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Cornell Cooperative Extension

Central New York Dairy, Livestock and Field Crops

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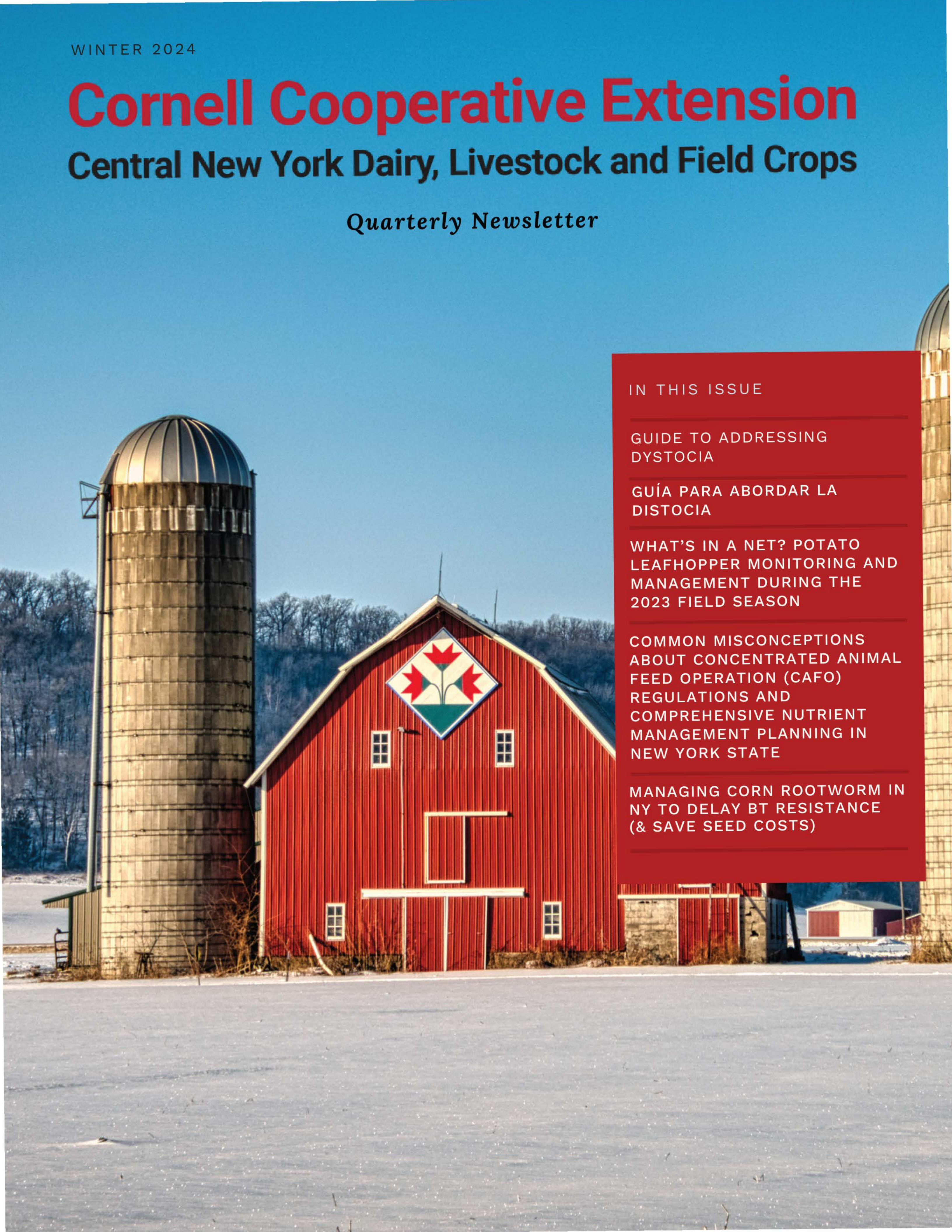

IN THIS ISSUE

Guide to Addressing Dystocia

By Daniela Gonzalez Carranza, Regional Dairy Management Specialist, CNYDLFC Team

Dystocia is not desirable, but it is an inevitable situation that we will have to face from time to time, and repercussions for cows and calves are complex. For example, even slight assistance can have an impact on production and fertility, not to mention on calf morbidity and mortality. Regardless of your calving management system, it is crucial to understand the process and stages of parturition.

What should we know about calving?

Cows go through three stages of calving, and it starts days before calving when the calf's cortisol (stress hormone) triggers hormonal changes in the cow that initiates parturition.

The first stage refers to the cervix's dilatation and can last between 4-24 hours, depending on parity. As hormones dilate the cervix, other signs begin to show, for example, the first one can be isolation, and as the time to calve comes closer, the cow displays other signs such as raising the tail, increasing laying bouts, and paying attention to the abdomen.

Cow in Stage 2, notice the attention to abdomen and amniotic sac is shown.

