What's Cropping Up?

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Corn Silage Management Research in NYS

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Research has been conducted on a range of corn silage management topics in NYS over the past few decades. This summary is based on research that has included multiple sites and/or multiple years. Issues can be divided into two basic categories: Concerns prior to planting and concerns after planting. First, we prepare for the season, and then we have a limited number of options to react to the specific weather conditions of each season.

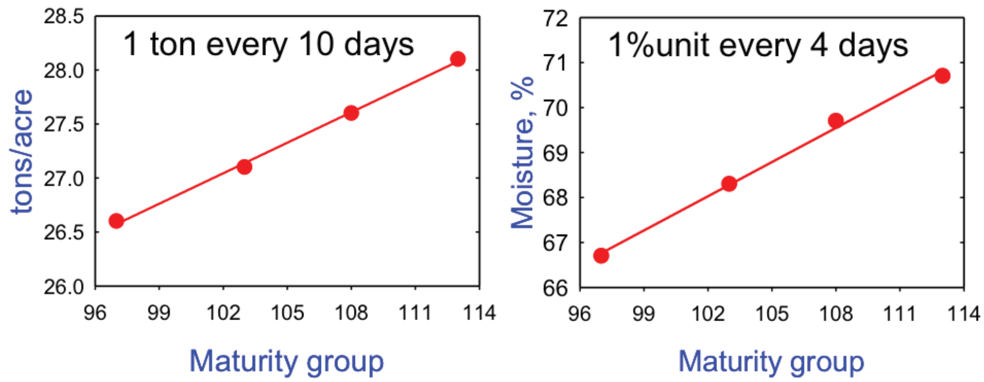


Figure 1. Effect of Maturity group selection on moisture and yield of corn silage, assuming all are harvested on the same day.

Pre-season

Hybrid selection

While there are a number of options regarding plant genetics, of primary concern is the selection of the correct maturity group for your area and for the particular season (Fig. 1). You can expect to increase yield by about one ton/acre for every 10 additional maturity group days. The greater the maturity group, the higher the moisture content will be on any given fall date. Keep in mind that moisture loss per day keeps

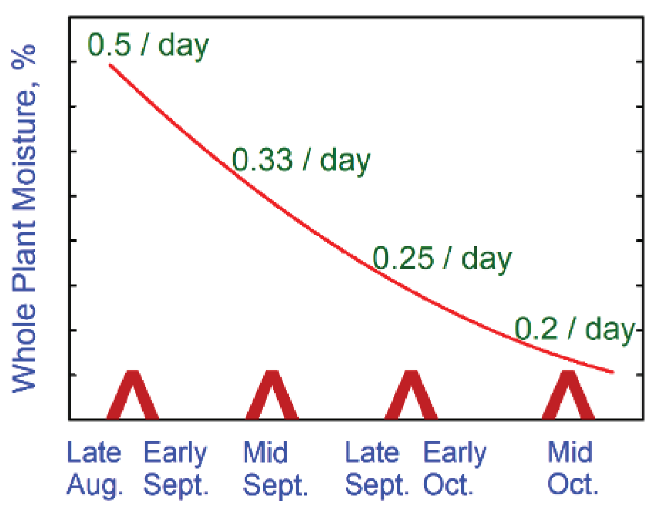


Figure 2. Approximate moisture loss per day through the fall.

shrinking through the fall period (Fig. 2), making it increasingly difficult to reach optimum moisture in late fall.

Maturity group selection is influenced by your planting date and by your normal first frost date. 1) Plant full season hybrids from late April (if soil is dry) to late May, 2) Adjust hybrid relative maturity to planting date - mid-season hybrid from late May-~June 10, or 3) Plant early-season hybrids after June 10.

Brown-midrib (BMR) corn hybrids continue to improve in comparison to other options, and are worth considering. BMR hybrids will yield about 90% of a normal hybrid, plus or minus a few percent. On the plus side, BMR hybrids can be up to 25% higher in fiber digestibility (NDFD) than normal hybrids. Dairy feeding trials have shown that a small increase in ration fiber digestibility produces a significant increase in milk production.

While there still may be some increased potential for lodging, current BMR hybrids are much improved over the original BMR offerings. However, one issue that remains is dry down, BMR hybrids tend to retain moisture significantly longer than normal hybrids in the same maturity group. Also, there are indications that BMR types are somewhat lower in starch digestibility than floury types.

Seeding rate

Numerous seeding rate trials over several decades in NY produced relatively consistent results (Fig. 3). Soil type has some impact on suggested seeding rates. Deep, well-drained soils => 36,000; Moist silt loam soils => 34,000, and Droughty soils => 30,000. Seeding at a rate of 35,000 is now very common in NY.

Row spacing

Trials comparing narrow rows (15”) with standard 30” rows have shown increased yield with narrow rows, if fertilized adequately with N (Fig. 4). Narrow rows have a more equidistant plant spacing, resulting in full sunlight being intercepted earlier in the season. The possible downside to narrow rows includes purchase of a new planter, and a row-independent harvesting head if not already on-hand. Any post-emergence applications

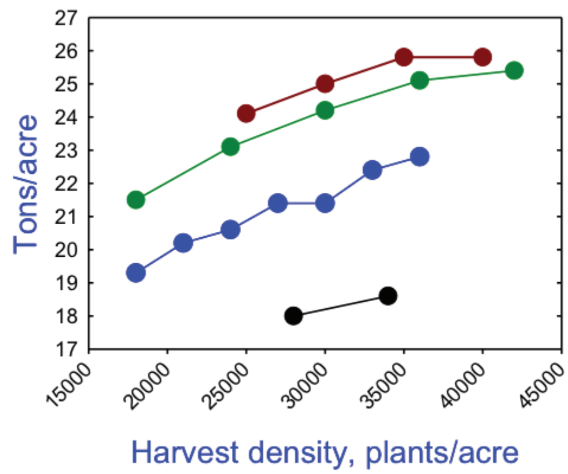


Figure 3. Yield as influenced by plant density.

will result in some wheel traffic damage, which can be minimized by large-width application equipment. Partial budget analysis, assuming the purchase of new equipment, shows a significant increase in returns when converting to narrow row corn.

During the Season

Side-dress N

There is an optimum amount of N for a given field that will maximize yield, excess N application beyond the optimum amount will have negative environmental consequences. There are several alternative methods for determining side-dress N application to corn, and also methods for evaluating the relative success of the chosen application rates.

