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The Cygnet News

CYGNET ENTERPRISES, INCORPORATED

As one of the largest supporters of aquatic herbicide research, Cygnet Enterprises, Inc. would like to thank our customers, friends, and family for your support and loyalty in 2016! Without valued customers like you, we would not be able to support organizations dedicated to our industry through the furthering of research and education! In turn, we hope that you find this newsletter issue informative and educational.

It is our goal to bring you the most current information from across the nation, as we know each year brings about changes to our ever-evolving industry.

With warmer weather fast approaching, we look forward to working alongside you in 2017!

The magic behind herbicide resistance in hydrilla

by Lyn A Gettys

The weed

Hydrilla (*Hydrilla verticillata*) was first introduced to Florida in the 1950s as a potential aquarium plant. Aquarium dealers had little interest in this new species because they already had a perfectly good oxygenator – *Egeria densa*, known in the trade as anacharis – and weren't interested in diversifying their offerings. For more details about the sordid tale of hydrilla's release and subsequent escape into our waters, check out "The Historical Introductions of Waterhyacinth and Hydrilla into the United States" by Don Schmitz in the Spring 2016 issue of *Aquatics* magazine.

The tool

Hydrilla quickly invaded Florida's waters and became our most intensively managed submersed weed, but the labeling of the aquatic herbicide, fluridone, in 1985 brought a new tool to the aquatic plant management toolbox. Fluridone targets phytoene desaturase (*pds*), an enzyme that is needed to make the pigments used by plants during photosynthesis. Fluridone had many positive attributes: in a nutshell, very low concentrations of fluridone (typically less than 10 ppb) could be expected to provide excellent, multi-season control of hydrilla with little damage to off-target plants. This soon made fluridone the "go-to" treatment for hydrilla management; it was cost-effective, lasted a long time and didn't wipe out the natives – what's not to like?

The problem

All was well until the late 1990s, when reports of poor fluridone performance began to trickle in. At first, these failures were chalked up to "operator error" (c'mon, be honest, haven't you ever sprayed water because you forgot to put the herbicide in the tank?). However, it soon became apparent that something else was going on. Extensive research revealed that some populations of hydrilla were resistant to fluridone. Before going on, let's break

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Inside this Issue:

Did you know that Cygnet makes it a point to support the industry? For instance, we are the **ONLY distributor** at the **Charter GOLD level** with the Aquatic Ecosystem Restoration Foundation.

Michigan Update

By: Garrett McClain

Welcome to the 2017 application season! We hope everyone had a safe and enjoyable off season! At this point everything should be starting to ramp up in our region. Hopefully everyone used the winter efficiently and is ready to get right to business!

We held our Annual Aquatic Applicator & Lake Managers Symposium in conjunction with the Michigan Aquatic Managers Association on February 2, 2017. We had great speakers and attendee participation which made for a wonderful show. We want to extend our gratitude to everyone who was able to attend and all the speakers who helped us put together an informative meeting. If you have not attended before or would like more information on our annual symposiums, please give us a call and we will be glad to get you involved.

The 37th Annual Midwest Aquatic Plant Management Society's conference was held in Milwaukee, Wisconsin, February 27 through March 2, 2017. This year they had an offsite president's reception which was great and Milwaukee was a very welcoming city. There were a lot of great speakers and a lot of great presentations, along with some special sessions on starry stonewort. If you have never attended the MAPMS conference and are in the Midwest, I would highly recommend looking into MAPMS and their purpose. Next year's conference will be held in Cleveland, Ohio, so mark your calendars! We look forward to seeing you next year.

Furthermore, we are excited to introduce two new members to the Cygnet team at our corporate office. Warren Foster and will be working in our warehouse handling all of our shipping, receiving and warehouse needs and Eva Worthing will be our new customer care representative. So the next time you stop by to pick up some product or call our office please say hello and introduce yourself to Warren and Eva!

Lastly, when you have a moment, please take the time to visit our website: www.cygnetenterprises.com. We are constantly updating it with the latest industry news, and it is a great place to find valuable information such as current product labels and SDS's. If you are not able to find what you need on our website, please give us a call and we will do our best to answer your questions or find someone who can. We are eager to provide for all your aquatic needs and look forward to working with you this year! Have a safe and successful 2017!

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Michigan Restricted Use Pesticide Update

On December 20, 2017 Michigan's Restricted Use Pesticides Regulation (Regulation 633) was amended and the changes are effective immediately. All formulations of Diquat Dibromide have been removed off the MI RUP list and are now classified as general use. Also any end use pesticide that contains greater than 1% diuron is now classified as a Restricted Use Pesticide. Examples of common diuron brand names that are now restricted include: Karmex, Sahara, Imazuron and Valpar Alfmax. This was the first time the rule has been amended since its inception in 1979. You can find the most up to date MI RUP list on the Michigan Department of Agriculture & Rural Development's website (www.michigan.gov/mdard).

California Update

By: Andrea Sealock

Another year has passed and we are full speed ahead toward a new season of aquatic plant management! We hope the new year finds you healthy and happy? Here at Cygnet West, we remain hopeful as drought conditions across the state of California continue to steadily improve. How exciting it is to be starting 2017 with record rain falls and a strong snow-pack!

This time of year, as many of you know, is a time for conferences, meetings, and preparing for the upcoming treatment season. In January, Cygnet West attended the California Weed Science Society's annual conference in Monterey, California. For those of you that made it out there, we truly enjoyed spending time with you! In March, Cygnet West also attended the Western Aquatic Plant Management Society's joint meeting with the Western Society of Weed Science in beautiful Coeur d'Alene, Idaho. It was a wonderful meeting and great opportunity to network with colleagues and customers alike. If you were able to attend, we hope you enjoyed it as much as we did!

We would also like to remind everyone that this a great time of year to send us copies of your updated licenses, permits, and other important documents required for pesticide purchases in the state of California. This allows for timely processing of all orders. In addition, please keep in mind that our Concord and Fresno warehouse locations are open for daily will-call purchases during the week, Monday through Friday. We simply ask that you phone-in your orders in advance, which allows us time to prepare your order and the supporting documents required for release, transportation, etc. We appreciate your consideration of these procedures and if you have any concerns, please contact Andrea Sealock directly.