Once the cow is dilated and the calf is in delivery position, **stage 2**, which is delivery of the calf, starts. It is considered that stage two starts once the cow has frequent abdominal contractions (ideally 2-3 per minute) and the "water bag" (amniotic sac) is shown. The normal duration of this second stage can go anywhere from 30 minutes to 2 hours for multiparous cows and 3-4 hours for primiparous cows. Stage 2 ends when the calf is born. **The third stage** is the expulsion of the placenta.

When do I need to check?

Assisting calvings can be challenging since each cow is different, and the process can be affected by various factors, including environmental conditions. However, here are some practical tips that can help determine whether intervention is necessary.

1. Once you recognize the cow is in stage 2, check progress every 30 minutes. If you don't know when the cow started stage 2, be patient and give time to monitor.
2. If the cow is in stage 2 and there is no progress in 30 minutes, you could proceed to do a vaginal exam.
3. If the cow is in stage 1 and there is no progress in 2-4 hours, you could proceed to do a vaginal exam.
4. Keep in mind if the cow is still having uterine contractions (2-3 per minute).

How to do a vaginal exam?

When doing a vaginal exam, always remember these golden rules:

- Cleanliness: Prepare and clean the vaginal area of the cow to reduce the risk of infections.
- Lubrication: Lubrication helps with friction, less force is needed and decreases the risk of injuries to the cow and calf.

The first step is to evaluate the cervix dilatation. No progress will be made if the cow is not dilatated enough for the calf to go through. The next step is to evaluate the calf's position or the reason for slow progress.

- What is the calf position, anterior (head first) or posterior (tail first)?
- Is the calf too big? Is the calf alive?
- Is there any obstruction?
- Is the water bag broken?

Some tips

- When identifying the front legs from the hind legs, two joints will flex in the same direction for the front legs. On the contrary, the two joints will flex in opposite directions for the hind legs.
- Always pull when the cow is having a contraction.
- When using chains, two loops (one above and one below the fetlock) will reduce the risk of injury for the calf.
- Rotation of the calf (90 degrees) can help avoid hip lock.
- When manipulating a leg inside the cow's uterus, protect the calf's hooves with your hand to avoid lacerations to the uterus.

There is no secret recipe for how to intervene in each dystocia, every case is different, and there may be difficult scenarios where you will need professional assistance from your veterinarian. Nonetheless, intervening calmly and precisely is crucial for a smooth transition into lactation, reducing injuries, and prioritizing the welfare of cows and calves.

Calving workshop delivered by Cornell Cooperative Extension specialist

Guía para abordar la distocia

Por Daniela González Carranza, Especialista Regional en Manejo Lechero, CNYDLFC Equipo

Los partos distocicos no son deseables, pero es una situación inevitable a la que tendremos que enfrentarnos de vez en cuando, y las repercusiones para vacas y becerros son complejas. Por ejemplo, una asistencia mínima puede tener un impacto en la producción y la fertilidad de la vaca, sin mencionar la morbilidad y mortalidad de los becerros. Independientemente de su sistema de manejo del parto, es fundamental comprender el proceso y las etapas del parto.

¿Qué debemos saber sobre el parto?

Las vacas pasan por tres etapas cuando paren, y todo comienza días antes cuando el cortisol (hormona del estrés) del becerro desencadena cambios hormonales en la vaca que inician el parto

La primera etapa es la dilatación del cuello uterino o cervix y puede durar entre 4 y 24 horas, dependiendo del numero de lactancia de la vaca. A medida que las hormonas dilatan el cuello uterino, comienzan a aparecer otros signos, por ejemplo, el primero puede ser el aislamiento, y a medida que se acerca el momento del parto, la vaca muestra otros signos como levantar la cola, aumentar las veces que se echa y presta atención al abdomen.

Vaca en Etapa 2, observe que se muestra la atención al abdomen y el saco amniótico.

Una vez que la vaca está dilatada y el becerro está en posición de parto, comienza la etapa 2, que es la expulsion del becerro. Se considera que la **segunda etapa** comienza una vez que la vaca presenta contracciones abdominales frecuentes (idealmente 2-3 por minuto) y se muestra la “bolsa de agua” (saco amniótico). La duración normal de esta segunda etapa puede oscilar entre 30 minutos y 2 horas para vacas multíparas y entre 3 y 4 horas para vacas primíparas. La etapa 2 termina cuando nace la cría. La **tercera etapa** es la expulsión de la placenta.

¿Cuándo necesito intervenir?

Intervenir en los partos puede ser un desafío ya que cada vaca es diferente y el proceso puede verse afectado por varios factores, incluidas las condiciones ambientales. Sin embargo, a continuación se ofrecen algunos consejos prácticos que pueden ayudar a determinar si es necesaria una intervención.

1. Una vez que reconozca que la vaca está en la etapa 2, verifique el progreso cada 30 minutos. Si no sabe cuándo la vaca comenzó con la etapa 2, tenga paciencia y dé tiempo para monitorearla.
2. Si la vaca está en etapa 2 y no hay avances en 30 minutos, se podría proceder a hacerle un examen vaginal.
3. Si la vaca está en etapa 1 y no hay avances en 2-4 horas, se podría proceder a hacer un examen vaginal.
4. Tenga en cuenta si la vaca todavía tiene contracciones uterinas (2-3 por minuto).