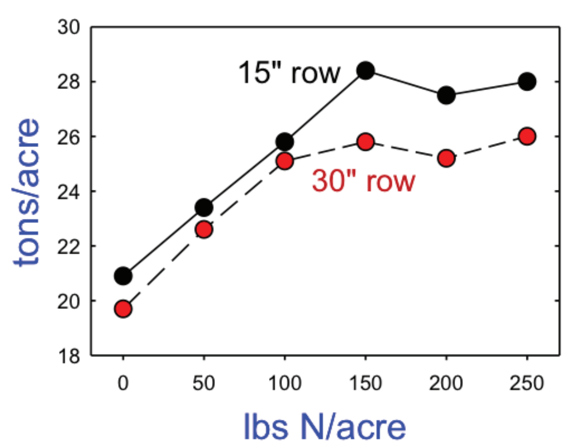


Figure 4. Narrow rows can increase yield, if adequately fertilized.

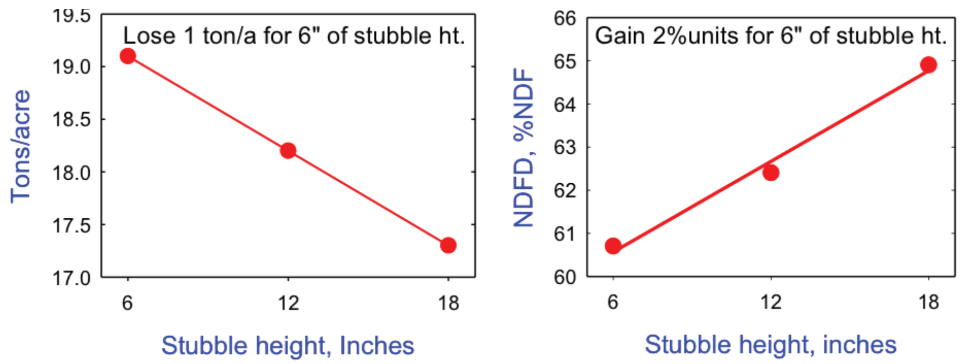


Figure 5. Relationship between harvest stubble height of corn silage and yield or quality.

Whatever method is used to determine N application rates, it is critical to have confidence in that process, as it must adhere to federal conservation practice standards, which are mandatory for concentrated animal feeding operations (CAFOs). The process for development of Land Grant University guidelines for fertility management and for evaluating environment risk is currently being formulated.

Harvest stubble height

If excess silage yield is anticipated, corn may be harvested at a higher stubble height to increase silage quality. Yield decreases linearly and NDFD increases linearly, with increased harvest stubble height (Fig. 5). A corn plant is basically a low-quality fiber pole that holds a high-quality grain bin. Cutting the plant higher up loses some fiber (lower yield), but it concentrates the impact of the grain bin (higher quality). Conversely, cutting perennial grasses or legumes high to improve quality ends in failure, it only reduces yield.

If you are routinely cutting high to increase corn silage quality, consider switching to BMR hybrids. The typical yield loss with BMR is in the same range as the yield loss due to high stubble height. The increase in fiber digestibility with BMR, however, can be three times as great as the NDFD increase due to high stubble height.

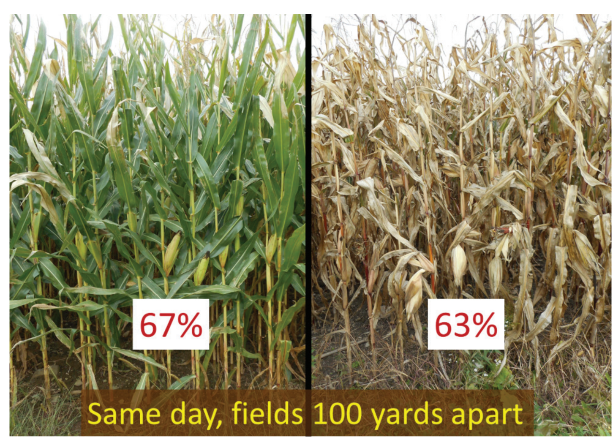
Determining optimum moisture at harvest

Harvesting at optimum moisture content is more important than hybrid genetics selection. Optimum moisture content for making silage is between 60 and 70%, although generally the ideal moisture content is in the upper 60's. It is nearly impossible to estimate whole plant moisture content visually. There are several methods of estimating moisture content to optimize moisture at harvest.

Growing Degree Days. On average, a 100-day hybrid will have 1200 GDD from planting to silking. Another 800 GDD is the average from silking to silage harvest. The current year's local weather data can be used to determine the actual GDD up to the present time, and then long-term average weather data can be used to predict into the future. The shorter the prediction time period, the more accurate a GDD prediction will be.

Chop and measure moisture. A more accurate method of determining whole plant moisture is to use the harvester to chop a few hundred feet into the field and either dry a sample or use an on-board NIRS instrument to determine moisture content. While this can be very accurate, it only provides a measure of moisture for the current day. An estimate of future field drying is required (Fig. 2) to reach optimum moisture.

Cut a sample by hand. Another method is to walk through a portion of the field and cut a number of plants by hand, then chopping the plants and drying



It is very difficult to estimate whole plant moisture visually.

to determine moisture content. The number of plants required depends in part on the uniformity of the field. During the fall of 2019 we cut 40-50 individual plants/field out of a number of fields across central and northern NY. Since we measured individual plant moisture content, it was possible to determine the number of plants required to get a representative field moisture value. For a very uniform field, 5 plants are likely to provide a good field moisture estimate. Even with more variable fields (uneven emergence issues, etc.) 10 plants is likely to provide a reasonable estimate of field moisture.

NIRS on whole plant corn. Since estimating moisture content for harvest is critical, we are evaluating small hand-held NIR units to determine if it is possible to estimate standing whole plant corn moisture. One major issue with standing whole plants is that ear moisture changes at a very different rate than stover moisture. Ears begin drying down much earlier than the stalk, so estimates of standing plant moisture may need to include information on both ear and stover moisture status. A fast and accurate method of estimating field moisture would be very beneficial for the large acreage of corn silage in NY.

There are many important management decisions regarding corn silage that must be made prior to the start of the season. The relatively few management decisions that can be made during the growing season, particularly moisture content at harvest, can make the difference between profit and loss.