In closing, we would like to thank our customers for their loyalty and patronage. The relationships we have with each of you are truly valued. If there is ever anything we can do to better your experience with us, please let us know. We wish you much success in 2017!

Western Region

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North Carolina Update

By: Neal Coulter & JJ Ferris

The North Carolina Office of Cygnet Enterprises, like many of you, is eagerly waiting for spring as it approaches. Like last year, it has been an unusually warm winter. These factors will again create new challenges for aquatic vegetation managers, for it is allowing plant growth in ponds and lakes to prosper. It will be very interesting to see what 2017 has in store for all of us in the aquatic industry.

Due to hurricane Matthew wrecking havoc in the Southeast this past fall, The 38th Annual South Carolina Aquatic Plant Management Society (SCAPMS) had to push back the 2016 conference to January 17-19, 2017. Despite the move, the conference was still a great success. It was a pleasure seeing and visiting with many of you. It's always encouraging to see so many of the industry's professionals come together to support one another and the society.

Cygnet had the pleasure to be a vendor at the 2nd Annual Society of Lake Management Professionals (SLMP) on January 24-26th in Daytona Beach, FL. We encourage all lake managers, if you have not done so already, to join and be a part of this rewarding society. The Purpose of SLMP is "to foster an appreciation for and enhance the management of ponds and lakes, managed by private companies, with particular concern for the aesthetic and recreational uses and stewardship of such waters. Using tools such as innovation, education, representation, accreditation, and standardization of best management practices.

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North Carolina Update Continuation

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Advocate wise stewardship of privately owned water, promote and recruit fishing opportunities in private water environments, and protect our environment."

We would like to thank our customers for supporting us. Though many have been affected by the economy, our business has managed to continue to grow, allowing Cygnet to be a steady partner for our industry and customer base. We look forward to seeing everyone at the upcoming APMS, SCAMPS, and MSAPMS. The dates of these trade shows will be available on our website when they have been determined. In addition, we will be involved in the North Carolina Regional Invasive Plant Council's annual meeting on March 22nd-23rd in Elon, North Carolina.

Once again we would like to thank our customers in the South for giving Cygnet Enterprises, Inc. an opportunity to supply the water resource management products for your company and/or agency.

Pennsylvania Update

By: Jo Ann Dunlap

The Northeast Aquatic Plant Management Society's annual conference was held on January 10 - 12, 2017, at Wentworth by the Sea in New Castle, New Hampshire. This is a gorgeous venue and we had equally gorgeous weather this year. Joining me at the conference was Donna Packer from my Pennsylvania office and Garrett McClain from our Michigan office. All three of us enjoyed the opportunity to socialize with old and new clients alike. Cygnet Enterprises was once again pleased to sponsor the NEAPMS raffle, donating the raffle tickets and grand prize, a DJI Phantom 3 Professional Quadcopter 4K UHD Video Camera Drone. To all of you who bought raffle tickets, I would personally like to thank you and acknowledge your support of NEAPMS' scholarship fund, to which all raffle proceeds are applied.

Coming up next for us is the 27th Annual Pennsylvania Lake Management Society (PALMS) Conference at the Ramada Hotel and Conference Center in State College, Pennsylvania, on March 1 & 2, 2017. For more information on this society and their annual conference visit www.palakes.org. This year's keynote speaker will be Rob Richardson from North Carolina State University. If you have not meet Rob, he is a great guy and a fabulous speaker, so don't miss this occasion to hear him.

Prior to start of treatment season, we will be holding our 9th Annual Applicators Symposium on March 21, 2017, at the Ramada Conference Center in Fishkill, New York. Cygnet Enterprises is pleased to be able to provide this program as a value added service to our clients, please note that re-certification credits for 10 states in the Northeast will be available, breakfast & lunch will be provided and this is a free event. If you are not currently a Cygnet client, but are an aquatic applicator and believe you would benefit from getting the lasted updates from major manufacturers and interacting with other applicators, please contact me for an invitation to this event.

For those of you of that know Charles Gilbert, I would like to relay that he is having some health issues. Charles has played an integral role in promoting the development of aquatic plant management and has been a mentor to many of us. If you wish to reach out to him and let him know you're thinking about him, please get in touch with me for his contact information. I'm sure he would appreciate hearing from you all!

Donna Packer, Russ Hodgson, Joshua Beeman and I would like to thank our clients for your business and support. We anxiously await spring's arrival and wish everyone a healthy, productive and profitable 2017 season. We look forward talking to you and seeing you soon.

Take care!

Northeast Region

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Indiana Update

By: John Olsen

The 2017 treatment season is fast approaching, and I hope everyone got a chance to enjoy the holidays? After taking some time off this winter, it was good to get back to work. I realized how much I enjoy getting a chance to share and learn from everyone in the aquatics industry. I look forward to attending the shows and visiting as many organizations as I can before the season starts.

We recently held our 13th Annual Cygnet Aquatic Winter Workshop on January 31st at the *Purdue University Beck Center*. I want to especially thank all our speakers. Ed Spanopoulos from Lake and Pond Biologists gave a great talk on the impact of water quality on pesticide performance. The talk focused on water pH and how that affects our treatments. He also showed how limited pH information is on many labels. Scott Banfield, with Aquatic Enhancement and Survey, shared a 2017 update of the results of early season treatment strategies for Eurasian Watermilfoil (Myriophyllum Spicatum) and Curly-leaf Pondweed (Potamogeton Cripus) in northeast Indiana lakes. We were also joined by representatives from Biosafe Systems, UPI, Syngenta and SePRO for product and technology updates. I would also like to thank everyone from the Indiana Department of Natural Resources (INDR) who attended the workshop. The IDNR has given some great talks over the years as well as Fred Whitford, with the Purdue Pesticide Program, and Joe Becovitz, from the Office of the Indiana State Chemist. I appreciate everyone taking time out of their busy schedules to show up and be part of something that brings us all together.

This season, there are a couple new products you should be aware of, the first of which is called Depth Charge. This is a 2,4-d and Flumioxazin combination. It delivers fast control of tough invasive and nuisance plants such as Watermilfoil (including hybrids), Pondweed (including Illinois and Largeleaf), Duckweed, Watermeal, Coontail and many more. It has two modes of action, so it makes for a great resistance management tool. The other new product is Clipper SC, which is liquid Flumioxazin. This product delivers fast selective control of tough invasive and nuisance plants such as Cabomba, Watermeal, Eurasian Watermilfoil, Water Lettuce, Giant Salvinia and many more. Both of these products are manufactured by Nufarm. If you are interested in more information on either of these new products, please give any of our offices a call.

