What's Cropping Up?

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Western Bean Cutworm in New York State

Ken Wise (NYS IPM Program) and Mike Hunter (CCE North Country Regional Ag Team)

Western bean cutworm (*Striacosta albicosta* [Smith]) (WBC) was first discovered in New York State in 2009. It has been expanding its range from its origin in the high plains area of the US over the last 20 years. WBC is an insect pest of corn and dry beans, and can cause significant yield and quality losses to field corn grain. In other parts of the Corn Belt, it has become a pest causing significant economic losses in field corn. WBC is a Lepidopteran Noctuidae moth species that lays eggs on the upper surface of leaf just before tasseling (Fig. 1).

Once eggs are laid on leaves, they appear white and will turn tan, and then a purplish color before hatching (Fig. 2). The 1st instar larvae will eat their egg shells before finding other food and an area of protection from predators or parasitoids. The small larvae will move to the whorl and/or leaf axil, and they will eat pollen, tassels and silks (Fig. 3). By the 4th instar the larvae will bore into the corn ear and feed on kernels of corn (Fig. 4). One difference between WBC and other species of worm pests of corn ears (European corn borer, corn ear worm) is that you can find multiple worms in one ear. Other species are cannibalistic, and allow only one larvae to enter the ear, while WBC does not mind if there are several per ear.

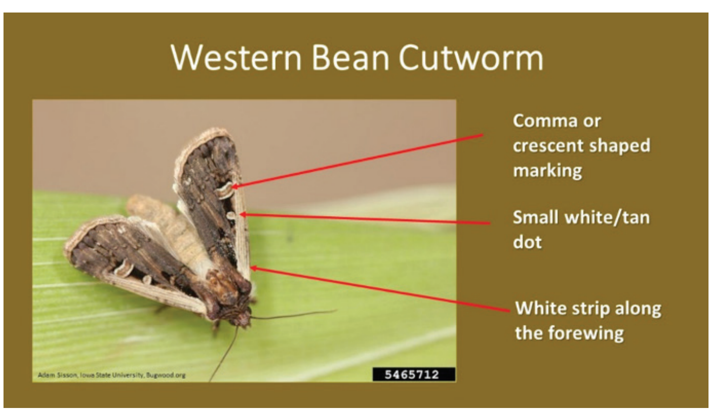

Fig 1. Identification of a western bean cutworm moth (Photo by: Adam Sisson, Iowa State University, Bugwood.org)

Fig 2. Eggs are white when first laid (left) and then turn purplish before hatching (Photo by Mike Hunter, CCE)

One to several larvae per ear can really affect the yield. Once the larvae reach the 6th instar they drop from the plant to the soil surface, where they burrow into the soil and create a chamber where they will overwinter in a

Fig 3. First instar Western Bean Cutworm larvae (photo by Mike Hunter, CCE)

pre-pupa stage (Fig. 5). They will finish the pupation in late spring and early summer, and emerge from the soil from mid-July through mid-August with peak flights during the last week in July to the first week in August.

Since the discovery of western bean cutworm in New York in 2009, we have monitored its progression across the state. In 2010, we developed a WBC pheromone trap monitoring network. This network of Cornell Cooperative Extension Educators, crop consultants and agricultural professionals placed out bucket pheromone traps to capture moths each year from late June through August. A female WBC pheromone lure is placed in the trap which attracts and catches only the male WBC moths. Each week the number of moths are counted and reported by the location of the trap. These traps are deployed to monitor moth presence and determine the peak flight. Traps help us identify fields at risk and when scouting should take place, but we cannot use trap counts to determine when a field should be sprayed with an insecticide.

Since 2010, the population of the WBC in New York has increased exponentially. We started with 19 volunteers

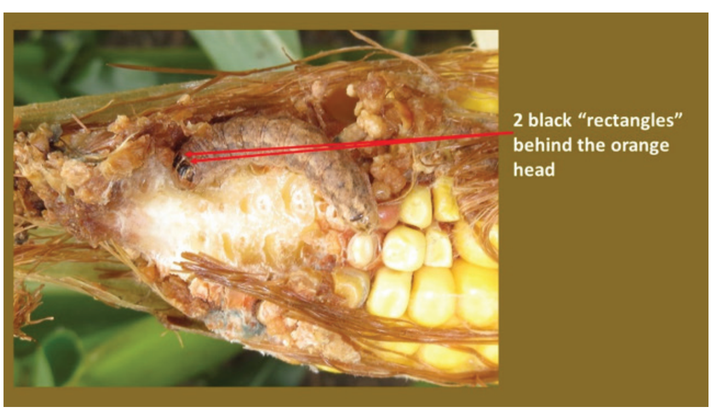

Fig 4. Mature Western Bean Cutworm Larvae (Photo by Ken Wise, NYS IPM)

Fig 5. Soil chambers created by western bean cutworm larvae- Photo by Keith Waldron, NYS IPM

and 44 traps in 29 counties, and in 2018, we had 50 volunteers and 118 traps in 45 counties.