¿Cómo hacer un examen vaginal?

Siempre recuerde estas reglas de oro al realizar un examen vaginal.

- Limpieza: Preparar y limpiar la zona vaginal de la vaca para reducir el riesgo de infecciones.
- Lubricación: La lubricación ayuda con la fricción, se necesita menos fuerza y disminuye el riesgo de lesiones a la vaca y al ternero.

El primer paso del examen es evaluar la dilatación del cuello uterino o cervix. No se logrará ningún progreso si la vaca no está lo suficientemente dilatada para que pueda pasar el becerro. El siguiente paso es evaluar la posición del becerro o el motivo del progreso lento.

- ¿Cuál es la posición del becerro, anterior (la cabeza primero) o posterior (la cola primero)?
- ¿El becerro es demasiado grande? ¿Está vivo?
- ¿Hay alguna obstrucción?
- ¿Está rota la bolsa de agua?
-

Algunos consejos

- Al identificar las patas delanteras de las traseras, dos articulaciones se flexionarán en la misma dirección para las patas delanteras. Por el contrario, las dos articulaciones se flexionarán en direcciones opuestas en las patas traseras.
- Siempre jale cuando la vaca esté teniendo una contracción.
- Cuando utilice cadenas, dos vueltas (una encima y otra debajo del la articulacion del metacarpo o menudillo) reducirán el riesgo de lesiones para el becerro.
- La rotación de la becerro (90 grados) puede ayudar a evitar el bloqueo de la cadera.
- Al manipular una pata dentro del útero, proteger las pezuñas del becerro con la mano evitaran laceraciones en el útero.

No existe una receta secreta sobre cómo intervenir en cada distocia, cada caso es diferente y puede haber escenarios difíciles en los que necesitarás asistencia profesional de tu veterinario. No obstante, intervenir con calma y precisión es crucial para una buena transición a la lactancia, reducir las lesiones y priorizar el bienestar de las vacas y los terneros.

Talleres de asistencia al parto impartidos por el especialista de Cornell Cooperative Extension.

What's in a Net? Potato Leafhopper Monitoring and Management During the 2023 Field Season

By Ashley Bound & Erik Smith of CNYDLFC Team, and Emily Anderson, CCE Chenango County

Potato leafhopper (PLH) is a major pest to alfalfa crops across the US and in Central New York. It causes damage to young plants and successive regrowth, resulting in a decrease in overall quality with the potential to cause financial losses to farmers. With funding from the Chobani Community Impact Fund and leadership from the Central New York Dairy, Livestock, and Field Crops (CCE CNYDLFC) regional team and Cornell Cooperative Extension of Chenango County (CCE Chenango), local Future Farmers of America (FFA) chapters worked together to inform farmers about PLH population dynamics in their fields. The goal of this project was to monitor alfalfa fields for PLH, inform farmers if and when PLH populations had reached the action threshold (the population at which a farmer would want to take action to prevent economic loss) and gain a better understanding of the populations of potential insect predators of PLH through the growing season. In the process, community members of different ages and backgrounds had the opportunity to come together to gain hands-on experience with agriculture in the region, share skills and unique perspectives, connect with farmers, and participate in a local citizen science project.

Alfalfa is a good source of protein for livestock and a high-yielding crop for silage, hay, and pasture, and is an essential component of Total Mixed Rations on most dairy farms. Alfalfa is also useful in crop rotations because its root systems help improve soil structure and, as a legume, it is able to fix nitrogen from the atmosphere.

One of alfalfa's most common pests in New York is potato leafhopper (Empoasca fabae) (PLH) (Fig. 1). Heavy PLH pressure can result in the reduction of stand quality and the loss of nutritional value, and it can impact the availability of successive cuttings. PLH is found across much of the eastern half of the United States and is a pest of many different crops, including clovers, potatoes, soybeans, and apples. At ¼ in, the small PLH can cause big problems. It feeds by using its straw-like mouthparts to extract sap from plants. While taking nutrients from the plant, the PLH also secretes a toxic saliva, which reduces the plant's ability to photosynthesize. Leaves of infected plants will begin to yellow; this is known as "hopper burn" (Fig. 2).

Figure 1. A potato Leafhopper adult is about ¼ inches in length (Ken Wise)

Figure 2. Hopper burn, PLH-damaged alfalfa (NYSIPM)

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Potato leafhopper management

PLH pressure in alfalfa fields is commonly addressed two ways: spraying the field with a pesticide to reduce PLH numbers or harvesting the field early. Costs and benefits exist between both of these options, but often the decision relies on the timing of the upcoming harvest.

Advising between when to cut and when to spray pesticides can help the farmer reduce the cost of pesticides, fuel, and labor used while also maintaining the value of the alfalfa stand.

If the field has high PLH numbers, but the farmer is within one week of harvesting the field anyway, it would be more cost-effective to cut the field early. Cutting early allows the farmer to prevent further damage caused by PLH and maintain the quality of the alfalfa without unnecessarily expending time, fuel, and product by spraying with a pesticide. On the other hand, if the field is more than one week away from harvest and PLH numbers are high, it would make more economic sense to treat the field with an insecticide to provide the alfalfa more time to mature without PLH damage, since a low-yield harvest would have low economic value.