Another important item I would like to remind you about is our annual recycling program. Cygnet's recycling program is hassle-free and available to all our customers! We supply the bags and will pick up your empty pesticide containers to have them disposed of properly. We simply ask that you triple rinse the containers and keep them clean for pick-up. I know we all care about the environment so please recycle your containers! We thank you in advance for doing your part.

I would also like to thank all our valued customers. Because of you, we are able to put on events like the workshop at Purdue and help support the many different associations and trade shows we attend during the winter. We will be attending and exhibiting at the Midwest Aquatic Plant Management Society, the Lake Management Association and the Indiana Lake Management Society. We hope to see you there!

Wishing you continued success in 2017!

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"There is hardly anything in the world that some man cannot make a little worse and sell a little cheaper and the people who consider price only are this mans lawful prey"

John Ruskin

Idaho Update

By: Doug Kleweno

It has been a busy start to the year in the Northwest! We are pleased to announce that our newest team member, Zach Kuzniar, is fully integrated with the customer base located in eastern Oregon, Idaho, and Montana. Although he is a long way from his native home in Michigan, he now calls Boise, Idaho, his home and is getting integrated into the community. Most of you in the NW have already met Zach this last year, so keep an eye out because he is very actively working throughout the territory and will be getting out to make introductions if you have not met him already. I recommend getting Zach involved in the maintenance of your canal systems and/or lakes and reservoirs, because he will be a valuable resource to your program.

Cygnet Enterprises has been very busy in our support efforts for organizations involved in water management. This has always been a big focus for our founder, Richard Hinterman and continues to be a point of emphasis for our current owner, Joe Bondra. Cygnet strives to support our water industry through support of various organizations that benefit our water users. In particular, our involvement with water user meetings in Montana (Montana Dams & Canals Association), Oregon (Oregon Water Resources Council), Washington (Washington Weed Conference & Washington Water Resources Association), Utah (Utah Water Summit and Water Users Association), and Idaho (Idaho Water Users Association & NW Irrigator Operators Association), as well as the Western Aquatic Plant Management Association (WAPMS) has kept us very busy this winter. We have also participated in a number of irrigation district and/or water user group training programs provided to applicators that need annual education credits for their licenses. Cygnet will continue to support and partner with these organizations in the upcoming 2017 water season and we will focus on all aquatic applications.

Overall last season's water availability was not as challenging as in the previous couple of years and most districts in the NW operated with a full allocation of water throughout the season. As many of you in the west are aware, this has been a record setting year for moisture that started in October and basically has not stopped at this point. Just 12-18 months ago the Owyhee Reservoir in eastern Oregon was drained down to less than 10%, which was essentially dead pool level and the water level in Klamath Lake in southern Oregon was also approaching historic low levels. As of the writing of this article, the Owyhee Reservoir has nearly two years accumulation of water built up and the Klamath Lake is full and spilling water. At this point in the year the snow pack in the mountains throughout the NW is above average and most water user groups are encouraged that this summer may be a normal water delivery season.

We are very excited about the upcoming water season here at Cygnet Northwest. We look forward to helping irrigators, lake mangers and private home owners responsibly and economically care for their water bodies. If you ever have any questions or concerns, please feel free to call our office and we look forward to having another great water season in 2017!

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Adaptive Plant Management in Irrigation Canal Systems

By: Zach Kuzniar

As seen in most irrigation canal systems, presence of aquatic plants and algae pose significant threats to efficient water delivery. Although the battle against "weeds" is not breaking news, the active and dynamic treatment programs designed to control them is of contemporary interest. Canal systems themselves are not static either, as target species seem to change alongside methods derived to eradicate them.

"implementing active, adaptive herbicide treatment programs may be the most valuable tool for all canal managers,"

Some of the largest irrigation projects in the country lie in southern Idaho, and canal managers in the area are no stranger to these challenges. For many years, Sago pondweed, *Stuckenia pectinate*, dominated the community composition of submerged macrophytes in Snake River plain irrigation systems. Herbicides and associated application techniques over the last decade have evolved to effectively control Sago, opening a niche of available habitat and resources, which has contributed to the increased diversity of invasive aquatic plants and algae found in the canals today. The steady influx of these invaders, many requiring specific herbicides and/or variable application rates, adds a layer of variability and complexity to a canal manager's treatment program.

For example, narrow-leaf water plantain, *Alismagramineum*, was identified at Twin Falls Canal Company (TFCC), in Twin Falls, Idaho, during a pre-treatment aquatic plant survey in the spring of 2016. Native distribution of narrow-leaf plantain includes much of the Northern Hemisphere; however, it has been absent in TFCC's system until recently. As designed, TFCC's initial round of herbicide treatments (using Cascade and Teton) effectively controlled Sago and Horned pondweed, *Zannichelliapalustris*, yet much of the plantain remained viable and continued growth relatively unaffected by the treatment(s). Interest in finding a way to control the population increased as the abundance of the plant grew over several weeks. After experimental increases in Teton concentration during TFCC's second scheduled treatment, results showed control of narrow-leaf water plantain at concentrations of 2ppm and a minimum exposure rate of 6 hours - approximately 1ppm greater than applied during the initial treatment.

Just as TFCC adjusted application rates relative to species presence to achieve desired results, herbicide treatment programs, in general, must be flexible enough to hit a moving target. Although challenges in the canal management arena seem perpetual, implementing active, adaptive herbicide treatment programs may be the most valuable tool for all canal managers, not just those located along the Snake River. Cygnet Enterprises strives to provide the products and services to ensure successful plant and algae management in the dynamic aquatic environments we encounter today.

out some terminology related to how plants respond to herbicides.

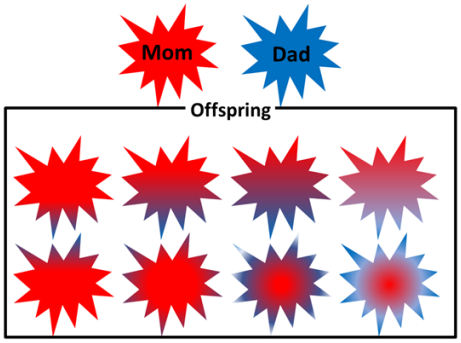
Resistance terminology

There are a number of strategies that a plant can use to prevent a herbicide from working.

