Welcome to Roots in Research, Yield of 2020. What a difference a year makes. COVID-19 definitely provided new challenges none of us were prepared for. We endured staffing shortages, crop inputs and supplies shortages, and equipment shortages. We faced the challenges of social distancing and travel restrictions while continuing to report to work every day in pursuit of our goal to serve the citizens of Maryland in general and the Maryland farmer in particular.

This past year brought about a greater appreciation for food security because for the first time in my life I, and many others, experienced difficulty procuring some of the essential items we are accustomed to having readily available. That experience really drove home why it is essential for us to maintain focus on those who are food insecure in our communities and to provide them with easy access to nutritious food. As you read through this newsletter you will see the great work done by the Terp Farm Project and Dining Services, with support from the College of Agriculture and Natural Resources and the College of Computer, Mathematical and Natural Sciences. All of the marketable produce grown on the Facility was sent to the Campus Pantry and other local food banks.

2020 showed the resolve of our Faculty and Staff to continue with work as usual in the face of so much uncertainty. This full and vibrant newsletter is testament to their hard work and sacrifice. I am proud of what we have accomplished and I hope you gain valuable insight from these pages.

https://agnr.umd.edu/research/research-and-education-centers-locations/cmrec/upper-marlboro

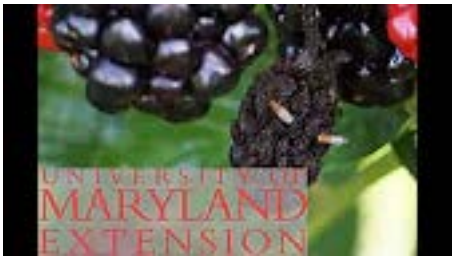
Donald Murphy, Facility Manager
dmurphy@umd.edu

In This Issue:

2020 *Virtual*
Crops Twilight Tour

With in-person meetings being cancelled due to COVID-19 restrictions, we have taken our annual twilight tour virtual! There's no tractor or hay wagon this year, but you can still learn what's been going on at the University of Maryland Research and Education Centers this past summer. Please enjoy these video presentations, and we look forward to having you

Click on each of the titles to view the videos from the 2020 Virtual Crops Twilight Tour!



Can Spotted-Wing Drosophila Vector Fruit Rot Fungi?

Developing a Perennial Living Mulch System to Manage

An IPM Approach to Controlling Harlequin Bugs in Brassica Crops

New Living Mulch and Cover Crop Combinations for Weed Suppression and Natural Enemy Enhancement

Optimizing Trellis Systems to Control Spotted Wing

Can Sequential Applications of Soil-Applied Herbicides Provide Weed Control in Pumpkin?

Marigolds, More Than Dependable Bloomers

Maryland Tobacco Seeds

Upper Marlboro CMREC continues to offer Maryland Tobacco Seeds for the growers that produce tobacco. Growers can purchase MD609 this year in pelletized form. Raw seed remains free of charge for Maryland residents and is available in MD609 and MD601. See the last page of this newsletter for the order form or click here. For more information, please call 301-627-8440

Upper Marlboro Weather Station

The webpage for the Upper Marlboro weather data is now complete! Data is now available from May 1956 to current and can be displayed by month, or by the year in a printable format. To compare weather data averages by the month or year, check out our website! If your research requires this data in a different format, please contact Elizabeth McGarry and she will help to get the information you are requesting.

CMREC Upper Marlboro F

MONTH	2021	2020	2019	2018	2017
JAN	1.75	2.64	3.69	1.23	3.12
FEB	4.36	3.50	3.79	6.29	0.45
MAR	3.26	2.61	4.18	2.50	2.81
APR	3.73	5.03	1.82	3.61	4.44
MAY	3.48	4.05	6.44	7.19	5.87

RECORD OF CLIMATOLOGICAL OBSERVATIONS AND EVAPORATION												
UPPER MARLBORO			PRINCE GEORGES MD				7:00 AM			EASTERN		
DATE	TEMPERATURE F				RAIN MELTED PRECIP INCHES	SNOW ICE HAIL INCHES	SNOW ICE ON GROUND INCHES	EVAP		WATER TEMP		REMARKS
	max	min	present					inches	reading after	max	min	

The Terp Farm Project

Allison Tjaden, Assistant Director of New Initiatives,
Department of Dining Services

2020 marked the eighth season for the Terp Farm Project, which began in 2014 as a collaboration between the Department of Dining Services and College of Agriculture and Natural Resources. The Terp Farm Project serves as a living laboratory for students interested in produce production and as an important source of local, sustainable vegetables for Dining Services. The COVID-19 public health emergency disrupted two main foci of the project: bringing students to the farm for in-person instruction and delivering vegetables to campus dining facilities in College Park.

Pepper harvest from the Terp Farm Project at the UMD Campus Pantry in 2020

Due to the campus closure in Spring 2020, the shift to virtual learning, and the Fall 2020 campus de-densification, The Terp Farm Project refocused on growing food for community members in need by providing produce to the UMD Campus Pantry, a Dining Services community engagement project.

Terp Farm Manager bagging lettuce for UMD Campus Pantry

Terp Farm Project Manager Guy Kilpatric with Campus Compact Mid-Atlantic AmeriCorp VISTA member, Nicole Ziesing and a crew of volunteers harvested and donated salad mix, Napa cabbage, turnips, peppers, garlic, carrots, radishes, sweet potatoes, and winter squash. In total, The Terp Project Farm brought the UMD Campus Pantry over five and a half tons of vegetables (11,737 pounds to be exact!) in 2020.

Kilpatric and Ziesing also worked diligently to support the Maryland community in other ways, for example packing grocery bags to be distributed to Prince George's County residents through the County's COVID Cares program.

COVID-19 brought the need for emergency food distribution to the forefront in our community. The strong collaboration between the College of Agriculture and Natural Resources' Upper Marlboro Facility and the Department of Dining Services' Terp Farm and UMD Campus Pantry Projects has positively impacted the University and helped the campus progress toward its vision of a Hunger-Free UMD.

Student volunteers (CIVICUS) at the Terp Farm Project

Sweet potato harvest on the farm and at the UMD Campus Pantry

http://terpfarm.umd.edu/

Southern Maryland Small Fruit Cultivar Trials

Alan Leslie, Extension Educator, Charles County

Blackberry Cultivar Trials

Blackberries are an attractive alternative crop for many fruit and vegetable farmers in Maryland, and present an opportunity to add diversity to pick-your-own, direct sale, or wholesale operations. In general, blackberries are well adapted to growing conditions in Maryland, but newer variety releases from state breeding programs in Arkansas and North Carolina have yet to be thoroughly tested in this state. In collaboration with the Southern Maryland Agricultural Development Commission, we established a variety trial, testing six newer varieties at the Central Maryland Research and Education Center in Upper Marlboro, MD. The blackberry varieties included in the trial are Arapaho, Freedom, Natchez, Osage, Ouachita, and Von (Fig. 1). All varieties are thornless, floricane-fruiting types, with the exception of Freedom, which is a thornless, primocane-fruiting variety. Floricane varieties produce fruit on the second-year growth of the plant, which results in earlier fruit production and typically a short fruiting period with high yields (Fig. 2). These varieties require overwintering of the first-year growth, and can be sensitive to extreme winter temperatures. Primocane varieties develop fruit on the first-year growth, and therefore typically do not mature until late summer or early fall, which can extend the harvest season. Primocane varieties do not rely on winter hardiness of first-year canes, and therefore may be more resilient to abnormally cold winters. For this trial, we retained the first-year growth of Freedom plants to measure both floricane and primocane production in a single season. However, future reports will focus on primocane production in this variety.

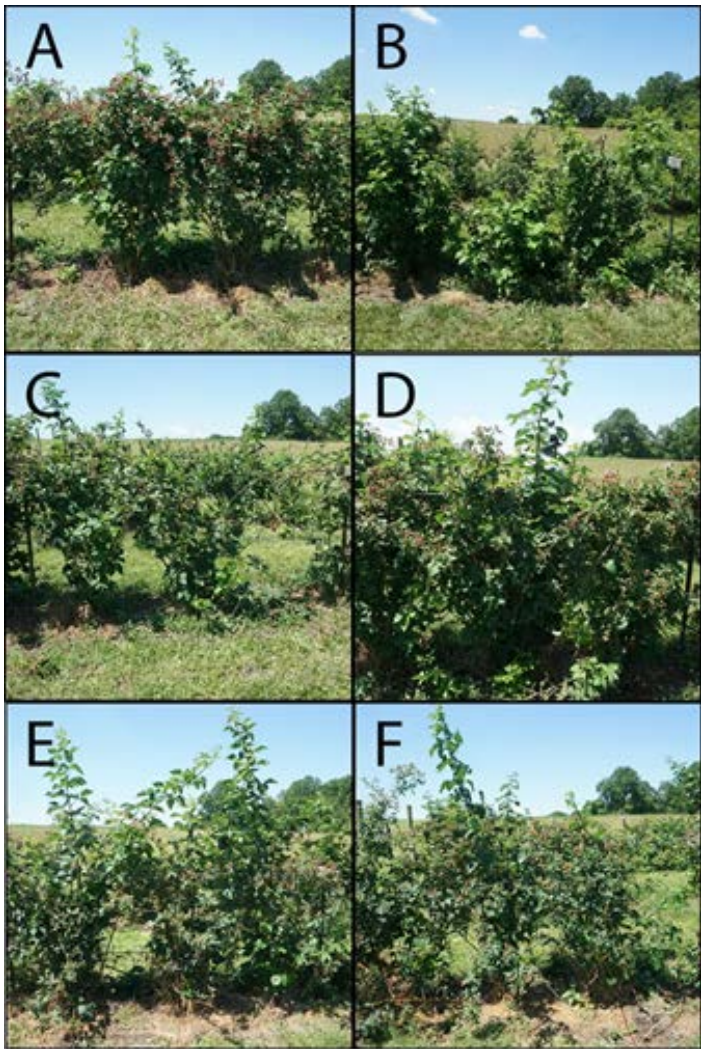


Fig. 1 *Representative plots of each blackberry variety tested: A) Arapaho, B) Freedom, C) Natchez, D) Osage, E) Ouachita, F) Von.*

The variety trial was initially established in the spring of 2018, with four replicates of each variety planted in a randomized complete block design. Each replicate contained three plants of that specific cultivar, each spaced 3 feet apart. For the initial two years, data were collected on plant vigor and survival, with 2020 being the first year that yield data were collected. Fertilizers and protective fungicides were applied according to production guide recommendations. Weeds were controlled with herbicide application in early summer and mowing between trellised rows. A single application of lambda-cyhalothrin (Warrior II) was made to suppress insect pests, but regular insecticide applications were not made through the season. Fruit loss to insect damage was substantial, and yield values are expected to be higher with better insect scouting and spraying. Therefore, this year's yield data mainly highlight differences in yield between varieties, and do not necessarily represent the actual yield potential for any individual variety. The primary insect pests observed this year were spotted wing drosophila (Drosophila suzukii), potato leafhopper (Empoasca fabae), and brown marmorated stink bug (Halyomorpha halys).