What is considered a high PLH number?

Table 1. Economic thresholds of PLH in non-PLH-resistant alfalfa (adapted from Cornell Guide for Integrated Field Crop Management

Height of Alfalfa (in)	Max PLH/Sweep
<3	0.2
3-7	0.5
8-10	1
11-14	2
15+	2*

** No action needed if within 1 week of cutting, and consider cutting early.*

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For Example...
If the stand of alfalfa is **17 in.** tall and the average number of PLH per sweep was **2.5**, then the action threshold has been reached, and it would make sense to cut the stand early to prevent further damage because it is within one week of harvest.

However, if the alfalfa in the field is only **10 in.** tall and an average of **1.5** PLH were found per sweep, the field should instead be managed with a insecticide application to prevent further PLH damage, since the next cutting will not happen within the next week.

If the alfalfa height is **20 in.**, but the average number of PLH per sweep was only **1.2**, then the action threshold was not reached, and no action would be warranted for the field.

Methods

Data collections were performed with a standard 15-inch-diameter insect sweep net (Fig. 3). Participants swept the net a total of 10 times back and forth in a swinging motion while walking forward - each swing counting as one sweep - and at the end of the 10 sweeps, the number of insects in the net was recorded. In addition to PLH, participants also recorded seven types of predators that are known to feed on PLH and other insect pests. These included hoverfly larvae (Fig. 4), ladybugs and ladybug larvae (Fig. 5), lacewing larvae, damsel bugs, assassin bugs, minute pirate bugs, and spiders (including harvestmen, also known as daddy longlegs).

Figure 3. Sweep net (Gemplers)

Figure 4. Hoverfly larva feeding on an aphid (NC State Extension Publications; Hover fly larvae)

Figure 5. Ladybug larva (Cornell University)

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This process was repeated for a total of three - five sets of sweeps, or 30-50 total sweeps per field. Fields were typically re-sampled weekly through the growing season, except immediately following harvest.

After counting the numbers of pests and predators and averaging those values across all sweeps, alfalfa height was recorded so that a determination could be made as to whether or not that field reached the threshold for management using the established economic thresholds (Table 1).

Results and Discussion

With four participating FFA chapters, we were able to monitor PLH in 21 alfalfa fields on 13 farms in 5 counties over 12 weeks from June to August, when alfalfa crops are at highest risk of PLH and when producers are most likely to invest in insecticidal sprays to salvage yield.

Across all fields and sampling dates, 1,951 PLH and 1,291 insect predators were recorded (Table 2). This does not include many other insects that were also observed in our sweep nets, like horse flies, deer flies, bees, aphids, and parasitoid wasps. The two most common insects sampled were aphids and several species of parasitoid wasps. Aphid populations seldom reach damaging levels in alfalfa, and these species of wasp parasitize other insects, primarily aphids in this setting.

Table 2. Total PLH and selected predators observed across all fields and dates

Table 1. Total individuals sampled

PEST	PREDATORS						
POTATO LEAFHOPPER (ALL)	LADYBUG (ADULTS AND LARVAE)	HOVERFLY LARVAE	LACEWING (ADULTS AND LARVAE)	DAMSEL BUGS	ASSASSIN BUGS	MINUTE PIRATE BUG	SPIDERS
1951	343	37	20	246	63	297	285

Out of 126 sampling efforts, the action threshold was reached only 10 times (7.9%). Of those 10 times, applying a short-residual insecticide was the most economical management strategy in five cases, while early harvest was recommended the other five times. This meant that it was only economical to spray in 3.97% of cases.

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Predators outnumbered PLH in our sweeps until mid-July, and again after mid-August (Fig. 6). We know that the predators we recorded have been reported by others to feed on PLH, but we do not have a good understanding of how well they may be able to control PLH populations. But if they are, our study shows that there is a period of about 5 weeks in the middle of summer that may be the highest risk for yield loss due to PLH infestation and potential yield loss. Alfalfa weevil is an important pest of alfalfa through late-June, and these predators may be exploiting this pest before PLH populations increase.