When a plant naturally has one or more of these strategies to prevent a particular herbicide (let's call the herbicide "Blammo") from working, it is considered **tolerant** of Blammo. This means Blammo has never caused the plant significant damage or provided any appreciable level of control. For example, 2,4-D doesn't damage grasses – it only works on broad-leaved species with a few exceptions such as water-hyacinth. A plant that lacks these defenses – and is well-controlled by Blammo – is considered **susceptible**. So what happens when a plant that has historically been susceptible to Blammo suddenly isn't affected by it? That, my friends, is **Blammo resistance**! If you replace "a plant" with "hydrilla" and "Blammo" with "fluridone", you've described what happened in Florida in the late 1990s. Just how the heck does that happen? Through the magic of genetics, of course!

Genetic variation

All living things – plants and animals alike – use **genetic variation** to add "spice to life". Variation is important for a number of reasons, but for the purposes of our discussion, we'll focus on the fact that it gives a population the ability to adapt to changes in the environment. Genetic variation can occur from recombination or from mutation. **Recombination** happens when two organisms mate and produce offspring by sexual reproduction; these offspring get half of their genetic material from mom, and half from dad. I know what you're thinking – plants don't have sex! *Au contraire*, faithful reader, they do indeed… at least most plant species do.



Pollen (produced by dad) is used to fertilize eggs (produced by mom); these fertilized eggs become seeds, which germinate into seedlings. The genetic composition of each seedling is a mix of the genetic material from both parents, and the exact mix tends to differ among the offspring. As a result, most groups of seedlings are "hybrid swarms" – they're different from either parent and from each other. The differences may be obvious or invisible, but they all add to the genetic variation in the population. The other source of variation is **mutation**, which can be induced or spontaneous. Induced mutation happens after exposure to a mutagen – a chemical, UV light or that sort of thing – that changes the genetic material in the exposed critter or plant. Spontaneous mutation is naturally occurring and results from random errors that occur when cells are preparing to divide.

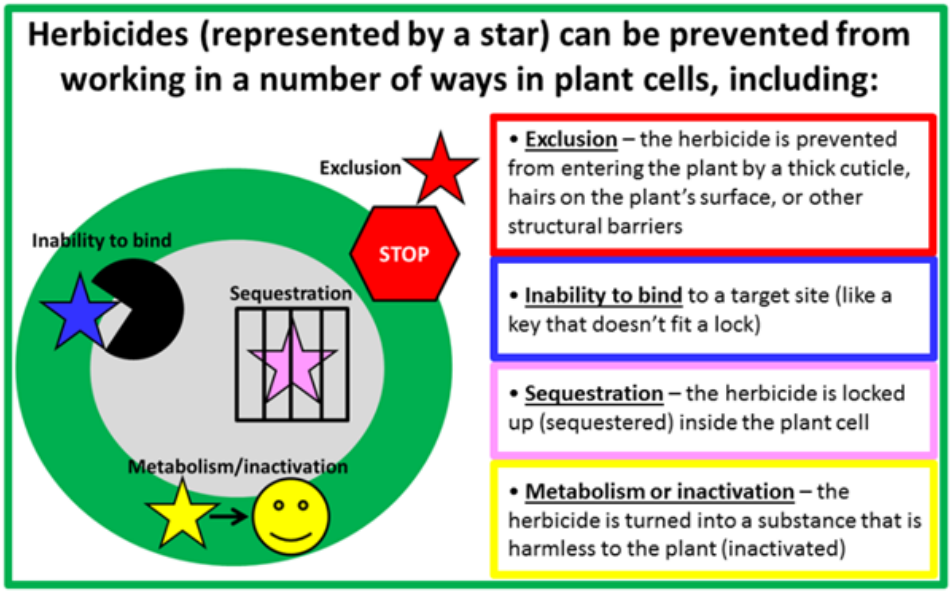
Let's pause for a brief pop quiz… which of these do you think is responsible for fluridone resistance in hydrilla?

A) recombination
B) induced mutation
C) spontaneous mutation

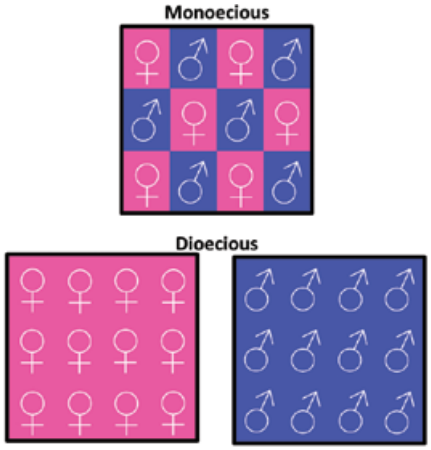
Could it be answer A? In short, no. There are two biotypes of hydrilla – monoecious and dioecious. Monoecious (from the Latin and Greek for "one house") plants have separate "male" and "female" flowers on the same plant; they're sort of like a co-ed dorm with boys and girls living under the same roof. In contrast, dioecious ("two houses") plants have only "male" or "female" flowers – think of these as single-sex frat or sorority houses with the boys and girls living apart from one another. All of the hydrilla in Florida is dioecious "female", so our hydrilla populations are composed only of sorority sisters (!!!) with no boys present. No boy hydrilla means no pollen source, which means no seed production and, therefore, no recombination.

How about answer B? Nah, fluridone is not a mutagen.

Answer C, perhaps? Why, yes… yes it is! If we look back at the explanation for ruling out answer A, we know that hydrilla doesn't make seeds – all



growth and spread results from vegetative reproduction as opposed to sexual



reproduction. Vegetative reproduction relies on cell division – known as mitosis – to make new plant material, and one of the processes that occurs before mitosis is the source of fluridone resistance in hydrilla.