Assessments were made of the vegetative growth and relative vigor of each blackberry variety on June 26, prior to initiation of berry harvest (Table 1). Ripe berries were picked weekly between July 13 and August 10 and weighed to determine yield per replicate. Because replicates had uneven plant survival, we then divided the yield values by the number of surviving plants to present yield on a per-plant basis as well as a per-plot basis (Table 1). A subsample of harvested berries were counted and weighed separately to determine average berry size. Yield totals for the entire season are summarized in Table 1, with Arapaho, Von, and Osage producing the highest yield on a per-plant basis during the harvest period. However, differences between varieties were not statistically significant, because of high variation in yield within each variety. Figure 3 shows differences in timing of fruit production, with Osage peaking earliest in the season (Jul 20), followed by Arapaho and Von the following week (Jul 27). Ouachita had a less pronounced peak, and had similar yields through two weeks of harvest (Jul 20 - Jul 27). Figure 4 shows the mean berry size by variety. Arapaho produced the highest yield and the largest berries, while Von and Osage, which produced the second and third highest yields, had the smallest berries on average. These data represent the first year of observations on yield for these varieties in Maryland, and multiple years of data will be required to draw any generalizations about the performance of these cultivars under growing conditions in this state. However, early observations indicate that varieties Osage and Von are good candidates for commercial production in Maryland. Arapaho had the highest per-plant production, but had the second lowest survival through establishment. One other interesting note was the overall poor performance of Natchez, with the lowest survival (66.7%) and the lowest per-plant yield among floricane varieties. Previous trials at CMREC have had good success with this variety, and the poor performance may be related to site differences or problems with nursery stock. Future work will repeat measurements of yield and berry size, and will include measures of berry quality and flavor parameters for each variety. The overall goal is to provide objective assessment of the quality of these different blackberry varieties for the Maryland farmer.

Fig. 2 *Floricane fruiting blackberry.*

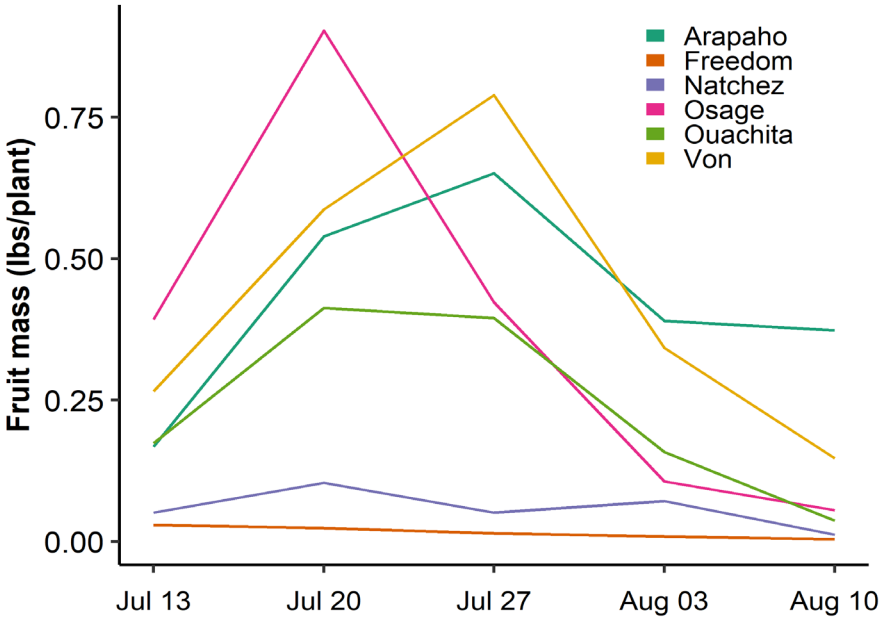


Fig. 3 *Mean yield per plant through the five weeks of harvest during summer 2020.*

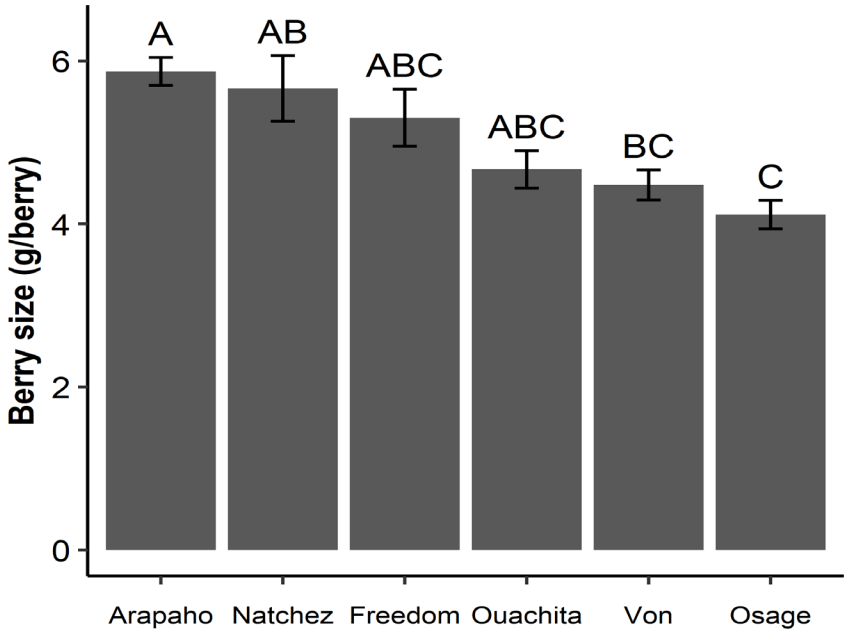


Fig. 4 *Average berry size for each blackberry variety tested. Bars represent standard error of the mean. Different letters indicate significant differences ($P < 0.05$)*

Variety	Survival (%)	Floricane (ft)	Primocane (#)	Vigor (scale 1-5)	Yield (lbs/plant)	Yield (lbs/plot)
Arapaho	75.0	4.25	1.7	2.9	2.88	6.39
Freedom	75.0	1.75	4.1	1.5	0.08	0.22
Natchez	66.7	3.12	1.2	1.3	0.29	0.53
Osage	100	6.50	4.2	4.4	1.88	5.65
Ouachita	91.7	4.75	3.4	3.1	1.18	3.38
Von	100	4.13	3.9	2.8	2.13	6.40

***Table 1**. Mean plant survival and yield on a per-plant basis for the six blackberry varieties tested. Note that Freedom is primarily a primocane-fruiting variety, so the main harvest will be later in the season*

Blueberry Cultivar Trials

A blueberry trial was established in the fall of 2018, building upon findings form a previous study of rabbit eye and southern highbush varieties. These new cultivars are better adapted to the hotter environment and soil types encountered in Southern Maryland. Some varieties will offer an extended harvest season for fresh market sales. Variety selections for this trial focused on berries with potential for good fresh market sales appeal as well as soil adaptation. Varieties under evaluation include Ozark Blue, Onslow, Legacy, Oneal, Ochlockonee, Overtime, Calypso, and Top Shelf (Fig. 5).

The planting was established in a in a complete randomized block design with four replicates. Each plot consisted of four plants spaced 42 inches apart in row. Rows were 10 feet apart. Soil was modified to a pH of 4.8 prior to planting. After planting, the rows were covered with 2 inches of well-composted mulch. Fertilizers and protective fungicides were applied according to production guide recommendations. Weeds were controlled with herbicide application in early summer and mowing between crop rows. Irrigation was applied through drip tape applied along the row. Berries were removed in the first and second leaf (spring of 2019 and 2020). Data were collected on plant survival, cane length and plant vigor. A summary of 2020 observations are presented in Table 2. A partial first harvest is anticipated during the third leaf in the summer of 2021.