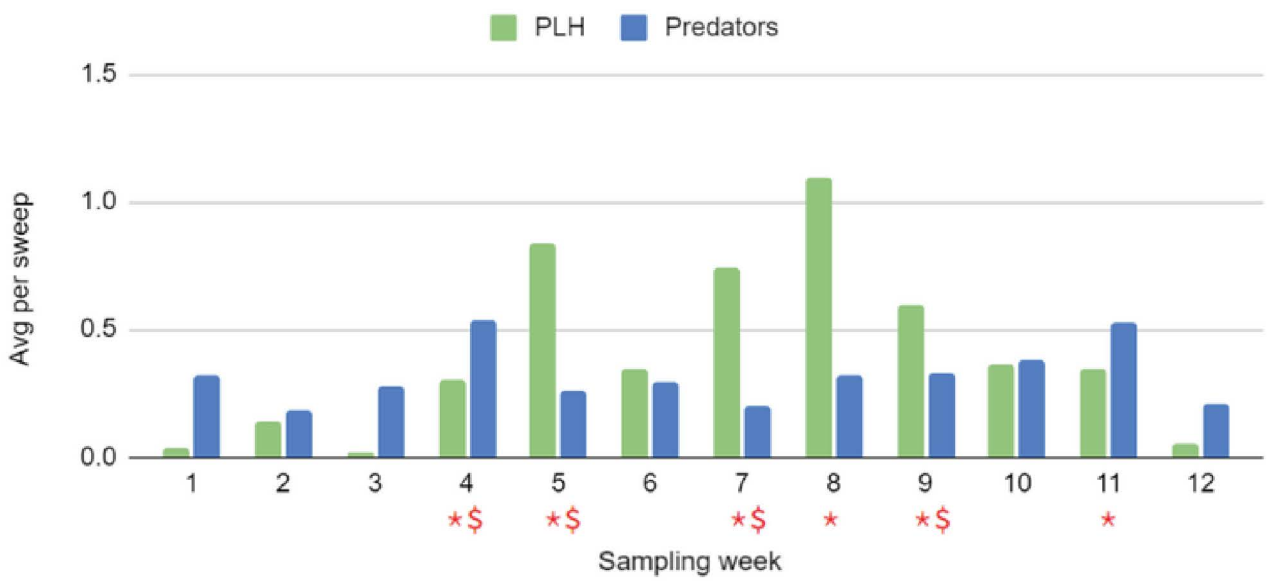

Figure 6. Insect population dynamics in Central NY alfalfa fields
⋆Economic threshold reached in at least one field that week
$ Insecticide spray warranted in at least one field that week

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Forage crops are unique because they are harvested multiple times per year, allowing for a partial reset of local pest populations with each harvest. But while the recommended short-residual sprays do not have extended activity directly, their effects can extend through the growing season if used incorrectly. Spraying without scouting to verify whether action thresholds have been reached, and spraying when pests are below economic thresholds not only wastes money in the short-term, but puts important insect diversity at risk. Not only non-target insects like pollinators, but also predators that may be feeding on PLH, alfalfa weevil, and aphids and preventing their populations from reducing forage yield and quality.

Alfalfa varieties exist that are resistant to PLH damage, and the economic thresholds of these varieties can be nearly 10x the level of traditional alfalfa. If PLH-resistant varieties were used in this study, the economic threshold would not have been reached in any of our farmers' fields.

The partnership between CCE Chenango, the CNYDLFC regional team, and FFA chapters was instrumental to the project's geographic reach and success. Through this partnership, young people in the community were able to aid farmers while learning about local agriculture and entomology.

Additional Resources

Potato Leafhopper | CALS: https://cals.cornell.edu/field-crops/forages/insects-forage-crops/potato-leafhopper

IPM Practices for Forage Crops: https://cals.cornell.edu/field-crops/forages/ipm-practices-forage-crops

Acknowledgments

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Common Misconceptions About Concentrated Animal Feed Operation (CAFO) Regulations and Comprehensive Nutrient Management Planning in New York State

by Carly Bass, Kirsten Workman, Greg Albrecht, et all...

Introduction

Farms that have more than 300 mature dairy cows (or an equivalent in other livestock animals) are required to operate under the New York State Pollutant Discharge Elimination System (SPDES) General Permit for Concentrated Animal Feeding Operations(CAFOs). The permit dictates that the farms follow environmental conservation practices and meet state standards designed to maintain the highest quality of water possible by mitigating the risk of pollution to New York waters. As only a small portion of our population is involved in agricultural production, it is not always understood what farms in New York State are required to do to stay in compliance. This article highlights and addresses some of the most common misconceptions surrounding New York CAFO farms and the CAFO permit.

Misconception 1:

"New York's permit is less strict than the federal permit"

New York works closely with federal agencies such as NRCS and the EPA to ensure their standards and permit satisfy or exceeds the federal requirements. New York takes the minimum guidelines set forth in the federal Clean Water Act (CWA) CAFO Rule and makes additional requirements for farms to follow within their Comprehensive Nutrient Management Plan (CNMP) to meet water quality and sustainability goals of the state. The following are examples where the New York CAFO permit is more environmentally protective, and thereby restrictive, than the federal CAFO rule.

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- New York CAFOs must maintain no discharge from their production areas (farmsteads)through a 100-year, 24-hour storm compared to the federal no discharge standard which is for a 25-year, 24-hour storm.
- New York CAFOs must utilize an AEM Certified Planner, whereas no professional certification is required by the CWA CAFO Rule.
- New York CAFO permitted farms must follow an integrated system of NRCS Conservation Practice Standards for management of nutrients throughout their farmsteads and fields; such engineering and management standards are not required by the CWA CAFO Rule.
- Farms must sample soil for nutrient values every three years versus every five years.
- Farmer fields need to be planned and managed to conserve soil and reduce erosion, whereas this is not a CWA CAFO Rule.
- New York CAFO’s must develop and maintain facility specific winter and wet weather application procedures and identify low-risk fields to be used for winter application in the case of an emergency.
- New structural practices need to be designed considering future flood risk due to climate change.
- Farm staff must be present and monitor active waste transfers from the production area(farmstead) while material is being transferred.
- The NRCS-NY 590 Nutrient Management Standard and associated Land Grant University Guidelines require New York CAFOs to account for nitrogen already present on the farm (soil, manure, crop rotation credits, etc.) when developing spreading recommendations.