The total number of WBC moths captured per trap in New York by year are depicted in Table 1. In 2010 there were less than 15 moths caught per trap with a high of 99. In 2018, we had 118 traps that caught 39,290 moths with an average of 333 moths per trap. Some traps in Northern NY had 1000 to almost 3000 moths in a single trap. Northern NY is the hot spot for WBC, and the number of moths caught in this region of the state far exceeds the rest.

When looking at the average number of moths caught per trap, 67% of the traps caught more than 100 moths and only 15% caught less than 20 moths (Fig. 7). Jefferson County had a single seasonal trap accumulation of 2964 moths. The range of trap counts were 0 to 2964. While the average came down just a bit from 361/trap in 2017 to 333 /trap in 2018, we had many more traps in areas of the state that do not have the same pest population densities of Northern NY. This brought the average number of moths/trap down for the first time since 2016. In 2016, we had drought conditions that might have caused a reduction in population of WBC.

Table 1. New York Western Bean Cutworm 2010 – 2018 Collection Data Summary*

	2010	2011	2012	2013	2014	2015	2016	2017	2018
No. Counties	29	37	44	39	41	39	40	40	45
No. Traps	54	67	88	89	96	91	101	101	118
Avg. No. WBC / Trap	13	23	42	66	117	266	193	361	333
Range in Totals	0 - 99	0 - 165	0 - 344	0 – 853	0 – 1019	0 – 1688	0 – 1662	0-2464	0-2964
Peak Flight	2-Aug	2-Aug	25-Jul	21-28-Jul	3-Aug	2-Aug	31-Jul	8-Aug	1-Aug

*Includes traps in field corn, sweet corn and dry beans

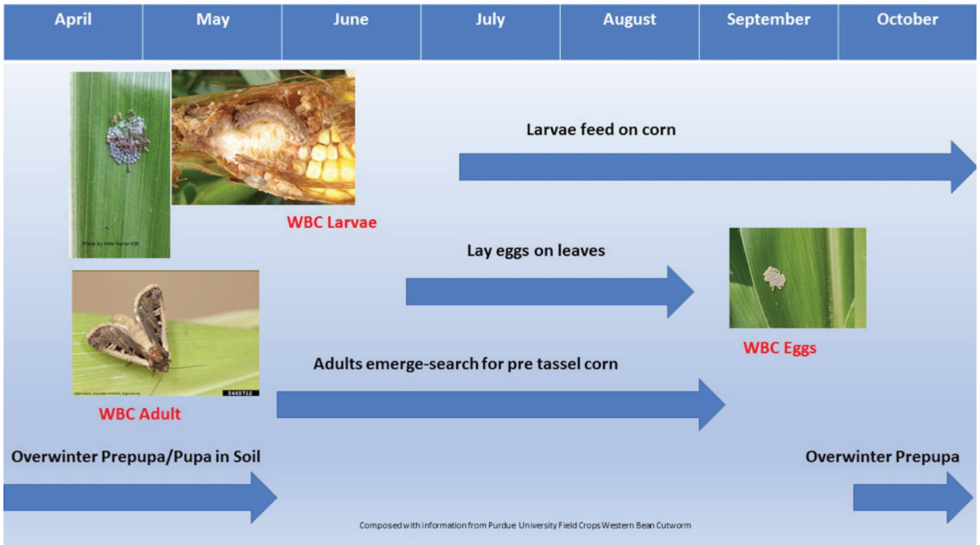

Fig 6. Western Bean Cutworm Lifecycle

A very important aspect of managing WBC is knowing when peak flight occurs. The annual peak flights are outlined in Figure 8. From 2010 to present, the peak flight has ranged from the last week in July to the first week in August. By knowing the peak flight, you know when most of the moths will be laying eggs in pre-tassel corn because the female moths prefer to lay eggs on this stage of corn growth. And this peak flight time is when we should be vigilant about scouting for WBC egg masses and small larva.

The data is starting to show that the population is beginning to build up in areas of the state that have previously had lower populations of WBC. The data in

Figure 9 indicates that the average number of moths caught per trap is increasing across the state outside of Northern NY. In time, WBC populations will likely rise across the state to the point that management will be needed for this insect pest. Widespread, high WBC populations in many areas of Northern NY have resulted in some corn fields being treated with insecticides to manage this pest.

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

Scouting corn at the pre-tassel stage of growth is an important aspect of managing this pest. The economic threshold is 5% of plants having egg masses and small larvae. The 5% is an accumulated threshold, meaning that if in week one 3% of the plants have egg masses and the folowing week there are 2% more, this equals a cumulative 5%.