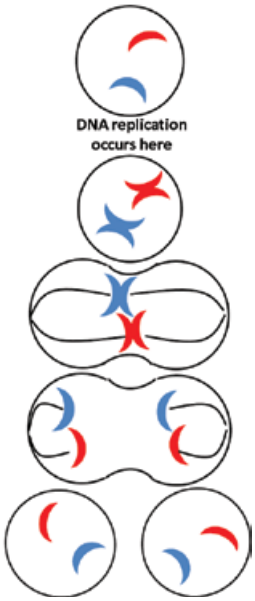
Mitosis and DNA replication

Mitosis starts with a single cell and ends with the production of two new cells that are identical to each other and to the original cell. In order for a cell to divide, all of the genetic material contained within it must be doubled; this occurs in the process of **DNA replication**. I know you've seen drawings of chromosomes in a cell, but you may not realize that each chromosome is made of densely packed and wound DNA (deoxyribonucleic acid), a double-stranded structure that contains all of the information needed for an organism to live its life. Before the cell can divide, the DNA loosens up and unwinds so it can be copied or replicated.

Unwound DNA is shaped sort of like a spiral staircase or a twisted ladder; the "side rails" are the backbone of the DNA and are made of sugars and phosphate, while the "steps" are made of pairs of bases that are held together by hydrogen bonds. Even though each DNA strand is billions of bases long, the entire length is made from only four different bases. These bases (abbreviated A, T, G and C for adenine, thymine, guanine and cytosine) bind in a very particular way – A always binds with T and C always binds with G. This is called **complementary base pairing** and is critical to DNA replication. Why, you ask? Because during DNA replication, the double-stranded structure splits – think of the steps of a ladder breaking down the center – and each strand is used as a template to build a new strand identical to the original. Look at this picture and you'll see what I mean.

So it's a perfect system, right? Well, not really. Replication happens really, really fast; it has to, because, remember, there are billions of bases in each strand of DNA and if it took a long time, life as we know it would end before replication finished. Think I'm exaggerating? Just for fun, I decided to do a little math; how long do you think it would take for a two-billion-base-long strand of DNA to replicate if it ran at a rate of one base per second? Somewhere in the range of 63 years and 5 months. Check for yourself; that's 2,000,000,000 bases at 1 second per base, divided by 60 seconds per minute, 60 minutes per hour, 24 hours per day, and 365 days per year. I did take one shortcut – I didn't factor in leap years. That's for replicating one strand of DNA before one cell division. Yikes.

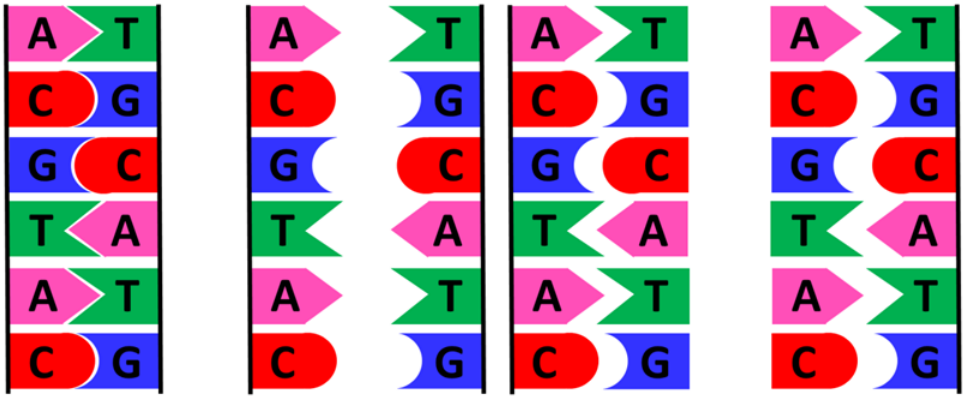
OK, so let's agree that replication happens really, really fast. Mistakes do happen, and there's a little enzyme called a polymerase that "proofreads" the strands to make sure



there's no monkey business going on – in other words, complementary base pairing works correctly so that A bases only bind with T and C bases only bind with G. The polymerase does a good job, but sometimes errors slip through. When that happens (say, an A base binds with G), the result is a cell that has a **point mutation** – a single incorrect base somewhere in the DNA sequence. This point mutation will be perpetuated in all of the cells arising from future divisions of that cell, since new DNA strands will be created using the mutated strand as a template. But what does this mean to the organism with the defective cell??? That depends on how the mutation affects gene expression.

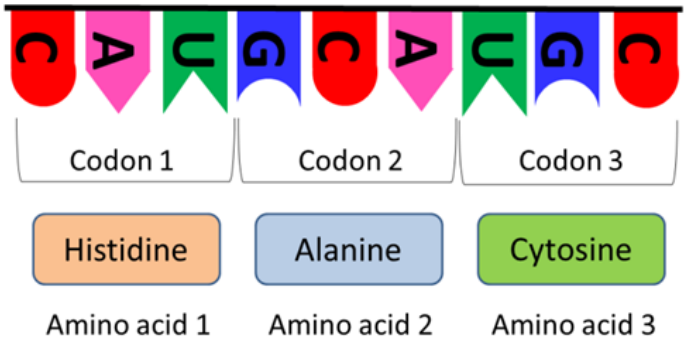
Gene expression

There's a nifty little flowchart of sorts in genetics known as the **Central Dogma** (hereafter CD), which states "DNA makes RNA, RNA makes proteins". RNA (ribonucleic acid) is very similar to DNA but uses the base uracil (abbreviated U) instead of thymine. The "DNA makes RNA" step is called **transcription** and the "RNA makes protein" step is **translation**. The CD is totally separate from DNA replication, which occurs before the CD kicks in. Think of DNA as a stone tablet that has your favorite recipe carved on it. You can't very well lug a stone tablet into the kitchen to make double-fudge brownies now, can you? No! The stone tablet has to stay perfect so your kids and grandkids and great-grandkids and so on can make the double-fudge brownies too, so you can't risk dropping the tablet, spilling stuff on it, or doing anything to damage it. You copy the recipe onto a sheet of paper – the sheet of paper is now the equivalent of RNA, which has been *transcribed* from DNA. You take the sheet of paper into the kitchen, which is already stocked with everything you need to make the brownies – the brownies are the protein, or the end product of gene expression after the RNA is *translated*.