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Misconception 2:

“Manure storages are not safe and impact drinking water”

Manure storages located and operated on New York CAFOs are required to be designed and constructed by a trained, State of New York licensed professional engineer to meet national standards (Natural Resources Conservation Practice Standard – NY 313). The NRCS-NY313 Standard requires that manure storages are designed, built, and operated to fully contain manure nutrients and any direct precipitation for future application to crops as fertilizer while remaining isolated and protected from ground- and surface waters. These standards require geological investigations, prior to the design, to properly site these structures and ensure an appropriate liner is selected to minimize any risk of leaking. To date, there has been no evidence of a certified manure storage contributing to an impact to groundwater in New York. In addition to the groundwater protections outlined in the standards, there are measures to ensure and protect against these structures overtopping. The standards themselves require maximum fill markers to help ensure that safety volume requirements are maintained. The New York CAFO permit also requires the final as-built plans, certified by a professional engineer, be maintained on site; fill levels be monitored and recorded; and operation and maintenance measures outlined by the professional engineer be followed. Finally, no farm in New York is allowed to impact the water resources of the state, no matter the size of the farm. Any impact to Waters of the State is considered a significant violation of the Environmental Conservation Law and is subject to substantial penalties and/or fines.

Misconception 3:

“Farmers can spread manure under any weather conditions”

All CAFO farmers are required to have a current Comprehensive Nutrient Management Plan(CNMP) developed by an AEM Certified Planner in accordance with the permit, NRCS standards, and guidelines. The CNMP must be updated annually and prescribes how much manure and fertilizer can be spread on each field, as well as the anticipated application method and timing. In addition to their individualized plans, the New York CAFO permit sets maximum single-application spreading rates. New York’s CAFO permit also contains specific requirements pertaining to winter and wet weather spreading, including a prohibition against spreading if the field is saturated or frozen-saturated.

New York does not have a calendar-based ban on winter spreading because calendar-based regulations do not take current weather and specific field conditions into account. Drivers of nutrient losses are based on specific field, soil, and weather conditions/forecasts. New York’s CAFOs must assess field conditions every time they spread and follow the specific guidance outlined in the “Revised winter and wet weather manure spreading guidelines to reduce water contamination risk”

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Misconception 4:

"New York regulations allow phosphorus to be applied to fields even when the crop does not need it"

Manure contains all 17 essential nutrients for plant growth and is a key to building soil health by providing organic matter and enhancing the soil ecosystem. Properly managed, use of manure can offset the need for purchased fertilizer, reducing the amount of imported nutrients onto farms and into a watershed. However, nutrients in manure aren't necessarily present in the balance required by a specific crop grown on a specific field. Within a farm's CNMP, the New York P-Index governs how much phosphorus can be applied to fields each year to ensure proper recycling of on-farm nutrients through crops and long-term, sustainable soil test levels for the benefit of water quality. In accordance with the New York P-Index, a farmer and AEM Certified Planner must assess the risk of phosphorus leaving the field. This needs to be done for all fields on the farm. Those assessments will determine how and how much manure may be applied and must be documented in the farms' CNMP. Farmers implement beneficial management practices to further reduce P runoff risk to lower the New York P-Index rating for fields. Making the most of manure nutrients is critical for water quality, air quality, and crop production, and to reduce N and P imports into watersheds. Most soils in New York are currently deficient in phosphorus so proper phosphorus management is needed to maintain productive and healthy soils for food production.

Misconception 5:

"Farmers pay AEM Certified Planners, therefore plans are biased"

New York has strict rules for who can develop and update CNMPs. A farm's CNMP needs to be written by a state-certified planner who has gone through extensive training, is required to keep certifications current through training sessions, and has signed a code of ethics. Such a certification is akin to other state certified professionals used across sectors, such as professional engineers, architects, accountants, etc. To become an AEM planner, an individual must first become a Certified Crop Adviser (CCA), which involves passing two exams (an international and a regional exam) and meeting further educational and experience requirements to demonstrate their knowledge in agronomy and environmental conservation in agriculture. The next step is satisfying participation in the state led CNMP Training. After completing these two steps, the individual's first three CNMPs must be submitted to CNMP specialists at the New York State Department of Agriculture and Markets(NYSAGM) for review, revision, and acceptance. Once the three plans satisfy the CNMP requirements, the individual becomes an AEM Certified Planner. Certified planners must sustain their CCA status, maintain compliant work through ongoing quality assessments by NYSAGM staff, and satisfy 40 credit hours of continuing education every two years to maintain their certification. In addition to this rigorous certification and assessment process, the NYSDEC reviews CNMPs during regular CAFO inspections and pursues enforcement if deficiencies are identified.