Variety	Survival (%)	Cane Length (in)	Vigor (scale 1-10)
Calypso	93.8	21.5	4.0
Legacy	81.3	22.5	4.3
Ochlockonee	100	25.5	6.0
Oneal	81.3	24.2	4.0
Onslow	75.0	19.8	3.8
Overtime	100	30.5	6.0
Ozark Blue	6.3	12.0	2.0
Top Shelf	100	19.8	4.8

***Table 2**. Vegetative characteristics of eight blueberry varieties.*

Primocane Raspberry Ripening Period

Cultivars Caroline and Josephine are being evaluated under different pruning programs to alter ripening periods (Fig. 6). The study will attempt to manipulate fruit ripening time to avoid damage form spotted wing drosophila (SWD). The trial was established in the spring of 2018 and consisted of 4 replications in a randomized complete block design. Each plot contained four plants planted 24 inches apart. For the initial two years, data were collected on plant vigor and survival. Fertilizers and protective fungicides were applied according to production guide recommendations. Weeds were controlled with herbicide application in early summer and mowing between trellised rows. A single application of lambda-cyhalothrin (Warrior II) was made to suppress insect pests, but regular insecticide applications were not made through the season. Once the planting is well established, different pruning timings and heights will be evaluated to alter fruit maturity and the incidence of SWD. In 2020 observations, SWD was found during the last week of June in ripe floricane raspberry fruit of both cultivars (Fig. 7). 100% of plants survived into the third year. Caroline was slightly more vigorous and had better density than Josephine (Table 3)

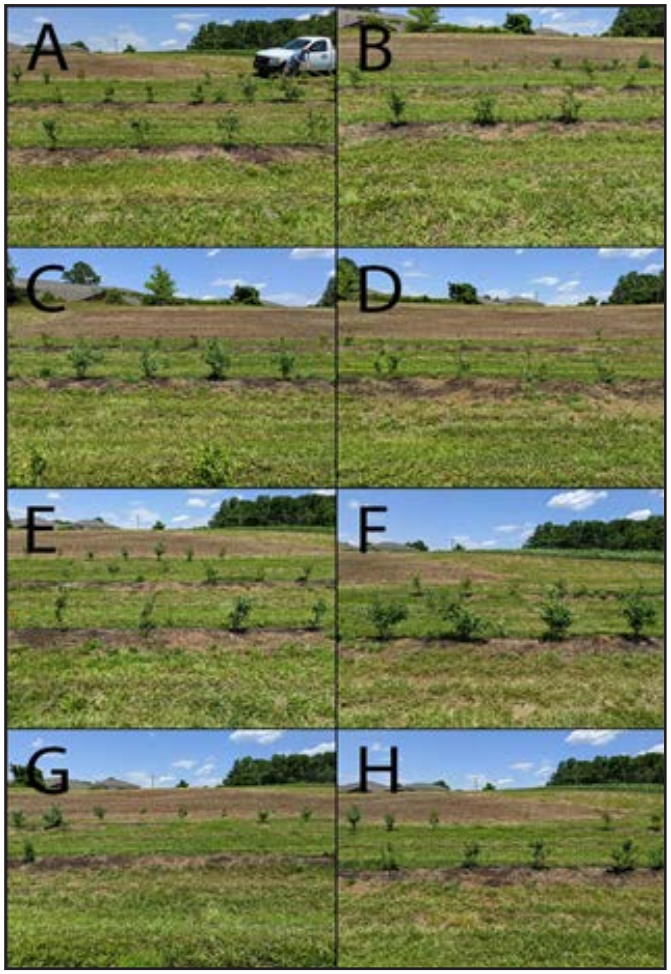


Fig. 5 *Representative blueberry plants: A) Calypso, B) Legacy, C) Ochlockonee, D) Oneal, E) Onslow, F) Overtime, G) Ozark Blue, H) Top Shelf.*

Fig. 7 *Spotted wing drosophila larva in raspberry fruit.*

Variety	Density		Vigor	
	high	low	high	med
Caroline	4	0	3	1
Josephine	2	2	1	3

Table 3*. Ratings for vegetative growth characteristics of raspberry varieties.*

Fig. 6 *Representative plants of raspberry varieties tested: A) Josephine, B) Caroline.*

Survey of Dragonflies and Damselflies in Agroecosystems and Their Role as Biocontrol Agents

Margaret E. Hartman, M.S. Student
William Lamp, Professor Department of Entomology - University of Maryland
College of Computer, Mathematical, and Natural Sciences

Natural enemies used as biological control agents in agroecosystems can greatly reduce pest populations at little cost to the farmer, and are therefore an important consideration for sustainable farm management practices. The insect order Odonata which includes dragonflies and damselflies (here referred to collectively as dragonflies) is one such example of a potential biocontrol agent. Though the presence of dragonflies in agroecosystems is apparent, given their bright coloration and often large size, they are understudied as viable biological control agents. Adult and larval dragonflies are generalist and opportunistic insectivorous predators. Diet analyses consistently show true flies (Order: Diptera) as primary prey, but they are known to eat a wide range of insects.

Understanding dragonflies in the context of biological control is especially important for the Maryland farmer due to the rich community of dragonflies found in the state. Of the 462 species of dragonflies and damselflies found in North America, 182 are found in Maryland. In fact, the states of Virginia, New York, New Jersey, Maryland and Pennsylvania are among the top eight most speciose in the United States. However, there is no known research examining the community composition of dragonflies on farms.

The following study was designed to analyze the abundance and richness of dragonfly species across selected crop and non-crop habitats on several Maryland farms. To address this objective, visual encounter surveys (VES) were conducted at four University of Maryland farms in central and western Maryland and include the Western Maryland Research and Education Center in Keedysville (KV), and three Central Maryland Research and Education Center locations at Beltsville (BV), Clarksville (CV), and Upper Marlboro (UM). Thirty-minute timed VES were conducted in two or three crops at each farm. Additionally, two farms were surveyed for non-crop, breeding habitat in the form of on-farm lentic water bodies. Twice a month from mid May 2021 through September 2021, 30-minute VES were conducted at Upper Marlboro in soy, corn and a retention pond (Fig. 1) twice a day. Each VES field was approximately 60 m x 60 m. During the VES, the number of novel dragonfly and damselfly encounters were recorded and identified to species.

"This material is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, through the Northeast Sustainable Agriculture Research and Education program under subaward number GNE21-257."

Dragonflies associated with Maryland agroecosytems

Of the 26 species of dragonflies and damselflies found at all four farms surveyed, 22 have been recorded at the Upper Marlboro farm across all crop and non-crop habitats during the 2021 growing season (Table 1; Fig. 2). Average daily abundance at Upper Marlboro (36 ± 49) was significantly greater than at Keedysville (0.4 ± 0.6), Beltsville (6 ± 5), and Clarksville (7 ± 9) ($p < 0.001$).

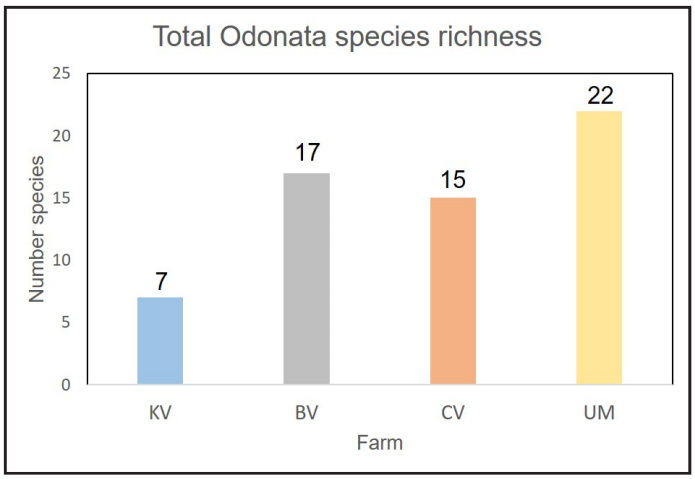
The five most abundant species at Upper Marlboro were in the family Libellulidae and included the common whitetail (*Plathemis lydia*), widow skimmer (*Libellula luctuosa*), blue dasher (*Pachydiplax longipennis*), Eastern pondhawk (*Erythemis simplicicollis*), and Eastern amberwing (*Perithemis tenera*). The habitat preferences of the most abundantly surveyed species are similar. They are common, cosmopolitan species found in all counties in Maryland and they are associated with slow-moving, lentic water bodies (Maryland Biodiversity Project 2021). VES conducted at Pond 1 showed higher daily abundance (84 ± 85) compared to crop fields

(20 ± 11). During the most abundant 30-minute VES of the season, a total of 219 dragonflies across 8 species were recorded at Pond 1. Three of the four farms surveyed had on-farm water bodies, and at Clarksville and Upper Marlboro the ponds were used functionally for water retention and irrigation. The farm with the lowest daily abundance (0.4 ± 0.6) and species richness (7) was Keedysville, which has no on-farm water bodies.

◀ **Fig. 1.** Aerial map of CMREC Upper Marlboro farm. Odonata visual encounter survey (VES) sites of soy and corn are highlighted in orange and two on-farm water retention ponds are highlighted in blue and labeled. Odonate VES were conducted at Pond 1 (Google Earth 2021).

Species	**Common name**	**KV**	**BV**	**CV**	**UM**
Plathemis lydia	common whitetail	*	*	*	*
Libelluia auripennis	golden-winged skimmer				*
Libelluia incesta	slaty skimmer		*		
Libelluia cyanea	spangled skimmer		*		*
Libelluia luctuosa	widow skimmer		*	*	*
Libelluia pulchella	twelve-spotted skimmer		*	*	
Libelluia vibrans	great blue skimmer		*	*	*
Libelluia semifasciata	painted skimmer		*	*	*
Perithemis tenera	eastern amberwings		*		*
Pantala flavescens	wandering glider	*	*	*	*
Pachydiplax longipennis	blue dasher		*	*	*
Erythemis simplicicollis	Eastern pondhawk		*	*	*
Tramea lacerata	black saddlebags	*	*	*	*
Tramea onusta	red saddlebags	*	*	*	*
Celithemis eponina	Halloween pennant		*	*	*
Epitheca cynosura	common baskettail	*		*	*
Anax junius	common green darner	*	*	*	*
Epiaeschna heros	swamp darner		*		*
Gomphus exills	lancet clubtail				*
Gomphurus vastus	cobra clubtail	*			
Ischnura hastata	citrine forktail				*
Calopteryx maculata	ebony jewelwing	*		*	*
Ischnura posita	fragile forktail				*
Ischnura verticalis	Eastern forktail				*
Enallagma exsulans	stream bluet				*
Enallagma civile	familiar bluet		*	*	

◀ Table 1. The species of dragonflies and damselflies surveyed at four University of Maryland farms from May through September 2021. The farm codes are Keedysville (KV), Beltsville (BV), Clarksville (CV) and Upper Marlboro (UM).