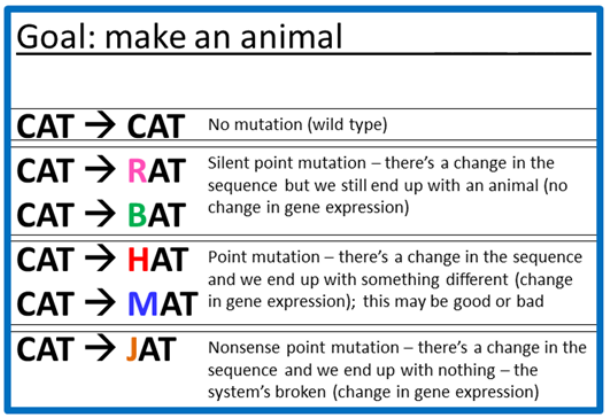


RNA isn't translated as one long strand; instead it's read in three-letter snippets called **codons**. Each codon is associated with one particular amino acid; think of amino acids as the ingredients needed to make your brownies. Translation uses a special coding dictionary that outlines which amino acid is called for by each codon. All of the amino acids called for by the codons in an RNA sequence are strung together and processed to create the final product – this is gene expression, also known as the brownies! Recall that your recipe was engraved on a stone tablet – the DNA. If the stone tablet is intact and correct, then your double-fudge brownies will be just that – double-fudge. What happens if the tablet was chipped or damaged or just plain wrong… say, like from a point mutation?!? That depends, because point mutations can affect gene expression – I mean, your brownies – in different ways.

Some point mutations are silent, meaning they have no effect on gene expression. For example, let's say the original text on your stone tablet said "Four ounces (1/2 cup) of chocolate chips", but the "Four ounces" line is damaged and unreadable. No worries, you still know that you need 1/2 cup of chocolate chips. Other point mutations are not silent, meaning they do affect gene expression. Some point mutations are detrimental and can result in a broken or useless end product; for example, if the line "Bake for 45 minutes at 425 degrees" was changed to "Bake for 45 HOURS at 425 degrees", your brownies would be, um, crunchy. Still other point mutations have effects that may be good or bad, depending on the situation. Maybe the original tablet instructions called for half a cup of coco-



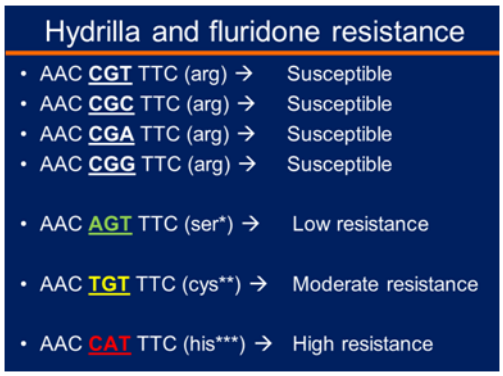
nut, but that line was changed to half a cup of peanuts. Some people might not know the difference; in that case, the point mutation is neutral. However, your friend Maybelle loves your famous double-fudge brownies and she's enjoyed them many times in the past… back before the point mutation (peanuts instead of coconut) occurred. Maybelle has a peanut allergy; see where I'm going with that? Another way to look at the potential effects of point mutations



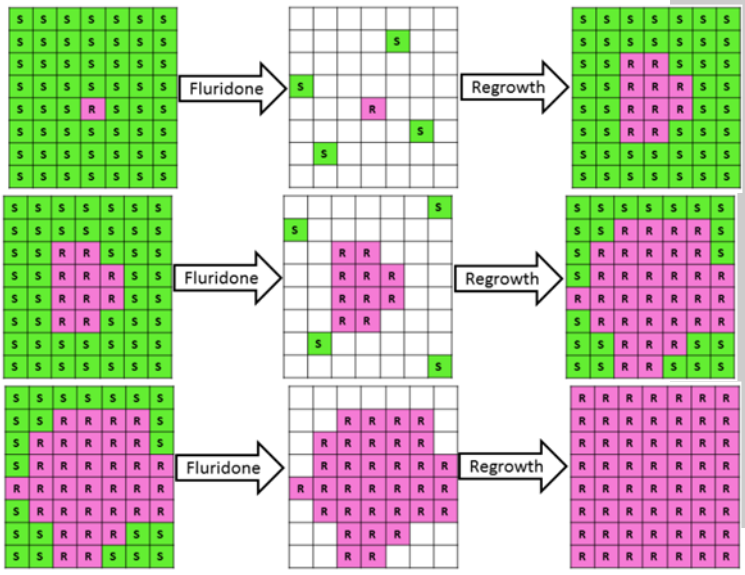
is the "Make an animal" goal outlined by yours truly at the recent FAPMS meeting – check out the graphic for a refresher.

Herbicide resistance – it's just a typo

By now, I bet you've figured out that fluridone resistance in hydrilla is the result of a point mutation. In fact, it's most similar to the "coconuts to peanuts" scenario described above. That's because the point mutation has no discernible effect most of the time; if you don't have a peanut allergy, the peanut brownies are fine, but if fluridone-resistant hydrilla is treated with something other than fluridone, it dies. There are actually four different mutations that confer different levels of fluridone resistance

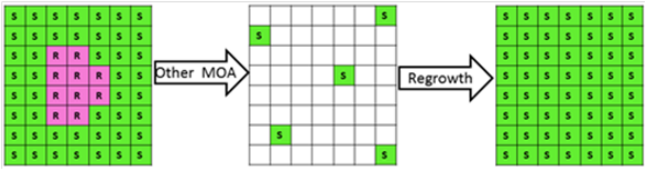


to hydrilla, and all are simple point mutations within a single codon in the *pds* gene mentioned way back at the beginning of this article. These mutations don't affect hydrilla under normal conditions, but plants with one of these point mutations (resistant types) have a distinct advantage when treated with fluridone – they survive the treatment. Susceptible plants (those without a mutation, also called "wild type") die. Although resistant types are initially very rare, over time they become the dominant type in a population that is being treated with fluridone.



What's the solution?

This one's easy – rotate modes of action!!! It's important to remember that fluridone-resistant hydrilla is resistant ONLY to fluridone – it has no defense against other herbicides. A single application of a product with a different active ingredient is often enough to knock back a population of fluridone-resistant hydrilla. It may seem wasteful to use a different – and often more pricey – product for hydrilla control if



your population is still well-managed with fluridone, but the most expensive treatment is the one that doesn't work. Relying solely on a single active ingredient is a gamble because sooner or later your population will shift to resistant types and you'll lose tools from your toolbox. Don't be that applicator – rotate!!!