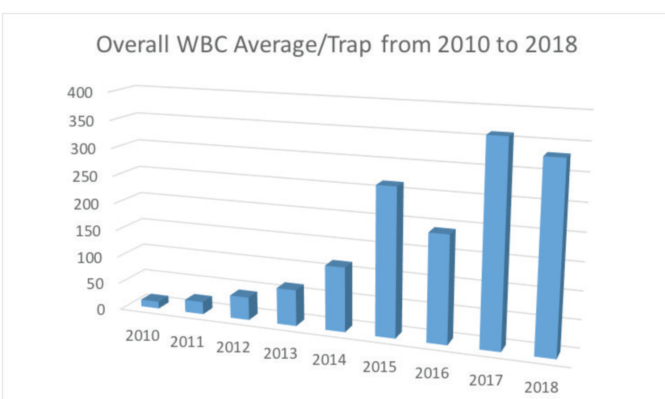

Fig 7. Overall average of WBC moth/trap captures statewide from 2010 to 2018

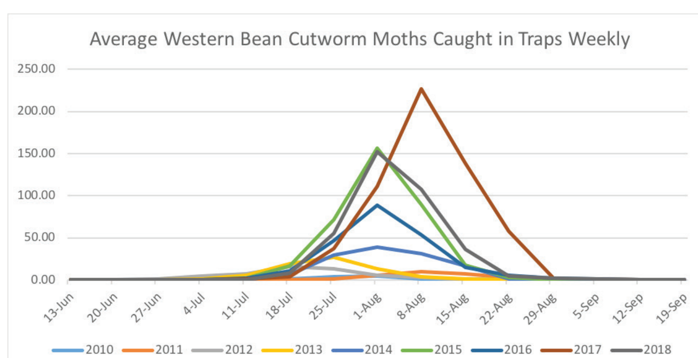

Fig 8. Average Western Bean Cutworm Moths Caught in Traps Weekly (Includes traps in field corn, sweet corn and dry beans)

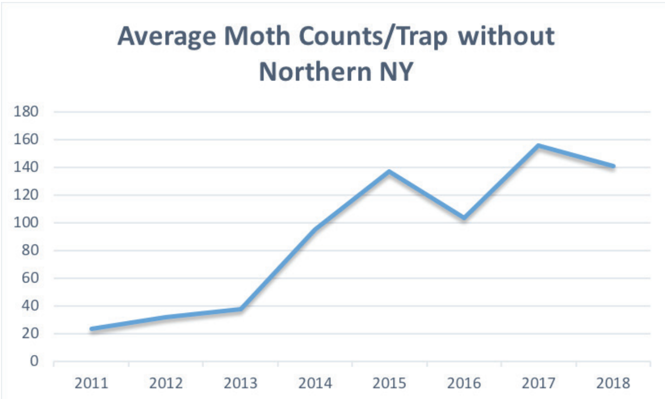

Fig 9. Average Moth Counts/Trap without Northern NY (Includes traps in field corn, sweet corn and dry beans)

Current strategies available for control of WBC in corn are the use of foliar insecticides or selecting transgenic corn hybrids with the Vip3A trait. Foliar insecticide treatments are effective but can be difficult to correctly time applications. If a field is found to be over threshold for WBC, an insecticide should be applied only if fresh silks are present. If no tassel is present there is no reason to spray an insecticide because it would be too early and the larva will not survive. Once the larva make their way into the ear tip it is too late to spray as the insecticide will not come into contact with the larva. Currently, only corn hybrids with the Vip3A trait will provide control of the WBC. There have been reports from Michigan, Indiana, Ohio and Ontario, Canada suggesting varying levels of control of WBC with the Bt corn trait containing the Cry1F protein, (DiFonzo, C., Krupke, C., Michel, A., Shields, E., Tilmon, K. and Tooker, J; 2016). Based on 2016 to 2018 on farm research trials in Northern and Western NY, it was determined that incomplete control from the Cry1F trait was confirmed, (Hunter, M., and O'Neil, K.; 2018, 2017, 2016).

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2018 New York WBC Pheromone Trap Monitoring Network:
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DiFonzo, C., Krupke, C.;,Michel, A., Shields, E., Tilmon, K. and Tooker, J; 2016. An open letter to the Seed Industry regarding the efficacy of Cry1F Bt against western bean cutworm. October 2016. Cornell University

Hunter, M., and O'Neil, K.; 2018 Evaluation of the Efficacy of Bt Corn for the Control of Western Bean Cutworm in NNY. Northern NY Agricultural Development Program. Cornell University (report forthcoming)

Hunter, M., and O'Neil, K.; 2017 Evaluation of the Efficacy of Bt Corn for the Control of Western Bean Cutworm in NNY. Northern NY Agricultural Development Program. Cornell University

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Growing GMO free corn: Insect management challenges revisited from the pre-GMO era

Elson Shields, Entomology - Cornell University, Ithaca, NY

Pest Management

Seed Treatments:

Seed treatments on corn seed is a critical component to achieve a uniform plant stand, particularly in cropping systems with animal manures such as our dairy farms. Without a uniform plant stand, economic yields are always a challenge. In some situations, seedling insects are shown to reduce plant stand by more than 50%. For the 2019 growing season, it appears that our use of neonic seed treatments are not threatened. Neonic seed treatments are effective against the two main seedling insect pest, seed corn maggot and wireworm. Activity against Black Cutworm larvae is variable at best. The standard "250" seed treatment dose is effective against the seedling insects listed above but not corn rootworm. For activity on corn rootworm, the "1250" dose needs to be used. A new class of compounds called Anthranilic diamides are being tested as replacements to the neonic seed treatments. These compounds work well on Seed Corn Maggot, but are weak on wireworms.