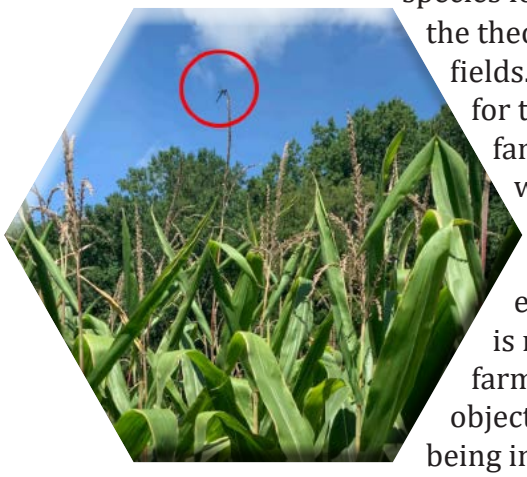
▲**Fig. 2.** The total species richness of dragonflies and damselflies surveyed from May through September 2021 at four University of Maryland farms. The farm codes are Keedysville (KV), Beltsville (BV), Clarksville (CV) and Upper Marlboro (UM).

Conservation biological control using dragonflies

Dragonflies are not used in classical biological control for various reason, one being that they are highly mobile and most species can easily disperse beyond the farm to find better foraging and breeding habitats. However, preliminary findings suggest active breeding populations on the farm may increase abundance and species richness of dragonflies in upland crop habitats. Implementing management practices for conservational biological control of dragonflies, wherein farmers encourage populations on the farm by creating and maintaining favorable habitat, is one strategy to increase dragonfly predation in your crops. Varied structural complexity in the agricultural landscape that includes both high perches and bare ground is also an important consideration for encouraging dragonfly predation. Dragonflies often use tall perches, such as corn stalks or sticky trap posts, while foraging (Fig. 3).

Fig. 3. Dragonflies are observed perching during foraging. Above, black saddlebags (*Tramea lacerata*) is perching on a sticky trap post and a great blue skimmer (*Libellula vibrans*) is seen perching high atop corn on the bottom(Photos by Muinot Anamashaun).

One possible explanation for the increased prevalence of dragonflies at Upper Marlboro is the presence of two well established ponds (Fig. 1) which provide dragonflies with ample breeding habitat. The most abundant species surveyed in crops, except for the migrant species the wandering glider (*Pantala flavescens*), were almost the only species found at Pond 1, which supports the theory that the on-farm water bodies are supplying dragonflies to the crop fields. Water retention ponds on farms are ubiquitous but often understudied for their ecosystem services. Upper Marlboro has two man-made, on-farm ponds ranging from 40 to 70 years old. Pond 1 is fed by overland water flow, whereas Pond 2 is stream fed. Both ponds are important water retention for later irrigation when conditions are dry. Pond 1 may be especially appealing to dragonflies because of the natural embankments with emergent vegetation (Fig. 4). Further research is needed to determine the exact drivers of dragonfly prevalence on farms, with an emphasis on aquatic habitat suitability factors. Our second objective, to analyze dragonfly diet using molecular techniques, is currently being investigated and results are forthcoming.



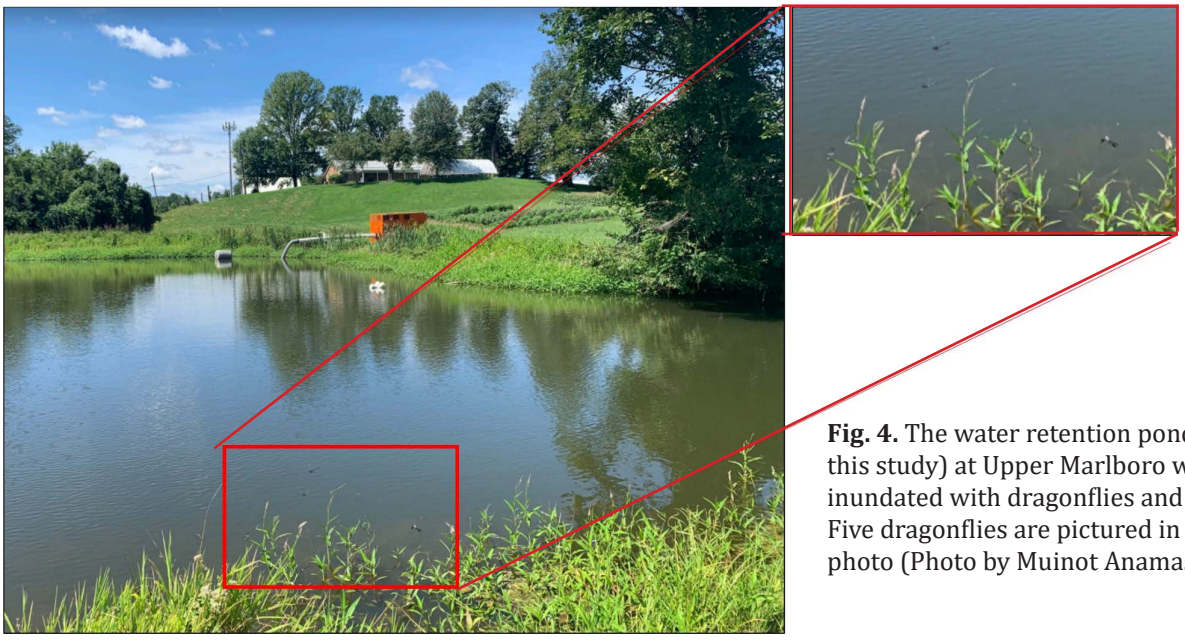


Fig. 4. The water retention pond (Pond 1 in this study) at Upper Marlboro was frequently inundated with dragonflies and damselflies. Five dragonflies are pictured in the inset photo (Photo by Muinot Anamashaun).

Genetics of Host Preference of *Chloridea (Heliothis) Virescens* and *Chloridea (Heliothis) Subflexa*

Rong Guo, Ph.D. student
Department of Entomology, University of Maryland, College Park

1. Introduction

Chemical signalling is one of the most ancient systems of communication between sexes in species with sexual reproduction. In Lepidoptera, communication and mating through pheromones is an olfactory-dependent behavior, where females emit the chemical signals and males receive them. The current paradigm is that this type of chemical communication is only used to signal species boundaries, to help males find females of their species in the environment. Under conditions where pheromones are primarily used by males to identify conspecific females in Lepidoptera, this signaling system should be under strong stabilizing selection. Yet studies of female pheromone production are inconsistent with this paradigm, and suggest there is significant variation in sex pheromones within and between populations. How do males respond to such variation? It is possible that there is corresponding variation in the pheromone receptors of males. Moreover, host plant preference plays a role in speciation, and host plant odors have been shown to synergize with pheromone blends to increase male responsiveness. Therefore, I aim to quantify the extent of nucleotide sequence variation in the pheromone receptor genes of male Lepidoptera and test the hypothesis that some of this polymorphism may be associated with male responses to females calling from different host plants.

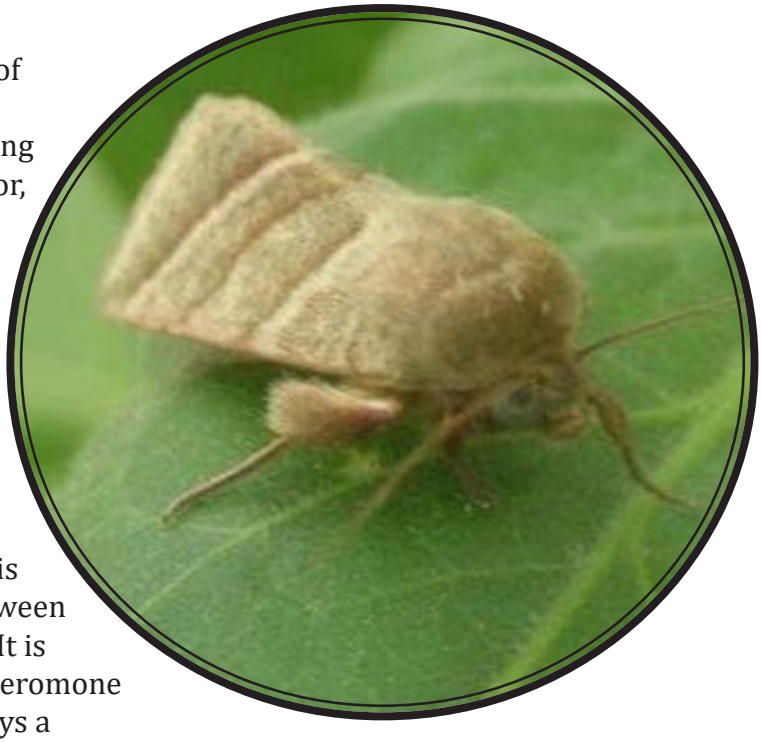


Fig. 1 *An adult male Chloridea virescens.*

Fig. 2 *An adult Chloridea subflexa (credit to John LeBlanc)*

To test this hypothesis, my research uses two closely-related Lepidopteran species, *Chloridea virescens* (previously *Heliothis virescens*, Figure 1) and *Chloridea subflexa* (previously *Heliothis subflexa*, Figure 2). The two moth species occur sympatrically throughout North and South America, but have divergent pheromone communication systems and host plant preferences. *C. virescens*, also known as tobacco budworm, is an important pest in many crops in the United States. *C. subflexa* is a specialist, however, only feeding on a few species of plants in the genus *Physalis*. I will examine genetic variation at the pheromone receptors in *C. virescens* and *C. subflexa* wild males trapped in preferred and non-preferred host plants, to test whether the polymorphism is associated with host plants.

2. Methods

Previous studies, including our own, suggest that tobacco is a preferred host plant of *C. virescens*. Yet *C. virescens* is also capable of ovipositing upon and developing on *Physalis*, a preferred host of close relative, *C. subflexa*. To verify this, we established pheromone-baited traps in both crops and quantified the numbers of *C. virescens* males trapped in each. Plots of tobacco and tomatillo were planted at 3 research farms around the state of Maryland: CMREC Beltsville and Upper Marlboro, and WMREC Keedysville. Tomatillos were planted on black plastic bags, 2 rows in each plot with 2 feet between plants. Tobacco was planted on bare ground, 6 rows and 8 rows respectively, with 40 inches between rows and 2 feet between plants.