New York Phosphorus Index 2.0

Karl J. Czymmek[1,2], Quirine M. Ketterings[2], Mart Ros[2], Sebastian Cela[2], Steve Crittenden[2], Dale Gates[3], Todd Walter[4], Sara Latessa[5], and Greg Albrecht[6]

Nutrient Management

After more than 15 years of field use, version 1 of the New York Phosphorus Index (NY-PI) has been updated. The new version (NY-PI 2.0) incorporates new science and does a better job of addressing P loss risk while still giving farm managers options for recycling manure nutrients. The process of updating the NY-PI was led by the NMSP at Cornell in partnership with NYSDAM, NYSDEC, and NRCS and in consultation with certified planners and farmers. Farms that are regulated as concentrated animal feeding operations (CAFOs) will need to start using the new NY-PI when the CAFO Permit is updated (current permits are due to be renewed in 2022). Farms that are in state or federal cost share programs will need to use the tool based on NRCS determination. Agency discussions are in progress to make sure the roll-out is as smooth as possible.

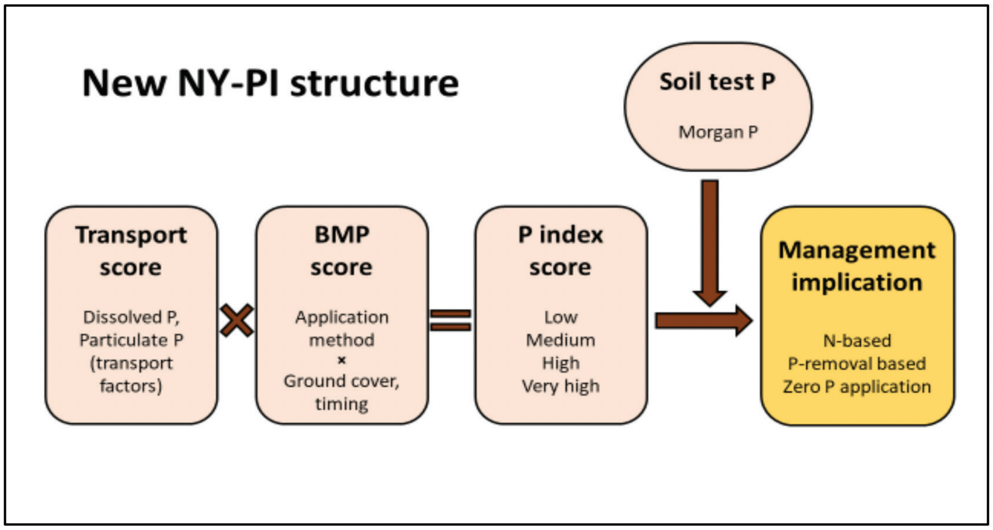


Figure 1: The new NY-PI has a transport × BMP approach.

Here is how it works: a farm field is rated based on an assessment of its runoff risk-related transport features, including those observed directly during a field visit and others from normal soil survey information (most of these factors are the same as those used in the old NY-PI). For example, being close to a stream or watercourse, poorly drained soil, or higher levels of soil erosion are some of the risk factors that can lead to a high transport score. For fields with a high transport score, manure and P fertilizer application practices can be selected to reduce the transport risk. These best/beneficial management practices (BMPs) cover a combination of changes in application timing (close to planting) and method (placing P below the soil surface), and more vegetation on the soil surface when P is applied. Thus, implementation of BMPs will reduce the final PI score. Field practices include setbacks, ground cover (sod or cover crops) or placing manure below the soil surface (injection or incorporation). Combined with information about soil test P levels, the final NY-PI score results in a management implication: if risk is classified as low or medium, manure may be used at N-based rates; if classified as high, manure rate is limited to expected P uptake by the crop, and if very high, no P from manure or fertilizer may be applied. This transport × BMP approach is shown in Figure 1.

Coefficients were set for the new NY-PI using a database of more than 33,000 New York farm fields supplied by certified nutrient management planners and a second dataset that included data for PI assessment and whole-farm nutrient P balance assessments for 18 New York AFO and CAFO farms. While some farm fields had to have manure diverted, in almost all situations, the NY-PI 2.0 provided a pathway for farms with an adequate land base to both reduce risk and apply the manure generated from their herd. The full NY-PI 2.0 can be seen in Table 1. (See Table 1 on next page.)

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Table 1: The New York Phosphorus Index (NY-PI) 2.0.

Overall interpretation (transport factor score × BMP score × 10)					
		Management implication[1]			
P-loss risk	PI score	Soil test P (Cornell Morgan extraction in lbs/acre)			
		< 40	40-100	101-160	> 160
Low	< 50	N-based	N-based	P-based	Zero P
Medium	50-74	N-based	P-based	Zero P	Zero P
High	75-99	P-based	P-based	Zero P	Zero P
Very high	≥ 100	Zero P	Zero P	Zero P	Zero P

Transport factors (DP score = FD + FF + CF + HSG_{DP} + VB_{DP}; PP score = FD + FF + CF + HSG_{PP} + E + VB_{PP})					
Factor	Option	Coefficient	Factor	Option	Coefficient
Flow distance (FD) to first intermittent or perennial stream in ft	> 500	0	Hydrologic soil group (HSG)	A	DP: 0 PP: 0
	300-500	4		B	DP: 4 PP: 1
	100-300	6		C	DP: 6 PP: 3
	≤ 100	8		D	DP: 8 PP: 5
Flooding frequency (FF)	Never	0	Erosion (E)[2] in ton/acre	≤ 1	0
	Occasionally	2		1-3	1
	Frequent	5		3-5	3
Untreated concentrated flow (CF)	Absent	0		> 5	5
	Present	4	Vegetated buffer (VB)	Absent	PP: 0 PP: 0
				Present	DP: -2 PP: -4

Best/Beneficial management practices (BMP score = method × ground cover and timing score)	
Method of applications	**Coefficient**
Surface spread without setback	1.0
Surface spread with 100-ft setback from down-gradient surface waters[3]	0.8
Surface spread with 35-ft managed vegetative (sod/harvested) setback from down-gradient surface waters[3]	0.7
Incorporation (within 24 h + with 15-ft setback from down-gradient surface waters)	0.7
Injection (with 15-ft setback from down-gradient surface waters)	0.5
Ground cover and timing	
Bare ground and more than 2 weeks before planting	1.0
Bare ground and within 2 weeks of planting (in spring)	0.8
Winter-hardy cover crop (fall/winter)	0.8
Whole-plant corn residue (fall/winter)	0.7
Sod after last cutting (fall/winter)	0.6
Growing sod or row crop/planting green	0.5

[1] Implications: 'N-based' can receive manure based on the crop's N needs; 'P-based' restricts manure and fertilizer applications to annual crop P removal equivalence; 'Zero P' means no P from any source. When Cornell crop guidelines call for P above the STP or rate limits in this table, P can be added to not exceed land grant guidelines as long as the NY-PI 2.0 score is 99 or lower. Farms with a whole-farm P mass balance (3-yr running average) at or below 12 lbs P/acre can apply manure at N-based rates on fields with STP less than or equal to 100 lbs P/acre, even if the initial NY-PI 2.0 score limits rates to P-based, as long as the selected BMPs to get to a P-based score are implemented. [2] Determined by the RUSLE2 A-factor. [3] Only for fields with FD ≤ 500 ft.