Resistance happens... At first, plants with the *pds* point mutation (shown here in pink) are a rarity in a population. However, they are able to survive exposure to fluridone, so they contribute most of the regrowth after treatment. Eventually most or all of the fluridone-susceptible hydrilla is killed off and all that remains are plants with the resistant biotype. This population shift from mostly susceptible to mostly resistant means fluridone won't work anymore and you've lost an important tool from your toolbox.

Dr. Lyn Gettys (lgettys@ufl.edu) is an Assistant Professor of Agronomy at the University of Florida/IFAS Fort Lauderdale Research and Education Center.
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PRESS RELEASE

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Endothall - Get to the Root of Your Problem!

A new study classifies endothall as a systemic aquatic herbicide vs. a contact herbicide - reinforcing its status as an excellent choice for a short contact, systemic herbicide in both large- and small-scale management programs.

Endothall, the active ingredient in Aquathol® K, Aquathol® Super K, Hydrothol® 191, Hydrothol® Granular, Cascade® and Teton®, has been registered as an aquatic herbicide since 1960. It has been successfully implemented as an effective control measure for hydrilla [Hydrilla verticillata (L. f.) Royle], early-season control of Eurasian watermilfoil (Myriophyllum spicatum L.) and curlyleaf pondweed (Potamogeton crispus L.), as well as a tool for providing weed and algae control in irrigation canals.

Throughout its history, endothall has been considered a contact herbicide in aquatic systems1. While this has been the assumption for many years, recent research conducted by Dr. Scott Nissen and graduate student Mirella Ortiz at Colorado State University has revealed that there is a significant amount of endothall translocated to the roots of hydrilla and Eurasian watermilfoil. The amount of herbicide translocated to the roots of these species are equal to or greater than translocation observed for other systemic aquatic herbicides. The data is summarized in the table below.

Percentage of Total Absorbed Herbicide Present in Roots at 192 Hours After Treatment

Herbicide	Eurasion Watermilfoil	Dioecious Hydrilla	Monoecious Hydrilla
Endothall	13.0% ± 1.3	23.6% ± 2.6	29.0% ± 3.4
Fluridone	2.6% ± 0.3[2]	9.0% ± 2.2[2]	
Penoxsulam	1.3% ± 0.3[2]	6.1% ± 1.5[2]	~20%[3]
Triclopyr	2.0% ± 0.4[2]		

Significance of these data:

• Endothall can now be classified as a systemic aquatic herbicide, no longer a contact herbicide.

• There is a greater percent of endothall translocation to root tissues compared to other aquatic herbicides classified as systemic.

• The conclusions support the versatile use of endothall as a short contact, systemic herbicide in both large- and small-scale management programs.

According to Dr. Nissen,"Based on our endothall studies in flowing water, we thought that endothall must have some systemic activity, and now we have data that confirms that endothall does translocate from shoots to root tissue. In fact, the ratio of endothall in the root vs. shoot tissue after 192 hours of exposure was greater for endothall than for other systemic herbicides that we have evaluated."

We look forward to hearing additional details from Dr. Nissen and Ms. Ortiz at regional APMS meetings this year, where they will share more in-depth data on this subject.

If you have any questions about the study, or about how endothall can benefit your waterways, a UPI representative would be happy to help.

Sources:

1 Gettys, L.A., W.T. Haller, and D.G Petty (2014). Biology and Control of Aquatic Plants, A Best Management Practices Handbook: Third Edition. pp 74.

2 Vassios, J.D. (2012). Herbicide Absorption and Translocation by Eurasian watermilfoil and Hydrilla (Doctoral dissertation). Retrieved from https://dspace.library.colostate.edu/bitstream/handle/10217/67656/Vassios_colostate_0053A_10996.pdf?sequence=1

3 True Meadows, S.L. (2013). Monoecious Hydrilla Biology and Response to Selected Herbicides (Doctoral dissertation). Retrieved from https://repository.lib.ncsu.edu/bitstream/handle/1840.16/9246/etd.pdf?sequence=2

Dust Masks and OSHA® Regulations

David Petty
NDR Research

The Occupational Safety and Health Administration (OSHA) categorizes dust masks (filtering facepieces) as negative-pressure respirators, and if their use is required by product label or safety standards, must comply with all the requirements of a canister-style respirator, including fit testing.

Any company utilizing respirators must comply with the following procedures:

- A written respirator program, which covers all procedures to meet the OSHA requirements.
- A written hazard evaluation, which determines the hazards faced on the job, and the rationale behind the selection of particular respirators.
- Perform a medical evaluation and annual medical check by a physician or licensed medical professional for all employees using respirators.
- Formal annual fit testing by a qualified person utilizing OSHA-approved methodology.
- Documented record keeping of all the above, as well as training in the use, maintenance, cleaning and seal checking of respirators.
- Periodic evaluation of the procedures being used.

Fit testing for dust mask respirators is done through the qualitative methodology, where the user's ability to sense an odor or taste from an approved chemical is tested under controlled conditions. Note that the regulations require that fit testing be performed for each brand and model of mask used.

As surprising as this probably is to many people, it has been well documented in OSHA records and responses to inquiries posted online. The full regulation for the use of respirators (29CFR 1910.134 Respiratory Protection) can be found at: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=12716.

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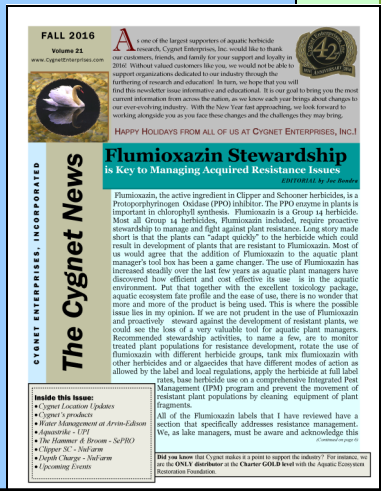
Have a study or successful project you want to share?

If the answer is Yes!!! Submit your article to your regional Cygnet manager, for review and consideration. Once it has made it through the review process it may be featured in our next newsletter. If you have any questions, please contact regional office.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As one of the largest supporters of aquatic herbicide research, Cygnet Enterprises, Inc. would like to thank our customers, friends, and family for your support and loyalty in 2016! Without valued customers like you, we would not be able to support organizations dedicated to our industry through the furthering of research and education! In turn, we hope that you will find this newsletter issue informative and educational. It is our goal to bring you the most current information from across the nation, as we know each year brings about changes to our ever-evolving industry. With the New Year fast approaching, we look forward to working alongside you as you face these changes and the challenges they may bring.