Black Cutworm:

Black Cutworm is a long-ranged spring migrant which rides the warm southern spring winds into NY between late-March and mid-April. Upon arrival, moths lay their eggs on grassy weeds in the field before the corn is planted. When these weeds are killed by tillage or herbicide, the larvae continue to feed on the dying tissue until the planted corn emerges and then moves over to the corn. It is important to remember that Black Cutworm larvae are in the field before corn planting and the larvae are usually early-mid-sized when the corn emerges. If the eggs were actually laid in the emerging corn, the developing corn would grow to V6 before the black cutworm larvae developed into the 4 instar where they begin cutting. V6 corn is very resistant to being cut by Black Cutworm.

Insecticide on the seed is often promoted to have Black Cutworm control properties, but control is highly variable and dependent on moisture conditions. Field scouting is the only dependable and reliable method to detect Black Cutworm infestations and treat them before economic loses occur. Smaller larvae feed on leaf margins leaving ragged leaves and do not begin cutting until the fourth larval stage. A trained scout can easily detect these larvae before cutting and recommend a timely application of a foliar insecticide to prevent damage. The threshold for treating a corn stand for Black Cutworm is 5% or more of the plants cut.

Armyworm:

Armyworm is a long-ranged spring migrant which rides the warm southern spring winds into NY between mid-May and early-June. Upon arrival, moths lay their eggs in grass hay fields and other grassy areas. When those areas are stripped from feeding by the larvae, the larvae "march" into neighboring field which are often corn. Scouting is the only reliable way to detect this insect and monitor its movement into adjacent corn. The threshold for treatment in whorl sized plants is 3-larvae per plant with feeding damage present.

Corn Borer:

European corn borer before the GMO era was never an economic pest in NY field corn. While it could be found in almost every field, populations needed to be one larva in every plant before any economic impact could be measured. Reported infestations were never close to that population. With the introduction of corn borer-GMO corn varieties, the corn borer populations have fallen to an extremely low level and are not expected to poise any threat to the corn producer growing non-GMO corn.

Corn Rootworm:

Western corn rootworm remains the primary major insect pest of corn production, costing US corn farmers nearly $1 billion to control it. In NY, first year corn never has any problem with corn rootworm damage because the current NY strain of corn rootworm only lays its eggs in existing corn fields. Corn producers who annually rotate between corn and a non-corn crop do not need to deploy any management strategy for corn rootworm control. Corn producers who grow corn in a field for more than a single year are the producers who need to pay attention to the various corn rootworm management options. Generally speaking, the longer a field is in continuous corn production, the higher the risk from corn rootworm larval feeding injury and economic losses. For example, a 2nd year corn field generally has about a 25% risk for an economic infestation of corn rootworm and a 4th year corn field has 80-100% risk.

Scouting:
Adult scouting protocols are well tested and are useful in predicting the probability of a corn rootworm infestation the following spring. Adult rootworms are counted on three consecutive weeks starting around pollen shed. If the average adult beetle count is 1 beetle/plant for the 3 week period, the field is usually at risk the following year from corn rootworm feeding injury. More information can be found at the following link:

https://nysipm.cornell.edu/sites/nysipm.cornell.edu/files/shared/field-corn-scouting-proc.pdf

Management options:
The non-GMO corn producer only has two viable options to manage corn rootworm in continuous corn in years 2-6. Best control is the use of a granular insecticide in a T-band in front of the press wheel. An in-furrow application of a granular insecticide has a much lower efficacy than the T-band. Calibration of the granular insecticide applicators is important for good corn rootworm control. However, many producers no longer have granular boxes on their corn planters and the use of granular insecticides at planting is no longer an option. The only other option with some level of efficacy is the high rate of seed treatment on the seed (1250 rate). Often, this treatment fails under high corn rootworm larval pressure or wet growing seasons particularly in the months of May and June.

The use of liquid insecticide in the liquid popup fertilizer at planting has become a popular option and is pushed very hard by the various pesticide industry sales people. Unfortunately, this insecticide application is seldom successful in protecting the corn roots from corn rootworm larval feeding.