Stalk Nitrate Test Results for New York Corn Fields from 2010 through 2019

Nutrient Management

Quirine Ketterings[1], Karl Czymmek[1,2], Sanjay Gami[1], Mike Reuter[3]
[1]Cornell University Nutrient Management Spear Program, [2]PRO-DAIRY, [3]Dairy One

Introduction

The corn stalk nitrate test (CSNT) 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. Research shows that the crop had more N than needed when CSNT results exceed 2000 pm. Results can vary from year to year but 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.

Table 1: Distribution of CSNT-N (low, marginal, excess) for New York (NY) corn fields sampled in 2010-2019. Also presented are state average yield for corn (bu/acre at 85% dry matter [DM] and tons/acre at 35% DM). In grey are wet years and in orange are drought years, based on May-June rainfall (less than 7.5 inches in drought years, 10 or more inches in wet years). Yield data are from the USDA - National Agricultural Statistics Service.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NY corn grain (bu/acre)	149	133	134	137	148	143	129	161	159	158
NY corn silage (tons/acre)	19	16	17	17	18	17	16	18	19	18
April-June rainfall (inches)	10.0	16.5	10.2	14.6	12.8	12.8	7.6	15.3	9.7	14.4
April-July rainfall (inches)	14.0	18.6	13.2	19.1	18.1	16.5	10.7	20.6	14.6	18.2
May-June rainfall (inches)	**7.9**	**10.0**	**7.4**	**11.4**	**9.3**	**9.9**	**5.1**	**10.4**	**6.0**	**9.9**
May-July rainfall (inches)	11.8	12.2	10.3	16.1	14.6	13.5	8.3	15.6	10.9	13.8
May-August rainfall (inches)	15.9	20.0	13.6	20.0	18.3	16.7	12.4	19.2	16.4	17.9
Low (<250 ppm) (%)	24	21	20	35	29	37	13	34	15	31
Marginal (250-750 ppm) (%)	17	19	17	16	16	18	12	18	11	17
Optimal (>750-2000 ppm) (%)	19	24	22	20	19	21	24	20	20	19
Excess (>2000 ppm) (%)	40	36	41	29	36	24	51	28	54	33
Excess (>3000 ppm) (%)	28	24	29	20	27	16	37	19	44	24
Excess (>5000 ppm) (%)	14	12	14	9	14	6	19	9	26	11
Total number of samples	509	765	923	1473	1175	1039	859	1180	873	752
Maximum value (ppm)	13966	16687	15671	13147	14659	13947	14959	14517	14936	18651

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 through 2019 include results from NMSP and DairyOne.

Findings 2010-2018

The summary of CSNT results for the past ten years is shown in Table 1. For 2019, 33% of all tested fields had CSNT-N greater than 2000 ppm, while 24% were over 3000 ppm and 11% exceeded 5000 ppm. In contrast, 31% of the 2019 samples were low in CSNT-N. The percentage of samples testing excessive in CSNT-N was most correlated with the precipitation in May-June with droughts in those months translating to a greater percentage of fields testing excessive. 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. This includes weed pressure, disease pressure, lack

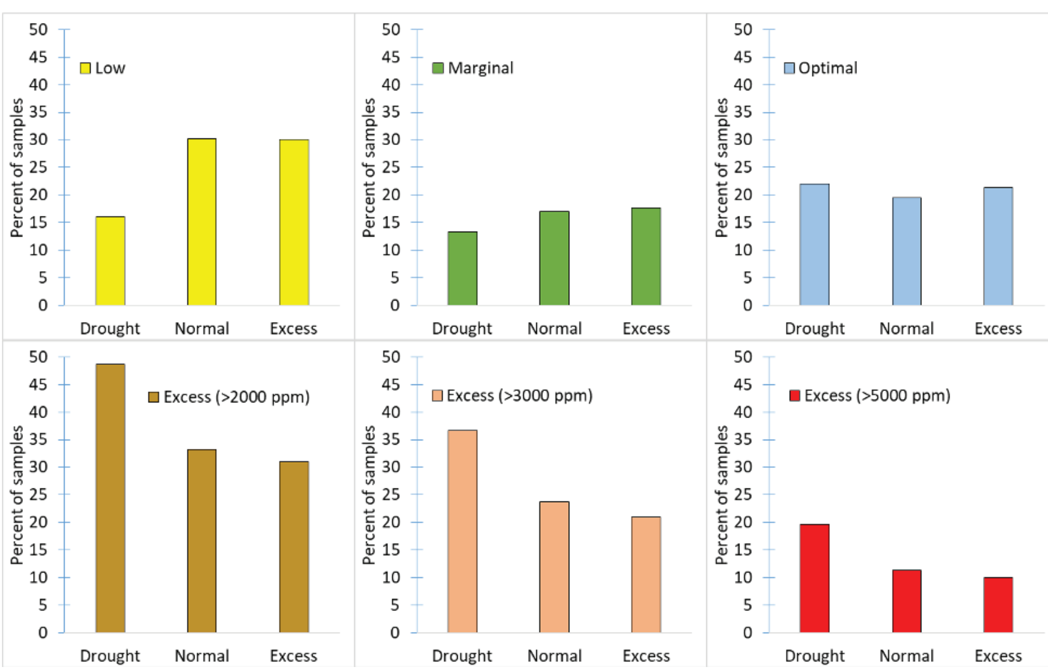

Figure 2: In drought years (determined in this analysis by May-June rainfall below 7.5 inches; which occurred in 2012, 2016, and 2018), more samples test excessive in CSNT-N while fewer test low or marginal.

of moisture in the root zone in drought years, lack of oxygen in the root zone due to excessive rain, and other stress factors that can impact the N status of the crop.

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. The 2018 expansion of adaptive management options for nutrient management now includes targeted CSNT sampling as a result of findings that targeted sampling generates more meaningful information while reducing the time and labor investment into sampling. Two years of CSNT data are recommended before making any management changes unless CSNT-N exceeds 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/publications/StalkNtest2016.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.