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Misconception 6:

“Only large dairy farms are regulated”

New York State laws and regulations require all animal feeding operations (AFOs) that meet certain animal thresholds, to obtain coverage under a State Pollutant Discharge Elimination System (SPDES) permit prior to operation. However, per Environmental Conservation Law Article 17, Title 5, Section 17-0501, no farm, regardless of size or permit coverage, is allowed to contribute to a water quality violation and impact New York’s water resources. New York also funds several programs that are available to all farms, including smaller AFOs. The AEM program, Dairy Advancement Program (DAP), and NRCS’s program help farms with conservation plan development (including CNMPs) and implementation of best management practices. To date, 13,500 practices on over 2,500 farms have been implemented through the AEM programs, the DAP has helped more than 300 non-CAFO farms develop CNMPs, and those NYS program accomplishments can be doubled when considering projects completed through USDA NRCS and the Farm Service Agency.

These programs augment the substantial investment by farmers and ensure that farms of all types and scales have there sources to implement nutrient management practices on their farms to aid with environmental management. Roughly 1,000,000 acres of cropland are impacted annually in New York by nutrient management guidelines due to the various programs in place.

Additional Resources

Bass, C., K. Workman, G. Albrecht, R. Bush, B. Jordan, D. Gates, J. Hornesky, S. Latessa, K. Reed, and Q.M. Ketterings (2023). Concentrated Animal Feeding Operation Regulations and Comprehensive Nutrient Management Planning in New York State. Cornell University, Ithaca NY. nmsp.cals.cornell.edu/publications/extension/CAFOCNMPNY2023.pdf

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Acknowledgements

The information shared in this article comes from a larger extension document that outlines regulations and comprehensive nutrient management planning in New York State (see additional resources above). We thank the members of the Nutrient Management Spear Program advisory committees for their feedback on the larger document. For questions, contact Quirine M. Ketterings (qmk2@cornell.edu) or Kirsten Workman (kw566@cornell.edu).

Managing Corn Rootworm in NY to Delay Bt Resistance (& Save Seed Costs)

by Elson Shields, Entomology, Cornell Univ., Ithaca

Note from Erik Smith, Field Crop Specialist: *The following article was published a few years ago, but with an increase in reports of rootworm populations overcoming GMO traits across NY, it's time to revisit a tried-and-tested option for long-term insecticide resistance management for soil-dwelling insect pests: entomopathogenic nematodes. Please reach out to Field Crop Specialist Erik Smith for more details on how to source and deploy these nematodes on your farm.*

Across the US and within NY, corn rootworm (CRW) is developing resistance to the Bt-RW traits in our GE corn varieties, causing increased root damage and decreasing yields. Yield losses from CRW root feeding can surpass 10% without any above ground symptoms, making this type of losses difficult to detect. In addition, corn grown for silage is more sensitive to yield losses from CRW feeding than corn grown for grain. As CRW resistance increases to Bt-RW, the damage becomes more apparent and easier to detect, but losses have been occurring in the field in prior years, going undetected. Increased damage has been reported in NY for all of the Bt-RW traits regardless of company.

Important points about CRW biology: There are two important points about CRW biology which need to be remembered when managing this pest and reducing its potential for developing resistance to any of our management tools.1) In NY, all eggs are laid in existing corn fields during August, and 2) if the newly hatch CRW larvae in the spring do not find a corn root, they die. Since CRW eggs are laid in existing corn fields in August of prior year, crop rotation is our best resistance management tool. Since the majority of the corn grown in NY is in rotation with alfalfa for our dairy farms, NY trails the rest of the nation in the development of CRW resistance to Bt-RW.

For our dairy farmers that grow corn in rotation with alfalfa, corn is typically grown in a field for 3-5 years. The longer corn is grown continuously in a field, the higher risk the field has for economically damaging CRW root feeding and yield losses. After rotating out of a non-corn crop, first year corn does not need any CRW management (or expensive Bt-RW trait costs). A non-Bt-RW corn variety should be planted with a seed corn maggot/wireworm effective seed treatment. This choice in year 1 saves $15-$20 per acre in seed costs. In year 2, the risk of CRW loss increases to 25-30% in NY. To offset this risk, a farmer has several options. Many farmers will assume the risk and plant a non-Bt-RW corn variety without any additional protection such as a soil insecticide. A second option in year 2 is to use either a 50% rate of soil insecticide (if insecticide boxes are available), high rate of neonic seed treatment or an insecticide added to the liquid popup fertilizer. The CRW pressure in year 2 is not high enough to recommend the use of Bt-RW in most cases and the option of an insecticide is often a less expensive route to reduce production costs. The deployment of different modes of toxicity in year 2 from Bt-RW significantly reduces the selection for Bt-RW resistance by CRW.