Scentry® 31" Heliothis traps with a removable top chamber were installed at each farm, and were mounted ca. 1-1.5 ft. above a tobacco or tomatillo plant 25 ft into the plot (Figure 3). Scentry® tobacco budworm lures were secured at the bottom of each trap. A control trap to assess trap catch in the absence of host plants was set ca. 1-1.5 ft. above grass in each farm only in 2021. Trap heights were adjusted as plants grew to maintain the distance of trap openings from plant foliage. The lures were exchanged every 2 weeks during the 8-week field collection period. Traps were checked twice per week and the numbers of adults collected in each trap were counted, recorded and returned to the lab for preservation and identification.

Fig. 3 *Pheromone-baited trap for Chloridea species set up in tomatillo at Upper Marlboro farm.*

Species were identified morphologically and molecularly. *Helicoverpa zea* can be separated from *Chloridea* morphologically. *C. virescens* and *C. subflexa* were identified according to nucleotide sequence differences in a conserved nuclear gene, *elongation factor -1α* (EF-1*α*). Primers were designed to amplify a small region of EF-1α, and *C. virescens* and *C. subflexa* can be distinguished from each other by 5 interspecific nucleotide variants. While the goal of our work was to specifically analyze the distribution of *C. virescens* across traps in different crops, as well as differences in nucleotide sequences at their pheromone receptor genes, we were surprised to find that our traps caught both *C. virescens* and *C. subflexa*. Therefore, a subset of both *Chloridea* species collected from tobacco and tomatillo traps (n = 30), as well as a few *C. subflexa* collected from tomatillo plots (n=10) were sent for whole genome sequencing (WGS). The WGS data will be analyzed to quantify the extent of polymorphism in pheromone receptors and determine its association with host plants. I am interested in comparing the pheromone receptor sequences and expressed isoforms of *C. virescens* trapped from tobacco with those trapped from tomatillo, as well as the pheromone receptor sequences and expressed isoforms of *C. subflexa* trapped from tomatillo.

3. Preliminary results

In total, 22 and 57 *Chloridea* were collected in year 2020 and 2021, respectively (Figure 4). In detail, only 3 *C. subflexa* were trapped in 2021, all from tomatillo. We did not collect any *C. subflexa* from the Upper Marlboro farm, and only 1 was trapped in the Beltsville farm in 2021. Most *C. virescens* (44 of 54) were trapped from the Upper Marlboro farm, and most (31 of 54) were from tobacco in 2021. A Chi-squared test was made to test if the trapped males of each species were equally distributed among crops. For each year, our results showed

modest biases in the distribution of trapped males of each *Chloridea* species among crops, but the differences were not significant at an □-level of 0.05 ($\square^2_{2020}$= 3.1145, p-value $_{2020}$ = 0.0776; $\square^2_{2021}$= 4.3542, p-value $_{2021}$ = 0.1134).

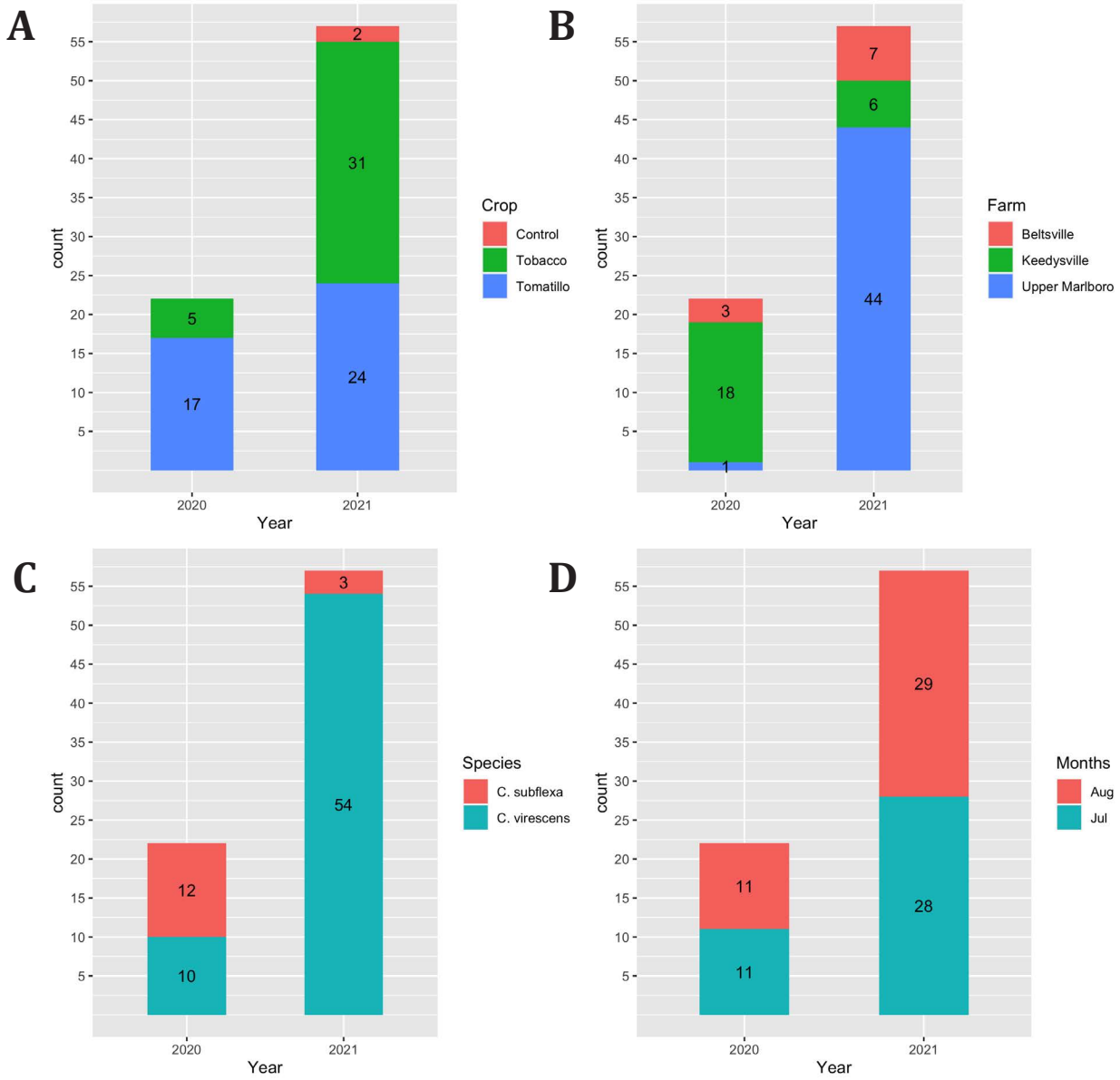


Fig. 4 *The number of trapped Chloridea males by (A) crop, (B) farm, (C) species, and (D) month.*

4. Future directions

The future plan is to analyze the WGS data obtained from trapped moths. In detail, the well-studied pheromone receptors (eg. OR6 and OR14-16) will be identified, and the genetic variation and its association with host plants will be examined. We can infer whether the receptors are under strong or slight selection, and are potential to have dual functions (eg. plant odors detection) in evolution. In addition, I will compare the pheromone receptor sequences and expressed isoforms of *C. virescens* and *C. subflexa* with the WGS data. Our prediction is that the pheromone receptor sequences and expressed isoforms of *C. virescens* trapped in tobacco are different from those trapped in tomatillo, and may be more similar to the pheromone receptor sequences of *C. subflexa*.

Effects of Planting Population on Yield in Full Season Soybeans

Final Report to the Maryland Soybean Board

Kelly Nichols, Willie Lantz, Jeff Semler, Bryan Butler, and Alan Leslie, University of Maryland Extension

Introduction

Soybean population plots were planted on four University Research and Education Centers (REC) and on one farm in Carroll County. Planted populations were 80, 100, 120, 140, and 160 thousand plants per acre. At the Wye REC, an additional population of 50 thousand plants per acre was added. Table 1 provides planting, data collection, and harvesting information for each site.

Location	Planting Date	Row Spacing	Final Stand Count Date	Harvest Date	Number of Replications
Beltsville REC	May 29	15 inches	October 9	November 10	4
Carroll County Farm	May 14	7.5 inches	September 22	September 23	2
Upper Marlboro CMREC	April 22	20 inches	September 14	October 8	4
Western Maryland REC (WMREC, Keedysville)	May 5	30 inches	October 21	November 18	4
Wye REC (Queenstown)	May 20	15 inches	October 15	November 20	4

Table 1 Site locations for 2020 Soybean Population Research Project.

Results

Final Stand Count

Stand counts were taken prior to harvest; this number of plants present in the field at harvest time was converted to a percent of the planted population. The average percent of planted plants at harvest across all populations was 56% (Wye), 63% (Upper Marlboro), 70% (Carroll), 75% (WMREC), and 86% (Beltsville). Some of these numbers were a bit lower than expected, and most likely due to wet spots, weeds, and variety performance. Even though some sites had a low survival rate, this did not correlate to a lower yield. Within each site, stand counts were fairly consistent across the planted populations (Figure 1). Planted population was not significant; one population did not lose more plants compared to another planted population.