Acknowledgments

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

Managing Oat Crown Rust to Prevent Yield Loss

Disease Management

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Crown rust is a continuing threat to oat production in New York, and recent epidemics have cast a spotlight on this disease. To better advise growers on crown rust management, we examined the impact of crown rust on oat grain yields and the disease resistance of available and soon to be available varieties.

The fungal pathogen that causes this disease, *Puccinia coronata* var. *avenae*, is widespread in New York and often found on susceptible oat varieties. Characterized by bright-orange, blistering pustules, this disease can be seen from June through August (Figure 1). Once established in a field, disease progresses quickly as the spores of the fungus are dispersed by the wind. The spores are blown to new leaves, different plants and even other fields. Older crown rust lesions develop a black rust spore stage, and these spores can infect the alternate host, common buckthorn, providing early inoculum for oat infections in fields adjacent to infected buckthorn in the following May.

Figure 1. Orange-brown uredinial pustules (bearing urediniospores) of crown rust on oat leaves.

The pathogen requires living plants to survive so it rarely persists through the winter on oat in New York. However, viable crown rust spores from maturing oat crops in states to our south arrive in New York on wind currents each spring to commence annual epidemics. Some overwintering can occur in New York when the fungus moves back and forth between oat and common buckthorn (Figure 2).

Figure 2. Yellow-orange aecia (bearing aeciospores) of crown rust on buckthorn leaves in May.

Management of crown rust is best achieved through careful selection of an oat variety. Few options exist to combat the disease after plants are in the field. Some fungicides are labelled for crown rust control in New York, and some growers have realized a return in investment from a timely fungicide spray at or prior to panicle emergence. Crown rust significantly impacts the yield of susceptible varieties and in extreme cases may cause crop failure. Even slight visual symptoms around the soft dough growth stage can translate to

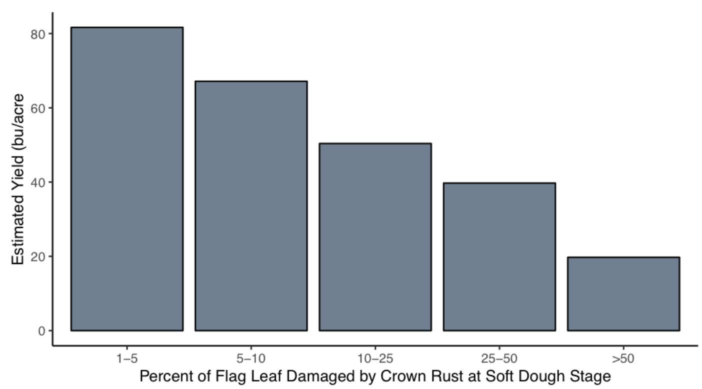


Figure 3. Effect of crown rust infection on oat yields. Crown rust infection can significantly impact spring oat yields. This plot shows the average predicted yields observed at different disease severities. This data was taken from 360 small research plots spread across western, central and eastern New York in 2015-17. The amount of crown rust damage to flag leaves in each plot was measured during early grain filling. Even when visual disease severity recorded at the soft dough growth stage appears as low as 5%, yield may be limited by crown rust.

Table 1: Crown Rust Susceptibility.
Based on observations across New York from 2015-17, the spring oat varieties listed below were rated susceptible (S), moderately susceptible (MS), moderately resistant (MR) or resistant (R) to crown rust. Planting susceptible varieties involves considerable risk because of potential losses due to crown rust. Choosing one of the more resistant varieties is recommended. Three varieties that may be released soon are marked with an '*'. The approximate yield provided is an average of the estimated yields from small variety trial plots planted in four New York locations each year during 2016 - 2018.

Oat Variety	Crown Rust Susceptibility	Approximate Yield (bu/A)
Corral	S	58
Hidalgo	S	53
Vitality	S	58
Buff	MS	52
Ogle	MS	59
CDC Norseman	MR	*NA*
Streaker	MR	48
Hayden	R	72
Horsepower	R	*NA*
Newdak	R	61
MN09255*	R	69
SD111922*	R	70
SD111946*	R	71

yield loss (Figure 3). Rust pathogens are known to evolve quickly to overcome resistance, but based on several years of observation we have identified the varieties that currently are most resistant in New York (Table 1). If you are considering a spring oat planting, choose a variety with proven resistance to current populations of the crown rust fungus in New York.

Late summer forage plantings are at a higher risk for infection since the spores that cause disease will increase and spread throughout the growing season. When these forage plantings are infected, pathogen overwintering on buckthorn can be increased. This contributes to crop epidemics the following year and may speed the breakdown of oat varietal resistance.

Crown rust will continue to threaten oat yields, but you can reduce the spread of this disease by planting resistant varieties and notifying your local Cornell Cooperative Extension Field Crop Specialist or the Cornell Field Crops Pathology Program if you find the pathogen in your fields.

Soybean Cyst Nematode Now Confirmed in Six Additional Counties in New York

Pest Management

Jaime Cummings and Ken Wise, NYS Integrated Pest Management Program; Mike Hunter, Mike Stanyard, Aaron Gabriel and Kevin Ganoe, Cornell Cooperative Extension; Michael Dorgan, NYS Dept. of Agriculture and Markets

The soybean cyst nematode (SCN) is considered the number one pest of economic concern of soybeans nationally and globally, potentially causing 10-30% yield loss in the absence of above ground symptoms. In 2017, national estimates reported over 109 million bushels lost to this pest in the U.S. alone. Considering that this pest is confirmed in surrounding states and provinces, and given its potential to spread, statewide survey efforts have been underway since 2013 to determine the presence or absence of the soybean cyst nematode in NY. From 2013-2016, numerous fields in 17 counties were sampled and tested as part of a statewide soybean disease survey led by Cornell's Field Crops Pathology program, funded by Northern NY Agricultural Development Program and NY Corn and Soybean Growers Association. In 2016, SCN was confirmed in one field in Cayuga County by Cornell's USDA ARS Nematology lab, albeit at very low levels. Since then, survey efforts have continued, because it is widely assumed that SCN is much more prevalent in NY.