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In continuous corn years 3-5, the risk of economic loss from CRW is high enough to merit the use of Bt-RW corn varieties. A second option in years 3-5 of continuous corn is the use of a full rate of soil insecticide, if insecticide boxes are available. Adding insecticide to the popup fertilizer during years 3-5 is not recommended due to unreliable efficacy with the higher CRW populations and increased risk for economic damage.

Strategy 2 for our dairy farmers: Incorporating biocontrol nematodes into their rotation and crop production.

By using the biocontrol nematode technology developed to combat alfalfa snout beetle in NNY, our dairy farmers can reduce their corn seed costs by eliminating the purchase of the Bt-RW traits in their corn varieties. A single inoculation of each field with native persistent NY biocontrol nematodes provides protection from corn rootworm larval feeding by attacking these insects before they damage the corn roots. NY research data indicates a single soil inoculation ($50-$60/acre) establishes these NY adapted biocontrol nematodes in the soil profile for many years, where they attack a wide range of pest soil insects across a wide variety of crops. During the corn years, these biocontrol nematodes attack rootworm larvae and during the alfalfa years, attack wireworms, white grubs, clover root curculio feeding on the alfalfa and grass in the field.

If the biocontrol nematodes are inoculated into the field during the alfalfa portion of the crop rotation, the farmer can use corn varieties without Bt-RW for the entire corn rotation. Biocontrol nematodes take until the second growing season after application to become fully established in the soil profile and when applied to the alfalfa crop, become fully established before corn is planted. If the field is inoculated with biocontrol nematodes during the first year of the corn rotation, the corn variety planted in year 1 can be without the Bt-RW trait because rootworm is never a problem in 1st year corn in NY. By the second year, the biocontrol nematodes are fully established and corn varieties can be planted without Bt-RW for the remaining years of the corn portion of the rotation.

However, if the corn field is inoculated with biocontrol nematodes during the 2nd-4th year when rootworm damage risk is higher, the corn variety planted during the year of inoculation needs to have the Bt-RW trait to provide some additional protection while the biocontrol nematodes become fully established in the field. If the cost of establishing biocontrol nematodes in a field is a one-time cost of $50-60/acre and the Bt-RW trait adds $20/acre/year to the seed costs, the breakeven point for the nematode application is year 3 when the Bt-RW trait is not purchased or used. In the years beyond 3-years after application, the seed cost savings will continue to be the cost of the Bt-RW which is an unnecessary expense.

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For our cash grain farmers, an annual rotation of corn and a non-host crop like soybeans completely eliminates the need for any CRW management tools. During the corn years, non Bt-RW corn varieties can be safely planted without risk of losses from CRW. The elimination of the Bt-RW trait in the corn planted reduces the seed cost $15-$20 per acre and the use of a Bt-RW trait is completely unnecessary. However, a seed treatment for seed corn maggot to protect plant emergence is recommended due to our typically wet cold soils. The enhanced adoption of cover crops to protect our soil from erosion and any history of animal manure application significantly increases the risk of plant stand losses from seed corn maggot.

Long-term continuous corn fields: The culture of corn continuously in the same field for multiple years using only Bt-RW to control CRW places tremendous selection pressure for the insect to develop resistance to the Bt-RW toxins. This widespread practice across the corn belt has resulted in the documented CRW resistance to all Bt-RW traits and the insect is causing economic losses for farmers adopting these continuous corn practices. Closer to home, Bt-RW failures have been reported in Central NY corn fields, multiple corn growing areas of Ontario, Canada and to the south in Pennsylvania. With no new technology against CRW available for the next few years, these growers have a real challenge on their hands to minimize losses from this adaptable insect, if these farmers continue with long-term continuous corn production without breaking the CRW cycle with crop rotation. Farmers with fields producing corn continuously for multiple years need to seriously consider working a crop rotation into their farming practices. There are well documented agronomic yield advantages/responses from crop rotation over continuous corn, even without considering the reduction in CRW root feeding damage.

However, if farmers insist on growing continuous corn in field without interruption, there are several issues to consider.The continued use of Bt-RW accelerates CRW resistance and the single field failure becomes the source of highly resistant beetles moving into neighboring fields, causing significant yield losses even in neighboring fields where farmers are utilizing crop rotation to minimize CRW-Bt-RW resistance development and yield losses. The farmer growing continuous corn and producing highly resistant beetles becomes “a neighborhood social problem” for his neighbors.Some farmers add a soil insecticide over the top of the Bt-RW trait, think this is a solution to the resistance issue. While the corn stands better with less damage at the plant base, selection for CRW Bt-RW resistance continues to accelerate within the root system in areas outside of the soil insecticide treated zone.

The addition of biocontrol nematodes to the continuous corn culture is a way of introducing an independent mortality factor to help the Bt-RW trait control rootworm larval populations. However in these high CRW pressure systems, biocontrol nematodes should not be used alone. CRW has developed resistance to every other management strategy used to manage its damage, biocontrol nematodes used alone will also select for CRW resistance.If farmers are interested in incorporating biocontrol nematodes into their continuous corn production, farmers should continue to use varieties with the Bt-RW trait to continue to kill the susceptible CRW larvae or match the use of biocontrol nematodes with a full rate of soil insecticide.

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