Western Bean Cutworm:
Western Bean Cutworm (WBC) has become an emerging challenge for the corn producer in NYS with the heaviest populations along Lake Ontario in WNY and across NNY. Previous larval control with Cry1F incorporated into the plant has increasingly failed to control the larvae. In the production of GMO-free corn, management of WBC becomes an important issue to be aware of. The larvae feed on the developing ear after pollination. The threat to the corn producer is both yield loss and mycotoxin contamination. Ingress and feeding by the WBC larvae opens the developing ear to increased infection by mycotoxin-producing fungi. At this point in time, the threat of high levels of mycotoxin in the harvested grain and chopped silage is the bigger issue than kernel/yield loss.

Scouting:
Use of pheromone traps to time scouting efforts is recommended. Moth flight begins about the last week of June, so traps should be in place by mid-June and should be checked weekly. Scouting should begin when multiple moths are being captured with frequency. Monitoring efforts should be focused upon fields that are just beginning to, or soon will, shed pollen. Fields past pollen shed are less attractive to the female moths to lay eggs.

Scout plants by examining the upper surfaces of new and not-yet unfolded leaves of plants in multiple areas of the field. 20 consecutive plants in at least 5 locations are suggested as a minimum. Infestations are very patchy, and oviposition occurs over several weeks so multiple field visits will be required. Upper leaf axils, tassels (before pollen shed), and silks should be examined as well for young larvae. Monitoring and early detection are critical for application of foliar insecticides. There is a suite of insecticides that will kill young larvae, but ensuring they receive a lethal dose before entering the ear is difficult.

Economic threshold:
When 5% of the plants have egg masses or small larvae and 90-95% of the tassels have emerged, treatment is recommended. If tassels have already

emerged and egg hatch is underway, applications should occur when 70-90% of eggs have hatched. Larvae must encounter insecticide or residue before entering the ear – once they enter the ear insecticide applications are not as likely to contact larvae, making control difficult.

Field Crop Production

Extremely Low Weed Densities in Conventional Soybean and Relatively Low Weed Densities in Organic Soybean (especially in the Corn-Soybean-Wheat/Red Clover Rotation) in 2018

Bill Cox and Eric Sandsted, Soil and Crop Sciences, Cornell University

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 transition 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 (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 weed densities in soybean in 2018 (highlighted in red in Table 1) at the full pod stage (R4), the end of the critical weed-free period for soybean.

The fields were plowed on May 17 and then cultimulched on the morning of May 18, the day of planting. We used the White Air Seeder to plant the treated (insecticide/fungicide) GMO soybean variety, P22T41R2, and the non-treated, non-GMO variety, P21A20, at two seeding rates, ~150,000 (recommended input) and ~200,000 seeds/acre (high input). We also treated the non-GMO, P21A20, in the seed hopper with the organic seed treatment, Sabrex, in the high input treatment (high seeding rate). We used the typical 15" row spacing in conventional soybean and the typical 30" row spacing (for cultivation of weeds) in organic soybean. We rotary hoed the organic soybeans on May 29, followed by a close cultivation on June 14, and then three in-row cultivations (June 19, July 10, and July 26). We applied a single application of Roundup to conventional soybeans on June 20.

Conditions were very dry for the 2 months following planting (3.12 inches from May 17 until July 16). Consequently, weed densities were quite low through late July. Over the next 10-day period (July 17-27), however, 4.89 inches of precipitation were recorded at the Aurora Research Farm. Consequently, very robust weeds (velvet leaf, foxtail, and ragweed in particular) were visible in the organic plots when we took our weed counts on August 10 at the full pod stage (R4 stage), the end of the critical weed-free period in soybeans. Conditions remained relatively moist with 3.53 inches of rain in August and another 2.0 inches of rain during the first 2 weeks of September.

Photo 1. Weed free conventional soybeans (soybeans in the corn-soybean-wheat/red clover on the left and in the corn-soybean rotation on the right) at the R 8.0 stage.

Photo 2. Organic soybean had fewer weeds in the corn-soybean-wheat/red clover rotation (on the left) compared with the corn-soybean rotation (on the right) at the R 8.0 stage.

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

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

Weeds were almost non-existent in the conventional plots that received only a single application of Roundup (Table 2). This is the 4th consecutive year in soybeans where we applied a single application of Roundup for weed control and had almost complete control. Rotation and management inputs did not affect weed densities in conventional soybean (Table 2). The use of the moldboard plow in conjunction with a Roundup application about 5 weeks after planting has certainly been an excellent weed control combination for conventional soybean in this study (Photo 1).

Although weed densities were relatively low in organic soybeans (mostly less than 1.0 weed/m^2, Table 2), the weeds were very robust (Photo 2). Undoubtedly, the very wet conditions from mid-July through mid-September provided excellent growing conditions for the late-emerging velvet leaf and ragweed. Unlike conventional soybean, rotation did affect weed densities in organic soybeans with higher weed densities in the corn-soybean rotation compared with the corn-soybean-wheat/red clover rotation in all three fields (spring grain, corn, and soybean fields in 2014). We also observed a rotation effect for weed densities in organic corn in 2017 (but not in conventional corn) with far fewer weeds in organic corn in the corn-soybean-wheat/red clover rotation compared to the corn-soybean rotation (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/). High seeding rates did not affect weed densities in organic soybean in 2018.