HAPPY HOLIDAYS FROM ALL OF US AT CYGNET ENTERPRISES, INC.!

CYGNET ENTERPRISES, INCORPORATED
The Cygnet News

Flumioxazin Stewardship is Key to Managing Acquired Resistance Issues

EDITORIAL by Joe Hendry

Flumioxazin, the active ingredient in Clipper and Schooner herbicides, is a Protoporphyrinogen Oxidase (PPO) inhibitor. The PPO enzyme in plants is important in chlorophyll synthesis. Flumioxazin is a Group 14 herbicide. Most all Group 14 herbicides, Flumioxazin included, require proactive stewardship to manage and fight against plant resistance. Long story made short is that the plants can "adapt quickly" to the herbicide which could result in development of plants that are resistant to Flumioxazin. Most of us would agree that the addition of Flumioxazin to the aquatic plant manager's tool box has been a game changer. The use of Flumioxazin has increased steadily over the last few years as aquatic plant managers have discovered how efficient and cost effective its use is in the aquatic environment. Put that together with the excellent toxicology package, aquatic ecosystem fate profile and the ease of use, there is no wonder that more and more of the product is being used. This is where the possible issue lies in my opinion. If we are not prudent in the use of Flumioxazin and proactively steward against the development of resistant plants, we could see the loss of a very valuable tool for aquatic plant managers. Recommended stewardship activities, to name a few, are to monitor treated plant populations for resistance development, rotate the use of flumioxazin with different herbicide groups, tank mix flumioxazin with other herbicides and or algaecides that have different modes of action as allowed by the label and local regulations, apply the herbicide at full label rates, base herbicide use on a comprehensive Integrated Post Management (IPM) program and prevent the movement of resistant plant populations by cleaning equipment of plant fragments.

All of the Flumioxazin labels that I have reviewed have a section that specifically addresses resistance management. We, as lake managers, must be aware and acknowledge this

(Continued on page 6)

Inside this issue:
- Cygnet Location Updates
- Cygnet's products
- Water Management at Arvin-Edison
- Aquastrike - UPI
- The Hammer & Broom - SePRO
- Clipper SC - NuFarm
- Depth Charge - NuFarm
- Upcoming Events

Did you know that Cygnet makes it a point to support the industry? For instance, we are the ONLY distributor at the Charter GOLD level with the Aquatic Ecosystem Restoration Foundation.

Look for our newsletter archive on our website

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Cutting Your Price Has No End

But Adding Value Has No Limits

By Perry Marshall

If you were to raise your prices 20% tomorrow and not lose any customers, what would happen to your profit margins?

If you make a ten percent profit margin now, you'd be making 25% tomorrow morning. On the other hand, if you cut your prices 20%, you'd be sending out dollar bills with every order.

Charge more and make more.

Which is a very simple way of saying that cutting your prices to win more customers is a very, very bad way to make more money. It's the fastest route to more hassles and less profit. There's always a way to charge more. And there are always people who are willing to pay more.

My dad was a minister. Which means that when I grew up there wasn't a lot of extra money laying around. If you ask my mom, she'll tell you that when I was seven or eight years old and forming my perceptions about money, our resources were pretty darn thin. Consequently I'm a pretty thrifty guy.

For me, there's a natural thrill to taking a single dollar bill and stretching seemingly impossible value from it. It's one of the things that makes me a good marketer. When the president of a company tells me that it costs him $50,000 to acquire a new customer (happened a year ago), I get a buzz. Because I know I can probably slash that cost dramatically and bring him a whole bunch more customers at the same time.

Is "cheapness" always a virtue?

But there's a downside to that thrift, too. I grew up thinking that there was great virtue in having low prices. Wal-Mart/Kmart mentality. And that's a very bad way to think when you're a marketer, because if you're not the 900 pound gorilla in a commodity market, you'll get smashed by him. One of the things that I had to learn was that being the premium priced guy in town is a good thing. Not only does it mean your profit margins are a whole lot fatter, but you also get more respect.

If you're thinking that cheapness is a virtue in your business, it's time to un-learn that misconception. Here's the real deal: Most companies ask themselves: "How low do we have to go to get customers to buy?"

But here's the real question you should ask yourself: "How do I add enough value to what I already sell so that people will pay twice as much for it?"

That's exactly what many companies including Whole Foods and California Pizza Kitchen have done. And when you're a marketing maniac like I am, your eyes and ears are open for examples everywhere you go.

Answer that question in your business and you'll be surprised at how fast your company can grow.

UPCOMING EVENTS

Cygnet Enterprises, Inc. will be attending to the following conferences, hope to see you there!

DATE	EVENT	LOCATION	CONTACT
March 13th - 16th	36th Annual WAPMS and the 70th Annual WSWS	Coeur d'Alene Resort Coeur d'Alene, ID	wapms.org
March 21st	9th Annual Applicators Symposium	Ramada Conference Center Fishkill, NY	Jo Ann (800) 275-3325
March 22nd & 23rd	North Carolina Regional Invasive Plant Council's annual meetingn	Koury Business Center Elon, North Carolina	nc-ipc.weebly.com/
April 21st & 22nd	2017 ML&SA Annual Conference	Crystal Mountain Resort Thompsonville, Michigan	mymlsa.org
July 16th - 19th	Aquatic Plant Management Society, Inc. 57th Annual Meeting	Hilton Daytona Beach Resort	apms.org
October 2017	Montana Association of Dam & Canal Systems Conference	TBD	madcs.org
Early November 2017	Washington State Weed Conference	TBD	weedconference.org

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We welcome any comments or suggestions!

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Cygnet Enterprises, Inc., has the ability to email your invoices to you rather than having a paper copy mailed to you. If you find this to be more convenient, please contact your regional Cygnet office to make the proper arrangements. We appreciate your commitment to sustaining our natural resources by going paperless!

All of the offices of Cygnet Enterprises, Inc. will be closed in 2017-2018 for the following National Holidays:

Memorial Day (May 29th)
Observance of Independence Day (July 4th)
Labor Day (September 4th)
Thanksgiving (November 23rd & 24th)
Christmas - New Years (Dec 25th - Jan 1st)

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