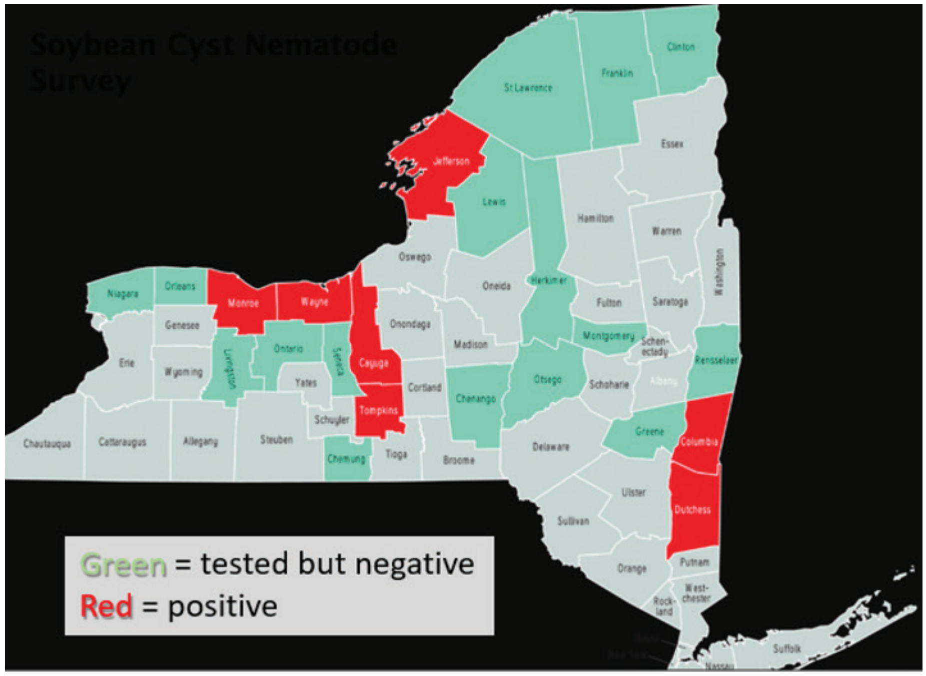


Figure 1. Soybean cyst nematode survey efforts in NY since 2013. Counties colored in green had fields tested with negative results, and counties colored in red had one or more fields that tested positive. The first positive result was in Cayuga County in 2016. In 2019, six more counties tested positive as a result of the soybean Cooperative Agricultural Pest Survey.

In 2019, the NYS Integrated Pest Management Program was commissioned by NYS Department of Ag and Markets to coordinate a Cooperative Agricultural Pest Survey (CAPS) in soybeans with Cornell Cooperative Extension specialists to maintain vigilance against potentially invasive species. For more information about the CAPS program and this survey effort, please refer to this article. As part of this survey, 25 soil samples were collected from fields in 16 counties across NYS and were submitted for testing at the SCN Diagnostics laboratory. Of those 25 samples, seven of them were positive for SCN in six different counties, confirming our suspicions that this pest is potentially widespread throughout soybean production areas in NY. This brings us to a total of seven counties in NY with at least one field positive for SCN. The counties identified with fields positive in 2019 include Columbia, Dutchess, Jefferson, Monroe, Tompkins and Wayne (Fig. 1).

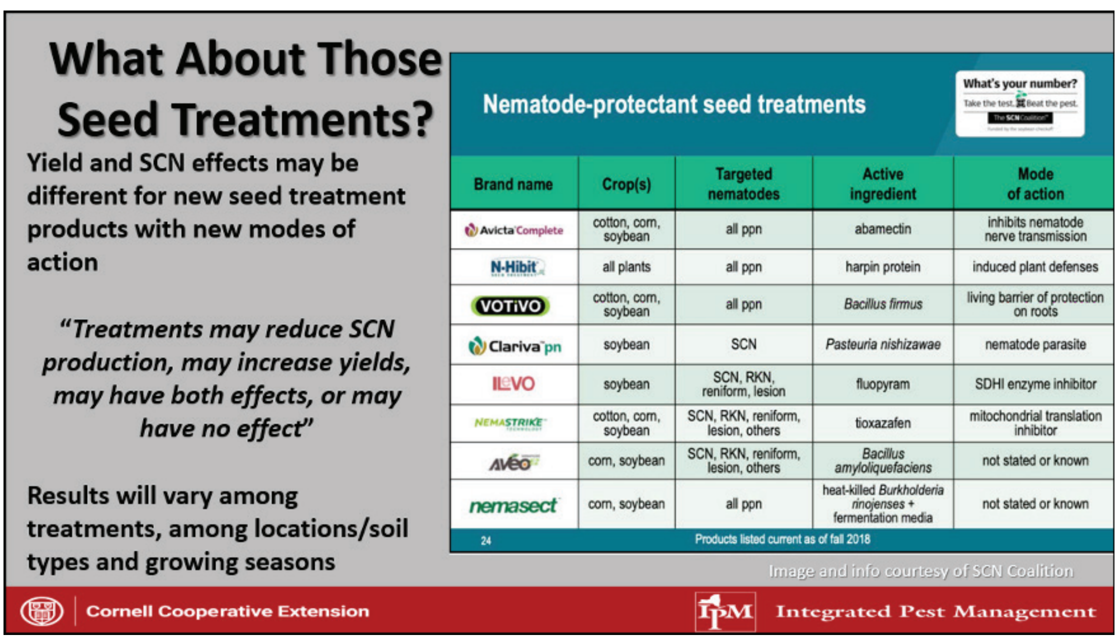
Thankfully, the egg counts in these positive samples were all below 500 eggs per cup of soil (250 cc of soil). Although that may sound like a lot, these are very low numbers compared to the 10,000-80,000 egg counts that some growers struggle with in other states. This means that we are in a good position to *proactively* manage for this pest *before* it gets out of hand and starts causing economic losses.

An integrated management approach will help NY soybean growers stay ahead of the soybean cyst nematode. This involves continued testing efforts to monitor your fields for SCN. Determining if you have the pest is the first step toward management. For detailed information and recommendations on how to collect samples for SCN testing and where to send those samples to, please refer to this article. If you get a positive result, keep records of your egg counts for each individual field. Implement the following tactics when managing for this pest:

1. SCN can be moved among fields on soil, whether it be via wind, water, equipment, or boots. Consider improving sanitation of equipment coming from fields with known SCN infestation to avoid spreading it to others.
2. Crop rotation is the number one tool for managing SCN. Rotating to a non-host crop, such as corn, small grains, alfalfa, forage grasses and mixes for one year can reduce the nematode population by up to 50%. Continuous soybean production in an infested field can increase nematode populations exponentially, since this pest can have up to three life cycles per season in NY.
3. Select and plant soybean varieties with resistance to SCN, and rotate those resistant varieties that you plant. The nematode quickly develops resistance to the resistant varieties when exposed to the same varieties over and over, in the same way that weeds develop resistance to over-used herbicides.
4. Consider nematicidal seed treatments if your SCN populations start causing economic damage (Fig. 2). Research has shown that these products are only cost-effective with high SCN population levels causing significant damage.
5. *Keep testing*. Continue to test fields that you get negative results from, and especially continue to test fields that you get positive results from. Keep track of your egg counts in each field to know how your populations are changing, as that may affect your management strategy. It is recommended that as long as egg counts remain below 30,000 eggs per cup of soil, crop rotation with SCN-resistant soybean varieties is the best approach.