In conclusion, conventional soybean had virtually no weeds in 2018 for the 4th consecutive year when combing moldboard plowing with a single application of Roundup. In contrast, organic soybean had very robust weeds in 2018, which resulted in a somewhat trashy looking field, but weed densities were relatively low for the 4th consecutive year. The corn-soybean- wheat/

Table 2. Weed densities in soybean at the full pod stage (R4 stage) under conventional management (P22T41R2,treated with insecticide and fungicide, and a Roundup application at the V4-V5 stage for weed control) and organic management (P21A20-non-GM variety with one rotary hoeing, a close cultivation, and three in-row cultivations for weed control) at recommended inputs ~150,000 seeds/acre seeding rate) and high inputs (~200,000 seeds/acre plus the organic seed treatment, Sabrex, in the organic cropping system) in a corn-soybean rotation and a corn-soybean-wheat/red clover rotation in three different fields with different previous crops in 2014. Red highlighted values are significantly higher for comparisons within a column (i.e. previous crops), based on the interaction LSD.

	PREVIOUS CROP (2014)		
TREATMENT/Rotation	**SPRING GRAIN**	**CORN**	**SOYBEAN**
	Weed densities (weeds/m^2)		
CONVENTIONAL			
Recommended: Corn-soybean-wheat/RC	0.03	0.05	0.03
Recommended: Corn-soybean	0.11	0.07	0.07
High Input: Corn-soybean-wheat/RC	0.03	0.03	0.02
High Input: Corn-soybean	0.09	0.08	0.02
ORGANIC			
Recommended: Corn-soybean-wheat/RC	0.31	0.40	0.50
Recommended: Corn-soybean	0.70	**0.85**	**1.10**
High Input: Corn-soybean-wheat/RC	0.29	0.67	0.46
High Input: Corn-soybean	**1.15**	0.72	**0.95**
LSD 0.05	0.42	0.38	0.45

red clover rotation had lower weed densities when compared to the corn-soybean rotation in organic soybean so the inclusion of wheat/red clover in the rotation appears essential to maintain weed densities at a manageable level in organic soybeans. The very wet conditions from about mid-July (R3 stage) through mid-September (R7 stage), however, may mitigate any potential yield losses in the corn-soybean compared to the corn-soybean-wheat/red clover rotation, despite ~ 2x higher weed density. High (~200,000 seeds/acre) compared to recommended seeding rates (~150,000 seeds/acre) did not reduce weed densities in organic soybean. Perhaps more emphasis should be placed on identifying the best crop rotations rather than high seeding rates for reducing weed densities in organic soybean in New York.

Soybean White Mold Variety Trial - Genesee County, 2018

Jaime Cummings
New York State Integrated Pest Management Program

Disease Management

White mold, or Sclerotinia stem rot, caused by the fungus *Sclerotinia sclerotiorum* is the most economically important and difficult to manage disease of soybeans across NY State (Figure 1). This disease is so undermanaged because the pathogen survives for a long time (>10 years) in the soil, making crop rotations a challenging management option. Fungicide trials in other states have shown great promise for a number of products (https://www.ag.ndsu.edu/Carringtonrec/plant-pathology/fungicide-efficacy-testing-results-2013-soybeans), but application timing and canopy penetration is critical and may require multiple applications during a highly conducive season, which may not be economical. Genetic resistance to this devastating disease should be a viable option, but many commercial varieties lack even modest levels of resistance.

A large-scale, non-replicated strip field trial was established in Genesee County to evaluate 24 soybean varieties for resistance white mold. The trial was organized by WNYCMA and planted on 5/1/18 in a field with a long history of white mold infection. The varieties evaluated in this trial included entries from five seed companies, and were representative of maturity groups 0.7 – 2.8. The trial was rated for white mold severity on 9/5/18 by Jaime Cummings of the NYS IPM Program and Dr. Gary Bergstrom of Cornell's field crops pathology program using a 1 to 9 rating scale, where 1 = resistant, and 9 = susceptible. The disease was well established consistently across all strip plots at the time of rating, despite it being rotated out of soybeans since 2014. The disease ratings are summarized in Figure 2.

Fig 1. White mold infection on soybean in the variety trial (photo by Jaime Cummings)

The ratings for all varieties ranged between 4 and 7, meaning that all varieties were classified as moderately resistant (3.6 - 5.9) or moderately susceptible (6.0 – 7.5) at the time of the rating. However, the disease would most likely progress in these plots over time, which would likely add one or two points to each rating, pushing many of them into the susceptible category (7.6 – 9). Even though none of the varieties evaluated showed strong resistance, it is good to note that there are noticeable differences among varieties.

