corn seedling dramatically reduces the risk of a black cutworm infestation in NY corn fields. If the separation between the killing of the cover crop/grassy weeds and the emergence of the corn crop cannot be at least 14 days, the corn seedlings need to be scouted for the presence of foliar feeding, early cutting and the presence of larvae. To the trained eye, pre-cutting foliar feeding is very obvious and easily detected.

Armyworm: Armyworm is a long-ranged migrant similar to black cutworm, but often arrives 15-30 days later in NY. It overwinters in the southern US, and the moths emerging in April in the south use the weather systems to move long distances. When the moths arrive, they are attracted to grass hay fields or grassy cover crops. If the eggs are laid in the hay field, larvae will feed on the grass and only move when the field has been stripped, thus the name armyworm. Neighboring corn fields are then attacked by the larger marching larvae. When eggs are laid in a grassy cover crop, the larvae will feed on the cover crop until it is stripped

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before moving. If corn is emerging in the cover crop, they will simply move onto the young corn plants. Armyworm larvae are totally foliage feeders and do not cut plants like black cutworm. With timely scouting, this insect is easily controlled with an application of foliar insecticide. Usually, the infestation is missed until the field is stripped and the larger larvae are moving into a neighboring field.

Seed corn maggot: Seed corn maggot (SCM) adults (flies) are attracted to decomposing organic material. This organic matter can range from animal manures to decomposing plant material/killed cover crop. Fresh decomposing organic matter is more attractive to the flies for egg deposition than composted organic matter; although, SCM will also lay eggs in composted organic matter. Adult flies are present for egg laying from early May until late September. The highest risk fields for SCM problems would be a green manure crop covered with a thick layer of animal manure prior to planting the crop. High manure application rates without thorough incorporation before planting of large seed crops is a high SCM risk field. Damage from SCM is plant stand reduction, and without insecticide protection, plant stands can be reduced 30%-80%. The primary reason for insecticide treatment (Poncho, Cruiser, etc) on large seed crops (corn, soybeans) is protection against SCM-related plant stand loss. Under extremely heavy SCM pressure, the insecticide seed treatment can be overwhelmed, resulting in corn/soybean stand losses.

To reduce risk from SCM, cover crops should be killed and allowed to turn brown before planting the season's crop. In addition, applications of manure should be subsurface rather than surface applied.

Wireworms: Adult wireworms (click beetles) are attracted to small grains, grass fields, run-out alfalfa fields which are mostly grass, and grass-based cover crops. Adult beetles search out these hosts during the growing season (June-August) and lay eggs. The larvae (wireworms) hatch and feed on a wide array of roots for multiple years. In cropping sequences where grassy/small grain/cover crops are present in the field during the June-August period, wireworms feeding on new seedlings and root crops can become

an economic problem. While corn is technically a grass, wireworms do not find corn fields attractive for egg laying. However, small grains are very attractive. Generally, spring planted grains are more attractive than fall planted grains which mature in early summer. In conventional production systems, the insecticide seed treatment generally is effective at reducing the impact of wireworm feeding. However, in the organic production system, there are no effective rescue treatments for wireworm infestations/feeding damage. If grassy cover crops are the only grass in the cropping sequence, timely crop termination before June will reduce the attractiveness to wireworms for egg laying.

White grubs: In NYS, there are two different groups of white grubs which can be problematic. The first group is the native white grubs which have multi-year life cycles and the second group is the invasive annual white grubs (Japanese Beetle, European Chafer). Adults from both groups are attracted to grassy habitats to lay their eggs during mid-June to mid-July. Eggs hatch during August, and the larvae begin to feed on grass roots. In the case of the invasive annual white grubs, the larvae grow quickly and achieve more than 50% of development before winter. In the spring, the larvae resume development and are quite large when the grassy field is rotated to corn or soybeans and the new plants are quite small. Plant death is caused by these large larvae feeding on plant roots faster than the plant can generate roots. Larvae become adults in June and the cycle repeats. In the case of the native multiyear white grubs, the life cycle is similar but larval development requires 2-4 years depending on the species. Subsequent crops following the grassy/cover crop/small grain field are then impacted differently. With annual white grubs, the damage to the subsequent crop is confined to the following year only. In the case of native white grubs, subsequent crops could be impacted up to 4 years with declining damage levels each year.

The following two different cropping scenarios seem to place subsequent crops at higher risk. The most common case is the alfalfa field which has become mostly grass or a grass hay field which is then rotated into a large seed crop like corn or soybeans. The

second scenario is the field which has been planted to a grass-based cover crop and not killed during the June-July egg laying period. In most cases, the insecticide seed coating on all corn and some soybean seeds reduce the impact of white grubs on subsequent crops. High white grub populations can overwhelm the insecticide, however.

Slugs: Increasing the organic soil cover with either the use of cover crops or last year's crop waste increases the slug problem. In cool wet springs, which slow plant emergence and growth, damage from slug feeding can be severe. There is a little anecdotal evidence to suggest the presence of green cover reduces the slug damage because of the surplus of green tissue. In these cases, slugs miss the newly emerging plants and feed on the green cover crop.

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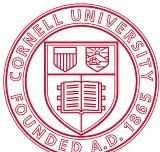
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Calendar of Events

FEB 9
FEB 13
FEB 13
FEB 15 & 16
FEB 21
FEB 22-24
MAR 1
MAR 7 & 8
MAR 13
MAR 20
MAR 29

[Hudson Valley Value-Added Grain School](#) - Coxsackie, NY
[2018 Corn Day](#) - Cooperstown, NY
[NY Certified Organic 2018 Meetings](#) - Geneva, NY
[71st Northeastern Corn Improvement Conference](#) - Ithaca, NY
[Weed Control in Organic Field Crop Systems](#) - McLean, NY
[New York Farm Show 2018](#) - Syracuse, NY
[Capital Region Pesticide Recertification Day](#) - Latham, NY
[Northeast Dairy Producers Conference](#) - Liverpool, NY
[NY Certified Organic 2018 Meetings](#) - Geneva, NY
[Organic Farm Tour](#) - Manlius, NY
[Are You Robbing Your Pastures to Feed Your Livestock?](#) - Dryden, NY

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