Crop rotation is the most important tool, and we are lucky to have a number of non-host crops already in our rotations. But, SCN has a fairly wide host range, including a number of our common weeds and cover crops. Some of these weed and cover crop hosts include chickweed, some clovers, common mullein, henbit, pokeweed, vetch and purslane (Table 1). That's just another thing to remember as you plan your crop rotations and weed management strategies.

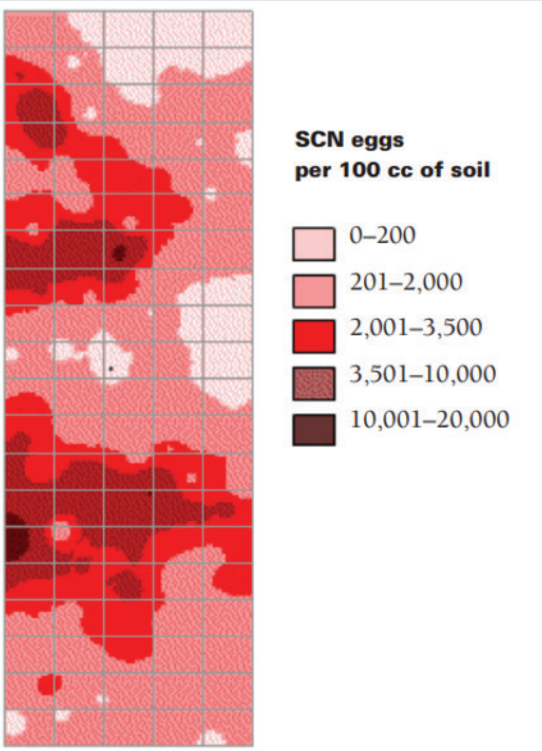
Keep in mind that testing for SCN can be tricky, since it can be difficult to detect at low population densities, and populations can be quite variable within a field (Fig. 3). Focus your testing efforts on fields with unexplained lower yields, or fields with a history of Sudden Death Syndrome (SDS) or Brown Stem Rot. It is well known that there is a strong correlation between the presence of SCN and SDS. If you see patches of SDS in your field, that would be an ideal location to pull soil samples for testing for SCN. For more information on the relationship between SDS and SCN, please refer to this article.



Brand name	Crop(s)	Targeted nematodes	Active ingredient	Mode of action
Avicta Complete	cotton, corn, soybean	all ppn	abamectin	inhibits nematode nerve transmission
N-Hibit	all plants	all ppn	harpin protein	induced plant defenses
VOTiVO	cotton, corn, soybean	all ppn	*Bacillus firmus*	living barrier of protection on roots
Clariva pn	soybean	SCN	*Pasteuria nishizawae*	nematode parasite
ILeVO	soybean	SCN, RKN, reniform, lesion	fluopyram	SDHI enzyme inhibitor
NEMASTRIKE	cotton, corn, soybean	SCN, RKN, reniform, lesion, others	tioxazafen	mitochondrial translation inhibitor
AVEO	corn, soybean	SCN, RKN, reniform, lesion, others	*Bacillus amyloliquefaciens*	not stated or known
nemasect	corn, soybean	all ppn	heat-killed *Burkholderia rinojenses* + fermentation media	not stated or known

Figure 2. Nematicidal seed treatments available for managing soybean cyst nematode. .

Table I. Host plants for SCN, including weed hosts, that have had one or more populations of SCN reproduce on them, and nonhost crops. (Courtesy of Univ. of Nebraska, extension publication G1383)		
Host Crops	*Weed Hosts*	*Nonhost Crops*
Birdsfoot Trefoil	Common Chickweed	Alfalfa
Edible Beans	Common Mullen	Canola
Clover (Alsike, Crimson, Sweet)	Field Pennycress	Clover (Red, White, Ladino)
Cowpea	Henbit	Corn
Lespedezas	Pokeweed	Forage Grasses
Lupine (White, Yellow)	Purslane	Small Grains (Barley, Oats, Rye, Wheat)
Soybeans	Sericea Lespedeza	Sorghum (Grain, Forage)
Vetch (Common, Crown, Hairy)	Wild Mustard	Sugar Beets



Variability in SCN egg population densities among half-acre cells of a 50-acre study area in Boone County, Iowa.

Figure 3. Grid sampling reveals high variability in soybean cyst nematode population densities within a single field. (Image courtesy of Iowa State University)

For more information on this pest and recommendations, please visit the Soybean Cyst Nematode Coalition website. There you will find numerous resources explaining the resistance issues with this pest, how and where to test for it, management recommendations, and success stories. Expanded SCN testing efforts will commence in 2020, supported by the NY Corn and Soybean Growers Association. If you suspect SCN in your fields, contact your area Cornell Cooperative Extension specialist for assistance, they may be able to offer you free testing on suspect fields as part of the expanded testing efforts in 2020.

Pest Management

Soybean Cooperative Agricultural Pest Survey: Vigilance against Potentially Invasive Species

Jaime Cummings and Ken Wise (NYS Integrated Pest Management Program), Mike Hunter, Mike Stanyard, Aaron Gabriel and Kevin Ganoe (Cornell Cooperative Extension), and Michael Dorgan (NYSDAM)

Annual funding in the Plant Protection Act 7721 supports the Cooperative Agricultural Pest Survey (CAPS) pest detection program, led by the USDA Animal and Plant Health Inspection Service (APHIS), to safeguard against introductions of potentially harmful plant pests and diseases. These surveys ensure the early detection of potentially invasive species that could negatively impact U.S. agriculture and/or environmental resources. The NYS Department of Agriculture and Markets (NYSDAM) works with APHIS to prioritize the potentially invasive species to monitor in economically important commodities in NY each year. In 2019, NYSDAM partnered with the NYS Integrated Pest Management (IPM) program to coordinate a soybean CAPS survey to monitor for two potentially invasive moth species, as well as to expand monitoring of the soybean cyst nematode across New York soybean production areas.