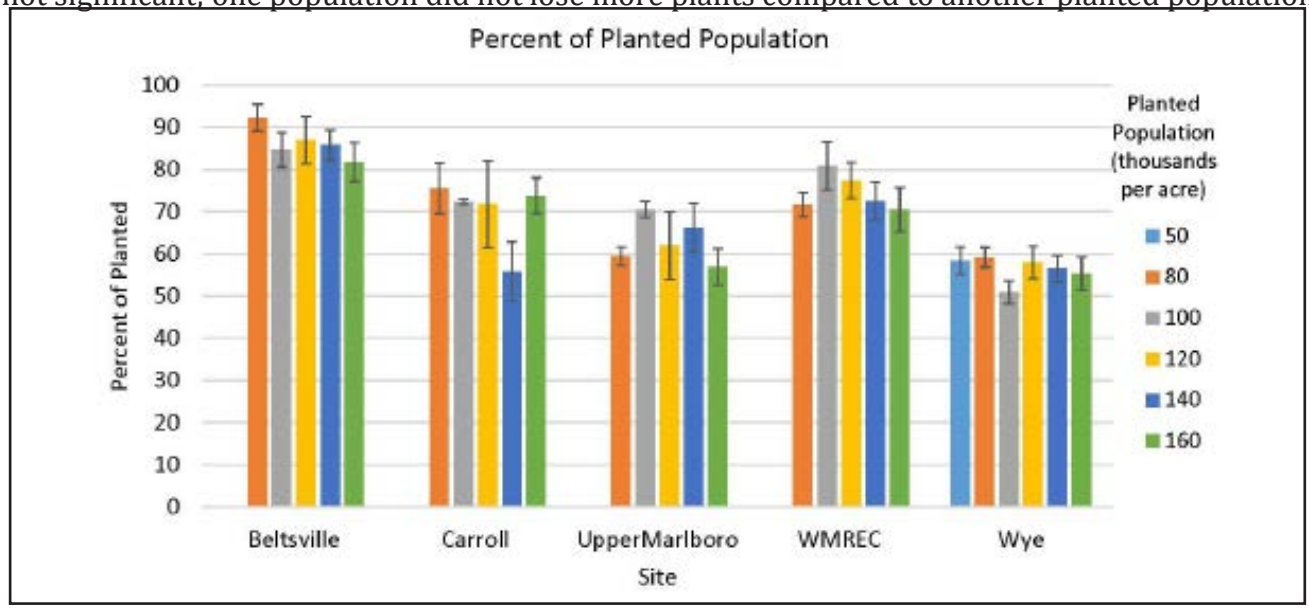


Figure 1. Stand count prior to harvest as a percent of the planted population.

Yield

The following yield ranges were seen at each of the sites: 59-63 bu/A (Beltsville), 52-56 bu/A (Carroll), 65-68 bu/A (Upper Marlboro), 67-71 bu/A (WMREC), and 66-80 bu/A (Wye). Figure 2 shows the yield at 13.5% moisture for each site. Yield was not statistically significant between planted populations, indicating that for these sites, a lower population could have been planted and yield could have been maintained.

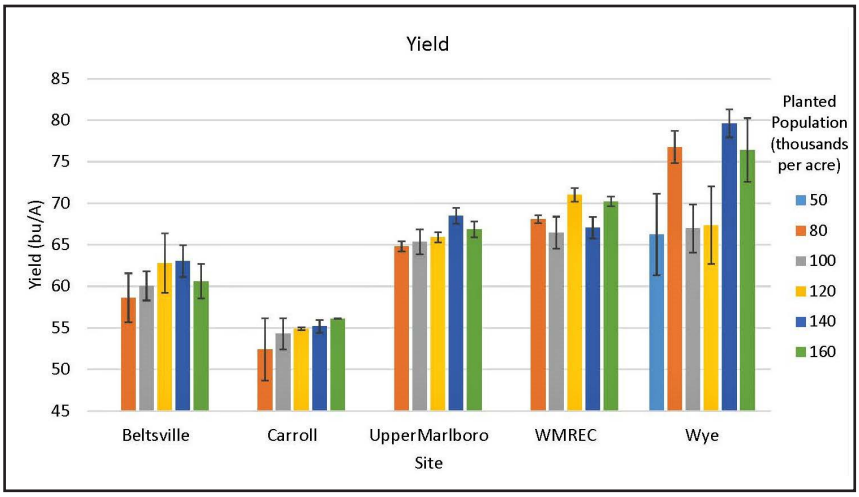


Figure 2. Yield at 13.5% moisture.

Net Amount Per Acre

The gross amount per acre was calculated by multiplying the soybean price per bushel by the number of bushels per acre harvested. The net dollar amount was then calculated by subtracting the seed cost from the gross amount. Seed prices are the price before any discounts would be applied, and varied by site (Table 2). At the time of harvest, soybeans were an average of $11.17/bu on the Chicago Board of Trade. At four out of the five sites, the highest net per acre was at a lower population than the lowest net per acre (Table 3). The highest net per acre was at the planted populations of 80,000 (Wye), 100,000 (Carroll), 120,000 (Beltsville and WMREC), and 140,000 (Upper Marlboro). The lowest net per acre varied across the five sites.

Site	Seed Cost (per 140,000 seeds)	Variety	Price on Chicago Board of Trade at Harvest ($/bu)
Beltsville	$75	Pioneer P31A95BX	11.17
Carroll	$69	Pioneer P33A24X	
Upper Marlboro	$82	Pioneer P25A82L	
WMREC	$69	Pioneer P39T73E	
Wye	$101	Pioneer P31A95BX	

Table 2. Seed cost and variety at each site.

Net Amount ($/A)					
Planted Population (in thousand plants per acre)	Beltsville	Carroll	Upper Marlboro	WMREC	Wye
50	- -	- -	- -	- -	704.26
80	611.71	546.19	674.82	720.95	800.03
100	616.27	557.25	669.17	693.06	676.74
120	637.51	553.78	662.94	734.20	667.03
140	629.05	547.41	680.43	679.96	789.02
160	589.74	548.01	649.92	705.16	738.36

Table 3. Net amount per acre. Numbers in green indicate the highest net per acre at each site; numbers in red indicate the lowest net per acre at each site.

Summary

Yield results indicate that optimum yield can still be achieved at lower populations. Based on this research, the planted population at the five sites in 2020, as well as two sites from 2019, could have dropped their populations down between 80,000 and 140,000 plants per acre, and still maintain optimum yield as well as an acceptable net amount per acre.

Drinking Wells, Water Quality and Septic Systems

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University of Maryland Extension now hosts monthly ***Wednesday Water Webinars*** on various water quality related topics. Join Andy as he dives into water topics that affect us all. These webinars take place via Zoom from 12 - 12:40 PM, allowing time for Q & A at the end. Click on a title below to register, or if the date has past, the link will take you to the recording of that webinar, or check out our website for past recordings and more!

8/19/20 - Groundwater Stewardship This webinar will discuss basics of groundwater, influence of geology, the hydrologic cycle, groundwater flow, connectivity to surface waters, types of aquifers, groundwater quality and stewardship practices to protect this valuable resource.

9/16/20 - You Are What You Drink / Testing Your Well Water The importance of water as a key nutrient for human health and the varied water sources (public and private wells) and their quality will be presented. Additionally a summary of recommended water testing practices will be shared.

10/7/20 - Drinking Water Treatment Does your water need to be treated? If so, this webinar will explain common water problems, the options of filters and filtration systems, their operation and maintenance to ensure you have safe and good quality water for drinking.This covers considerations, options and specific plants & practices to use.

11/18/20 - My New Home Has A Septic System / What Do I Do Now? Have you been used to public sewer in previous homes and now you wonder what a septic system is? A summary of septic system function and types will be presented. Key maintenance practices to keep the system operating effectively, prolong it life while protecting human and environmental health will be shared. To view the video in spanish, click here.

12/9/20 - Salty Roads / Salty Drinking Water? The connection of road salts for deicing and its impact on ground and surface water quality will be presented. In addition to potential increased water corrosion and the impact to home appliances, there are several important potential water quality related health risks including elevated sodium, heavy metals and radionuclides caused by road salts.

1/20/21 - Landscaping a Septic System? Whether it be a sand mound drainfield or the maintenance access ports to a septic tank or BAT unit, homeowners often wish they could camouflage these to make their yards more aesthetically pleasing. This covers considerations, options and specific plants & practices to use.

2/17/21 - All This Rain / Does It Harm My Septic System? This webinar will present basic hydraulic capacity and design flow of a septic system and how excessive surface water may negatively affect the efficiency of the system and potential harm to the system and environment.

3/17/21 - Pond Management Basics The basics of pond ecology and water quality will be presented while providing pond owners an understanding of the pond ecosystem and practices to help maintain water quality. Also covered are strategies for managing ponds for varied uses, e.g. fishing, swimming, and irrigation.

4/21/21 - Water Gardens and Management Water gardens can be an enjoyable feature of homes, providing a relaxing area with water sounds, fish and varied colored plants and flowers. Caring for theserequires new gardening skills and understanding of water quality to maintain the pond and minimize both required inputs and issues. This webinar will present the basics of managing a water garden.

5/19/21 - Upgrading to Best Available Technology (BAT) Septic System Advanced nitrogen reduction technologies provide significant improvements in onsite wastewater treatment compared to a traditional septic tank. This webinar will present how the systems work, operation and their care, and will describe Maryland's Bay Restoration Fund grant program supporting upgrading to the technology.

6/16/21 - Water Contaminants of Emerging Concern (CEC's) The growth in production and use of industrial chemicals and personal care products has resulted in these contaminants reaching surface and ground waters. Many of these compounds either have been shown to cause environmental damage or are detrimental to human health. This webinar will present an overview of many classifications of CEC's including organic waste compounds, endocrine disruptors, personal care products and PFAS.

7/21/21 - Prolonging the Life of Your Septic System A septic system may be the most expensive technology or appliance of a home. Providing proper care and maintenance can help protect your investment, prolong the system life, while reducing risks to public and environmental health. This webinar will present an overview of recommended maintenance practices to empower homeowner to protect their system and help save money.

About the UMD Bee Lab

https://www.umdbeelab.com/

The Honey Bee Lab at the University of Maryland has diverse personnel with multidisciplinary scientific backgrounds. Research in the laboratory is focused on an epidemiological approach to honey bee health.

We are proud to share our research into the major mechanisms that are responsible for reoccurring high loss levels in honey bee populations, such as pests and pathogens associated with honey bees, loss of natural forage habitat due to large monocultural croplands, and pressure from human induced changes in the environment.
We are also major partner and founding member of the Bee Informed Partnership (BIP) who collaborates closely with beekeepers from across the country to study and better understand the loss in honey bee colonies in the United States.