New York soybean growers do have options for selecting varieties with some moderate levels of tolerance to this disease, and should know to avoid

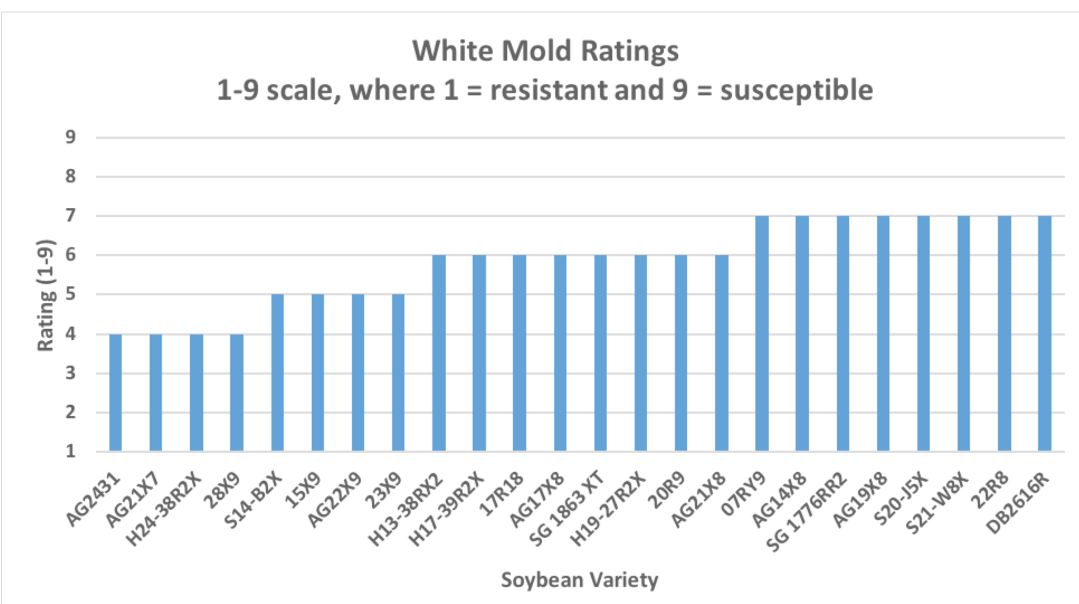

Fig 2. White mold disease severity ratings of 24 soybean varieties in a non-replicated field strip trial, rated on a 1-9 scale, where 1 = resistant and 9 = susceptible.

planting the most susceptible varieties in fields with a history of the disease. An integrated management plan which includes crop rotation, canopy management, foliar fungicides and planting tolerant varieties is the best approach to managing white mold in NY.

- For more information on white mold of soybeans in NY, please see the soybean white mold disease page on fieldcrops.org (https://fieldcrops.cals.cornell.edu/soybeans/diseases-soybeans/white-mold-or-sclerotinia-stem-rot/).
- For information on other soybean diseases and their management options, please visit the Diseases of Soybeans section of fieldcrops.org (https://fieldcrops.cals.cornell.edu/soybeans/diseases-soybeans/).
- And, check out the soybean disease survey pages (https://fieldcrops.cals.cornell.edu/soybeans/diseases-soybeans/soybean-disease-survey/).

Harvest Strategies and Forage Quality Monitoring for Corn Silage

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Forage Management

A great deal of time is spent on the basics of an optimum corn silage harvest. This time is justified as these steps are critical to a successful harvest, where the decisions made during a very short time period impact the farm's production performance and economics for the upcoming year. These important decisions include harvesting at the proper dry matter, adequate kernel processing, proper length of cut, and proper packing and covering of bunk silos. An overview of this information is covered in Setting the Stage for Success: Corn Silage Harvest (https://prodairy.cals.cornell.edu/sites/prodairy.cals.cornell.edu/files/shared/Corn%20Silage%20Harvest.pdf). The following will cover additional considerations for understanding and managing the forage quality of the crop.

As part of the Corn Silage Hybrid Evaluation program, we have focused significant attention over the last two growing seasons on the interactions between growing environment and corn silage forage quality. While this work is still developing, it does build on earlier knowledge of the impact of growing conditions on plant development, and provides some insight into managing the corn silage crop for forage quality.

Plant Development, Weather and Fiber Digestibility

Plant physiologists have long understood that characteristics of corn ear development are determined early in the growing season. Before the crop even reaches the reproductive stage of growth it has already determined the number of kernel rows per ear and the number of kernels per row. It is also understood that hot weather around the time of silking (three to five weeks) can lead to increased lignin content in the plant.