Figure 1. Golden twin spot moth and looper larva. (photos by S. Hatch and P. Hampson, Bugwood.org)

The overarching goal of the CAPS program is to monitor for species that shouldn't be here, and to confirm that they still aren't in NY or even the U.S. These surveys are often the result of cooperation among state and federal employees, such as APHIS pest inspectors, NYSDAM inspectors and extension specialists. This 'boots on the ground' approach allows for broad coverage of the surveys across the state involving many individuals with agricultural and pest identification expertise.

For the 219 soybean CAPS survey, two moth species that are already problematic elsewhere in the world, but not known to exist in the U.S. were selected. The Golden Twin Spot moth (*Chrysodeixis chalcites*), which currently causes yield losses in Africa, Europe, the Middle East and Canada, has a larval stage known as a 'looper' which can cause significant damage to soybeans, tomato, cotton, tobacco, beans and potatoes (Fig. 1). Feeding by the loopers can result in defoliation, and they can also cause foliar damage due to rolling leaves with webbing for nests. The Silver Y moth (*Autographa gamma*), which is already a concern in many countries in Asia, Europe and Africa, also has a caterpillar larval state that can cause significant damage to soybeans and many other agronomically important crops, including beets, cabbage, hemp, peppers, sunflower, tomato, potato, wheat, corn and wheat (and many more) (Fig. 2). These caterpillars also defoliate and harm leaves through rolling and webbing. Given how potentially damaging an introduction of these pests could be to U.S. agriculture, it's important that we are vigilant in our efforts to monitor for them and ensure they aren't in NY.

Figure 2. Silver Y moth and caterpillar larva. (photos by P. Mazzei and J. Brambila, Bugwood.org)

In addition to monitoring for these two moth species, we also prioritized a pest that has very high potential to affect soybean yields in NY, and one that has thus far only been confirmed in one field in NYS. The soybean cyst nematode (SCN) is considered the number one pest of soybeans nationally and globally, causing an estimated 109 million bushels of yield loss in the U.S. in 2017. Extensive collaborative sampling for this pest from 2014-

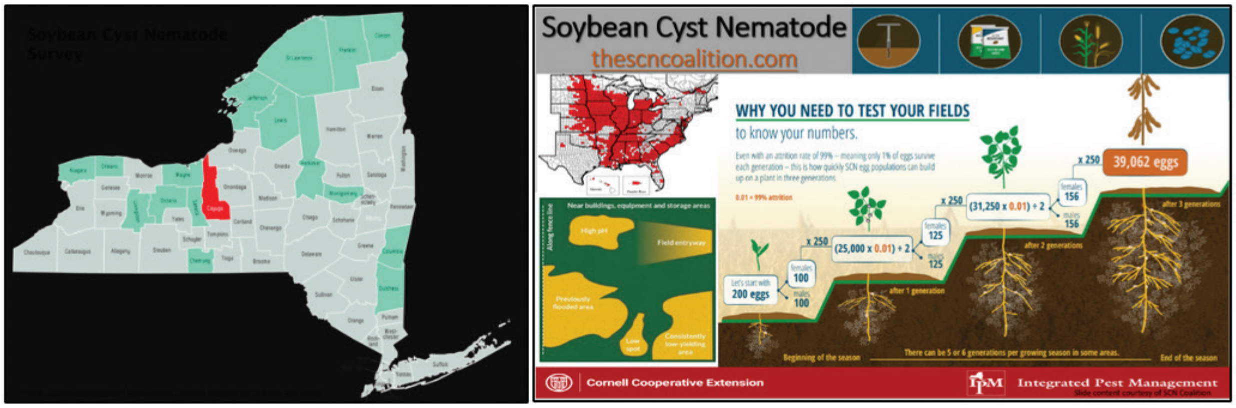


Figure 3. Soybean cyst nematode survey efforts in 17 counties in NY from 2014-2017, with one positive ID in Cayuga County in 2016, and information from the SCN Coalition on why you should test for SCN.

2017, supported by the NY Corn and Soybean Growers Association and Northern NY Agricultural Development Program, was coordinated by Cornell University and Cornell Cooperative Extension programs. Over the four years of the SCN survey, numerous fields in 17 counties were sampled, and one field in Cayuga County was identified as positive for SCN in 2016, albeit at very low levels (Fig. 3). Though it's promising that SCN wasn't identified widely across NY, we are fairly confident that it is very likely in many more than just one field in one county. Given the potential impact this pest could have on NY soybean (and dry bean) production, we decided to include this pest in the 2019 CAPS survey.

Six collaborators (Jaime Cummings and Ken Wise of NYS IPM, and Mike Stanyard, Mike Hunter, Aaron Gabriel and Kevin Ganoe of CCE) spent part of their typical summer soybean scouting efforts from western, to central, to eastern and northern New York setting up and checking pheromone traps intended to monitor for the Golden Twin Spot moth and Silver Y moth (Fig. 4). They communicated the importance of these surveys to cooperating farmers who agreed to host these traps in 25 fields across the state. Any suspicious moths caught in the traps are submitted to the Cornell Insect Diagnostic Clinic for thorough identification. Thus far, we have not caught any Silver Y or Golden Twin Spot moths. And that's good news! As the growing season winds down, we will collect soil samples from the same 25 fields for SCN testing at the SCN Diagnostics laboratory.

Figure 4. Distribution of the 2019 soybean CAPS survey.

A funding proposal to continue this work in 2020 has been submitted. If accepted, it may also be expanded to include a corn CAPS survey for other potentially invasive pests with additional locations in southwest and central NY. For more information on the national CAPS program, please visit their website. For additional information on the soybean cyst nematode, please visit the SCN Coalition website, and check out these resources on SCN efforts in NY: Soybean Cyst Nematode Now Confirmed in NY, Sudden Death Syndrome and Soybean Cyst Nematode in Soybeans, Fall is the Time to Test for Soybean Cyst Nematode.

Calendar of Events

FEB 13	Social Media Preparedness - Modern On-farm Preparedness - Homer, NY
FEB 27	Hay & Pasture School - Canton, NY
MAR 10	New York Certified Organic Meetings - Waterloo, NY
MAR 11 & 12	Northeast Dairy Management Conference - Liverpool, NY

Have an event to share? Submit it to jnt3@cornell.edu!

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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 email address to Jenn Thomas-Murphy,** jnt3@cornell.edu**.**

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