Creating a Model Community for Stormwater Management
Asbury-Solomons Retirement Community

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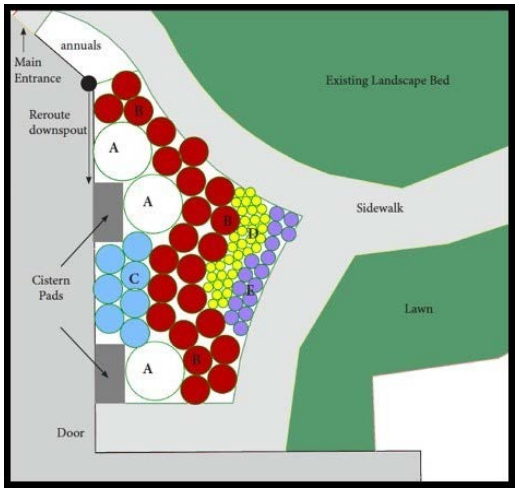
https://extension.umd.edu/programs/environment-natural-resources/program-areas/watershed-protection-and-restoration-program

Asbury Solomons Retirement community is a 42-acre tract of land on the banks of the Patuxent River in Calvert County. The property houses 228 apartments, 72 cottages, 24 Assisted Living Suites and 48 skilled nursing beds for some 600 plus residents. Built before the updated Environmental Site Design (ESD) standards, Asbury is a network of storm drains and underground conveyance that directs untreated stormwater to the Patuxent River.

In 2018, in an effort to be more of an environmental steward for the Patuxent River and make the residents aware of their impact on the local environment and waterway, Asbury's Go Green Team, in consultation with UME faculty, contracted Jennifer Vaccaro of Living Landscape Solutions to produce a Master Stormwater Plan for their campus community. The resulting plan identified several opportunities (10 conservation landscapes, 74 cisterns, 42 rain gardens; 1 level spreader system) to treat over 130,000 sq.ft. of impervious surface on their campus.

Asbury Solomons Master Stormwater Plan



◀ Design and final installation of conservation landscape and rainwater harvesting project.

In 2020, with assistance from Extension, Asbury Solomons successfully acquired grant funding ($5,000) to implement their first project, a 484sq.ft. conservation landscaping and rainwater harvesting project. The final project included the planting of 85 native perennials and shrubs, along with installation of 2,265-gallon cisterns. It also prevents 0.2 lbs of nitrogen, 0.02 lbs of phosphorous and 50 lbs of sediments from getting into the Patuxent River annually.

Since the completion of the Master Stormwater Plan, Extension faculty have been ground-truthing and inventorying various areas for suitability for future project sites and funding opportunities.

▲Conducting a perk test to determine infiltration rates of site.

Extension faculty conducted 2 virtual workshops and 2 rain barrel workshops for the local public in conjunction with this project.

The Asbury Solmons community allowed the newly formed Calvert County Watershed Steward Academy (WSA) to complete their class project on the campus. The steward candidates met with residents to determine stormwater areas of concern. Many noted that after rain events, water would stand on the certain areas of the walking/biking path for several days forcing residents to "off-road".
The final site chosen for the WSA class project was not on the original Stormwater Master Plan, but was identified as a "water" hazard by the residents.

The solution to the issue was the installation of 150 sqft rain garden with a planting plan that included a mix of native plants that can tolerate the various areas of moisture levels (dry to wet) within the rain garden.

Water hazard on sidewalk ▶

◀ Stewards prepared the site, amended the soil to allow for infiltration and planted the garden with 7 different varieties of native perennials that will add to the aesthetics of the area.

As a result of this project, water no longer lays on the ▶ sideway during or after rain events. The rain garden also prevents 0.06lbs of nitrogen, 0.006lbs of phosphorous and 14.5lbs of sediments from getting into the Patuxent River annually.

Extension faculty are looking forward to working with the Asbury – Solomons residents in the future to implement more practices on their campus. Our goal is to have the community serve as a model for other communities for stormwater management within Southern Maryland.

Long Term Phosphorus Remediation and Phytoremediation of High P Soils with Fiber Hemp Cultivation

Louis Thorne - Faculty Assistant, Department of Plant Science and Landscape Architecture
Dr. Nicole Fiorellino - Assistant Professor and Extension Specialist, Agronomy, Department of Plant Science and Landscape Architecture

For decades, the poultry industry has been supplying poultry litter to local producers to use as a low-cost fertilizer source. While there are benefits to using organic fertilizer sources, the imbalance of nitrogen and phosphorus in the litter, combined decades of application to soils has generated agricultural fields with high soil P concentrations. Excess P in soil is at risk of loss through runoff or leaching pathways to nearby surface water, which could lead to decreased water quality in these bodies. In response, statewide regulations have been implemented to minimize risk of nutrient loss, including limiting the application of nutrients to soils with high concentrations. While these regulations aid in preventing nutrient loss, they do not provide solutions to growers who are restricted from nutrient application until soil concentrations decrease.

Current solutions include continuous cropping to drawdown soil nutrient concentrations through crop removal at harvest, termed phytoremediation. Local research has shown it could take decades of phytoremediation with typical crop rotations for soil P concentrations to reach levels where growers can resume fertilizer application (Fiorellino et al. 2017). Continuation of this research is aimed at investigating the phytoremediation potential of novel, alternative crops. With the introduction of the 2018 US Farm Bill, industrial hemp (Cannabis sativa L.) is now recognized as an agricultural commodity and can be legally cultivated and sold in the United States. This versatile crop is commonly grown to harvest floral material for phytochemical extraction or to harvest fiber and grain. The production of a tall plant with large amounts of above- and below-ground biomass led researchers to believe it may have new implications in the fight against high P soils. Additionally, hemp has been used as a phytoremediator of other nutrients in the soil, including toxic heavy metals.

A long-term P draw-down study that was established in 1994 at three Research and Education Centers (Central Maryland Research and Education Center – Upper Marlboro, Wye Research and Education Center, and Lower Eastern Shore Research and Education Center – Poplar Hill) in Maryland has been monitoring the drawdown of soil P concentrations, measured in biennial soil samples analyzed for Mehlich-3 P, collected from small plots managed under typical grain and forage cropping systems. At each location, replicated plots with five different soil P concentrations (from ~50 to >300 mg kg-1 Mehlich-3 P) were created to evaluate drawdown of P at different initial concentrations. Although this study has mostly compared more conventional cropping systems, hemp for fiber production has recently been included in the rotation to evaluate its remediation potential. Currently, we only have preliminary data that indicates hemp removes greater P than corn in these paired plots. We look to continue this comparative evaluation upon the receipt of additional funding. If continuous cropping is the most practical solution to reduce agricultural soils high in P, this begs the question of whether there are alternative cropping systems with an increased ability to drawdown soil P while providing growers with a profitable crop for production.

Managing Striped and Spotted Cucumber Beetles in Cantaloupe with Living Mulches

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Cerruti R.R. Hooks, Associate Professor
College of Computer, Mathematical and Natural Sciences
Department of Entomology

Introduction

One of the most challenging aspects of cantaloupe agriculture is effectively managing the pests that infest them. Aphids, whiteflies, and spotted and striped cucumber beetles all have the capacity to spread serious diseases which threaten the livelihoods of cantaloupe growers. Striped cucumber beetles (Fig 1) are generally considered to be the most serious cantaloupe pest due to their ability to transmit bacterial wilt, a highly contagious disease that can lead to total yield losses. Because of this, systemic applications of neonicotinoids followed by frequent foliar applications pyrethroids are often necessary to keep striped cucumber beetle populations below the average density of one-per-plant that many extension offices suggest as the critical threshold for a knockdown spray.

Fig. 1 Striped Cucumber beetle. Photo credit: Katja Schulz, creative commons.

Such frequent and aggressive chemical control comes with its own drawbacks of course, ranging from their great economic costs to their disruptive impacts on non-target arthropods. These can further contribute to loss of pollinators and other beneficial insects, as well as promote future outbreaks of other pests. Because of these concerns, in cantaloupe and other similarly vulnerable cucurbit crops, there is interest in developing alternative practices for managing pests.

Research Objectives

The goal of this ongoing project at the University of Maryland's Central Maryland Research and Education Center (CMREC) is to investigate the viability of interplanting cantaloupe with different living mulch species for controlling cantaloupe pests. The term "living mulch" simply refers to a cover crop that is left alive throughout the cash crop's lifecycle. This research is partly informed by past work that showed similar companion planting strategies can reduce pest pressure in other cucurbit plots. This includes past work done by former Hooks' lab member Hanna Khal, who also did much of her work at CMREC. Her work showed that the presence of red clover increased the presence of beneficial arthropods while reducing cucumber beetle and aphid populations, all without imposing a penalty on cucumber yield.

This study is meant to see if similar results can be replicated in cantaloupe due to the similarities of its lifecycle and pest complex with cucumber, as well as to compare two structurally distinct living mulches for their different effects.

Experimental Protocol

For this study, alsike clover and Virginia wildrye were chosen as the living mulch species. They were selected because they are both perennial, cool-season cover crops that are lightly competitive and could be established in the field the fall prior to planting the cantaloupe (Fig 2). This allowed them to become well

Fig 2. Experimental plots planted with living mulches before cantaloupe planting. Photo credit: Demian Nunez

established before they would need to compete with weeds. It was also believed that during the cantaloupe's growth phase in the summer they would be less likely to harm yield through competition for resources. Choosing a clover species made sense, given the past success of clover for similar purposes in other studies. A perennial bunch grass was also chosen because of past research that suggested that ground beetles and wolf spiders (a particularly important cucumber beetle predator) thrive in bunch grasses. They are also known to provide excellent overwintering habitat for such species.

Fig 3. A yellow garden spider residing in a Virginia wildrye plot. Photo Credit: Demian Nunez

A variety of sampling techniques are being used in this ongoing study to evaluate the impact of the living mulches on the arthropods assemblages in the cantaloupe plots. Yellow sticky cards are being used for monitoring arial pests and natural enemies while pitfall traps are used for monitoring arthropods that move along the ground, including many generalist predators such as ground beetles and wolf spiders. Both of these traps were deployed both in the cantaloupe rows (intra-rows) and in the living mulch rows (inter-rows). Direct visual counts allow us to directly observe what is residing on the surface of the plants, and also allows for more frequent observations and the observation of certain arthropods that might not be detected using the other methods, such as web-spinning spiders (Fig. 3). Lastly, emergence cages are used to monitor the overwintering community in the living mulch. All sampling during the field season began about two weeks after cantaloupe planting, with sticky cards and pitfall traps being deployed for a week for a total of three sampling periods across the summer spaced two weeks apart. Foliar counts on the other hand were repeated every subsequent week up until cantaloupe were harvested.