In recent years, long term fiber digestibility measurements by laboratories have become more common. Neutral Detergent Fiber (NDF) digestibility at 30, 120 and 240 hours is now commonly measured, as well as the undigested NDF (uNDF) at these same time points. In 2015 and 2016, the Dairy One Forage Lab conducted a study where they tracked season-long weather information and measured its impact of uNDF content of the silage.

Some notable results included;

- Decreases in fiber digestibility (increases in uNDF) as both precipitation and heat accumulation increased throughout a growing season, with the most significant impacts in lowering fiber digestibility found during the months of:
  - August for rainfall (particularly at 240 hours)
  - June for Growing Degree Day (GDD) accumulation (particularly at 30 hours)

While we have seen these same trends in the Corn Silage Hybrid Evaluation program, we are awaiting more site years of data in order to draw stronger conclusions. The impact of this information on the 2018 crop will be of interest as we have had an overall warmer than average growing season, despite a relatively cool June, in addition to above average rainfall in August after excessively dry to drought conditions earlier in the season.

Taking Forage Samples at Harvest to Map Forage Quality

Given the number of factors that affect forage quality, and their field specific nature, we continue to encourage producers to take forage samples at harvest and submit these fresh samples to a lab for analysis, making sure to record both hybrid and field location. This information will help determine the farm specific impact of growing conditions, planting dates, hybrid selection, and soil type on resulting overall forage quality and, specifically, fiber digestibility. Sampling could also be done at feedout in situations where you are able to document exactly where specific fields and hybrids are located within the storage structure.

Corn Silage Chopping Height Considerations

Corn silage harvest height tends to be a topic of discussion in years of above average yields or significant carryover from the previous year. As we enter the 2018 harvest season, many farms have adequate carryover of (generally lower digestibility) corn silage. 2018 crop conditions vary greatly, and while some areas may be faced with below average corn silage yields, there are areas of the state where yields are expected to be above average. For some, the prospect of having a corn crop with better fiber digestibility to dilute out the remaining inventory of poorer 2017 corn silage is of interest.

A number of studies have been conducted to determine the pros and cons of varying the cutting height of corn silage, https://extension.psu.edu/considerations-in-managing-cutting-height-of-corn-silage, and Penn State provides a good review of these. Given the significant impact that growing season and other management factors can have on forage quality, it is not surprising to see some variation in the end results. This is also true of the magnitude of impact that cutting height can have on corn silage. However, when averaged together, we can develop a few "rules of thumb". In general, when starting with a cutting height of six to eight inches, raising the height of cut by approximately 12 inches, to 18-20 total inches, will result in the loss of approximately two tons per acre of yield (at 35% dry matter), but will gain five to six percentage points of NDF digestibility. Furthermore, given the fact that you will be harvesting less stalk but the same number of kernels, the percentage of starch in the resulting silage will increase.

In addition to the factors already discussed, the apparent interaction between Fiber Digestibility and Soil Type is another piece of relevant information from the Dairy One study and the Corn Silage Hybrid Evaluation program. Preliminary data indicate a trend of lower fiber digestibility on heavier soils. The work by Dairy One found that Hydrologic Class A (well-drained soils) were lower in undigested NDF (uNDF) than other soil classes.

Pre-Harvest Height Sampling

While it may be a little late for this year, those serious about making decisions to optimize yield and quality in the future may be interested in an idea suggested by Dr. John Goeser at Rock River Laboratories.

Many farms now "stage" corn fields prior to harvest to determine harvest order based on whole plant dry matter. During this time, it is suggested that you cut some stalks (Dr. Goeser recommends three to four stalks per height) from each field at different heights, chop them up, and send them to the lab for analysis that includes NDF digestibility; similar to collecting a representative bundle of stalks for whole plant dry matter testing. In this way, you will be able to better understand the impact of cutting height given the unique conditions that your corn crop experienced during the growing season, and therefore, better understand the tradeoffs between yield and quality for that season. Common cutting heights are in the range of six, 12, and 18 inches, but could vary by farm. If you traditionally chop low to the ground, then picking an increased height that provides a reasonable tradeoff based on what we know about yield decline with increased cutting height, will give you an idea of what could be gained in forage quality on your farm.

Favoring Higher Cutting Height	Favoring Lower Cutting Height
• Weather Conditions known to reduce Fiber Digestibility • Abundant inventories • Expectation of high yields • Heavier Soil Types • Lower Quality Hay Crop Silage	• Low inventory • Low Yield • BMR Hybrids • High quality Hay Crop Silage • Fields intended for rotation

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Calendar of Events

NOV 1	2018 Fall Roundup Grazier Meeting: Extending the Grazing Season for Livestock - Hudson, NY
NOV 29	2018 Cornell Field Crop Dealer Meeting - Syracuse, NY
DEC 12 & 13	Empire State Barley and Malt Summit - Syracuse, NY
JAN 4	Oneida County Crop Congress - Clinton, 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 address to Jenn Thomas-Murphy, 237 Emerson Hall, Cornell University, Ithaca, NY 14853**

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