Results So Far

The study is still ongoing so the data is still being analyzed and interpreted and the results aren't final. During the 2020 field season there was in general very low arthropod abundances across the board, including for major pest species, regardless of treatment. Treatment effects tended to be modest, but there were measurable differences for some of the important groups of insects being monitored. On average, foliar detections of aphids were higher throughout much of the field season though the differences didn't meet the standard for statistical significance. Differences in the captures of flying aphids on sticky cards were similarly modest, and though there were statistical differences on the last sampling date on August 27. There were fewer aphids detected in the cantaloupe rows within the Virginia wildrye treatment than the clover or control

treatments. Within the cover crop rows on the other hand, the clover had the most aphid detections, followed by control, and then the wildrye, with each treatment being statistically distinct from the others.
There was a modest treatment impact on striped cucumber beetle detections via foliar counts as well. Though this was mostly due to much lower striped cucumber beetle detections on August 12, and the other sampling dates remained statistically similar. On the sticky cards, striped cucumber beetles were consistently detected less frequently in the cantaloupe rows of both the clover and ryegrass treatments, with the biggest difference being between the control and the ryegrass.

Regarding natural enemies, the results are similarly modest. On most of the days where observations took place there were more spiders in the clover treatment than the ryegrass and control treatments, though the difference was only statistically significant on August 5th and 27th. There was a statistically significant treatment effect on parasitoid detections in the cantaloupe rows, with parasitoid detections being consistently the highest in the clover treatment, then the rye treatments, and lowest in the control plots, though despite this the differences still didn't meet the standard of statistical significance.

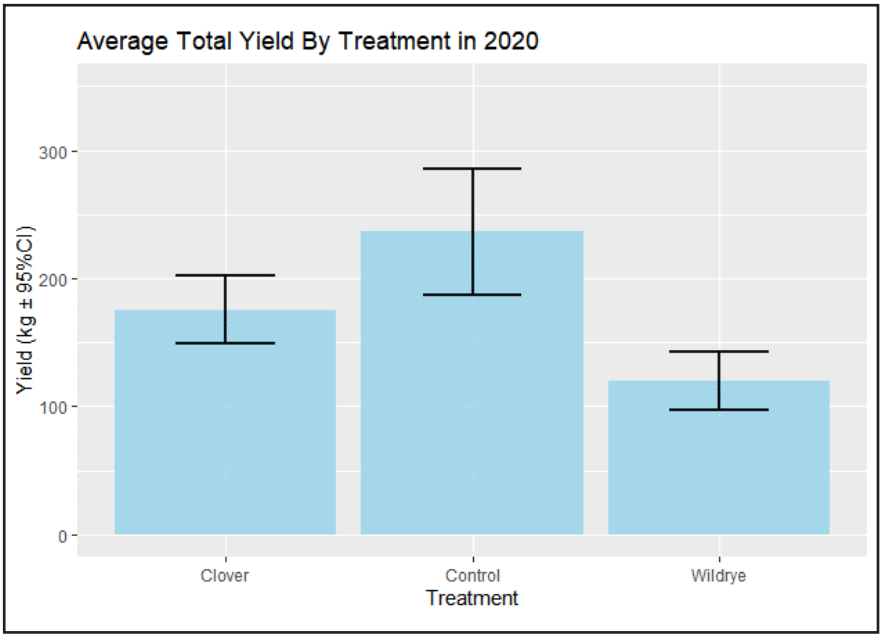

Fig 4. Average cantaloupe yield by treatment

The lack of dramatic differences in insect detections between plots could potentially be explained by a number of unknown factors. Perhaps in a year where insect populations weren't so low there would be more notable differences. However, to growers the most important thing to know would be the effect on yield. Unfortunately yield reductions were observed, with yield in the ryegrass plots being greatly reduced relative to the control, and the clover plots being intermediate between them (Fig 4.). Changes in the methodology are being investigated to ameliorate yield losses in the next stage of this project.

Plectosporium Blight Management in Pumpkins

Jerry Brust, IPM Vegetable Specialist

https://extension.umd.edu/programs/agriculture-food-systems/program-areas/fruit-vegetable-production/maryland-vegetables

By mid-August I usually see pumpkin fields infected with powdery mildew pretty commonly throughout the mid-Atlantic. And while powdery mildew can still be found in many pumpkin fields it is not as bad as in previous years. The one disease I am seeing a great deal more of throughout the region is plectosporium blight. This fungal disease of pumpkin, zucchini and squash can cause yield loss if left uncontrolled. Plectosporium blight, caused by the fungus *Plectosporium tabacinum* prefers warm, humid or rainy weather conditions. It overwinters on crop residue and can persist in the soil for several years.

Fig. 1 Plectosporium yellow-tan spots (lesions) on pumpkin leaf

Early in disease development plectosporium blight can be recognized from the small white to light tan spots on leaves (fig. 1) and elongated lesions on stems and leaf petioles (fig. 2). On green fruit the lesions are very small white to tan flecks (fig. 3) on more mature fruit the lesions are round to irregular shaped pimples on the surface of the pumpkin that often makes them unmarketable (fig. 3). These fruit lesions also allow soft rot pathogens to penetrate into the pumpkin that will cause the fruit to 'melt-down' into a deflated mess. When stem and foliar lesions occur in large numbers they can give a light gray or white appearance to the foliage. As the lesions increase in numbers and merge they turn the vines and leaf petioles white, with severely infected stems becoming brittle resulting in split or shattered stems (fig. 2). Even pumpkins that look good at harvest but are infected with the *Plectosporium* fungus can develop secondary infections and rotting stems (handles) after the pumpkins are cut from the vine and sitting on someone's porch (fig. 4).

Fig. 2 Plectosporium on pumpkin leaf petioles- the petiole to the right has split.

Fig. 3 Plectosporium lesions on small green fruit and on more mature orange fruit

In the past when plectosporium blight occurred, rotating away from summer squash and pumpkins for 2 years was often enough to reduce problems with this disease. But with more frequent heavy downpours this disease has become more difficult to manage. The general recommendations have been to scout pumpkin fields for the first signs of the disease and apply fungicides. Thorough coverage of foliage, vines, and fruit is necessary for good control. Studies have shown that most of the time a protective spray of chlorothalonil or mancozeb will give good protection from plectosporium blight, however when there is excessively wet weather this particular spray program has not been enough. This trial demonstrated that additional protective sprays are needed. These sprays consisted of using the fungicides Cabrio or Flint Extra or Pristine in rotation with the protectants, which resulted in very good control of plectosporium blight compared with the standard control program of using only the protectants.

Fig. 4 Pumpkins showing infection weeks after being harvested

Ecological Innovation For Making Equitable, Sustainable and Climate-Friendly Urban Spaces

Dr. Dave Tilley, Associate Professor, Environmental Science and Technology, University of Maryland

My research at CMREC is focused on developing novel ecological technologies that incorporate plants into the built environment to make urban spaces, home patios, and public spaces, like bus stops, more comfortable and useful for people and better for the environment. We are especially interested in protecting people from the excess heat that is found in cities. Plants are one of the main ways to cool cities. At CMREC we are focused on identifying species of vines that will grow well on our living umbrellas and green shelters, which we patented through UMD. We look for vines that are easy to culture, produce a lot of leaf material, are showy, durable, possibly edible, non-invasive and appealing to people. In addition we are also testing small "smart" solar powered irrigation systems that can be integrated into the living umbrellas and green shelters to make it easier for people to take care of their plants and to improve the use of water resources.

Our newest technology, the Cool Green Shelter for Bus Stops (see image), is focused on protecting waiting bus riders, capturing carbon, managing and reusing stormwater, reducing urban heat, providing solar electricity for charging personal digital devices and collecting environmental data. The aim is to demonstrate how more bus stops can have shelters by providing more amenities and an alternative business model for their implementation and operation. Stay-tuned to see where the Green Shelters pop up around Maryland.

Problems With Pollination in High Tunnel Tomatoes

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https://extension.umd.edu/programs/agriculture-food-systems/program-areas/fruit-vegetable-production/maryland-vegetables

During this past year I have received reports from high tunnel (HT) growers that were seeing flower abscission due to poor pollination in their tomatoes (fig. 1). There are unfortunately several factors that can cause poor pollination in tomatoes.

I'll start with a quick recap as to how tomato flowers are pollinated and fertilized. Tomatoes are self-pollinated at the rate of around 96% of the time. Tomato flowers are complete flowers that have both male (stamen) and female (pistil) parts within the same flower. The yellow anthers (produce pollen) of the stamen wrap around the pistil which is in the center of the flower. The style with the stigma on its end is the part of the pistil that extends above the anthers. Tomato pollen is heavy and sticky and needs to be jostled loose from the male to fall onto the female. This 'jostling' can include wind or insect visits. Once pollen is shed onto the stigma of the flower fertilization can take place. Without pollination the pedicle turns yellow, the flower dies and then drops. Tomato flowers must be pollinated within 50 hours of forming or they will abort. Pollination usually occurs between 10 a.m. and 4 p.m.

Fig. 1 Complete flower loss on tomato cluster.

One of the most important factors affecting pollination is temperature. Tomato plants will drop their flowers when daytime temperatures are above 88°-90°F or when nighttime temperatures are above 70°F. These temperatures occurred in our HTs this past summer. However, in the early part of the season low nighttime temperatures below 55°F can interfere with the growth of pollen tubes or cause the pollen to become sterile, preventing normal fertilization and causing flower drop. Fruit will not set until nighttime temperatures are above 55°F for at least two consecutive nights.

Besides temperature, the other big problem causing poor pollination in high tunnels is poor flower vibration or 'jostling'. Because tomatoes are in high tunnels they may not always be exposed to winds that will help 'jostle' the tomato flower, which releases pollen. Some other mechanism is needed at times to vibrate tomato flowers to increase pollination. The final size and weight of fruit is largely determined by the number of seeds set, which is ultimately due to the quality of pollination and fertilization. A HT tomato plant should produce between 20-30 lbs of fruit/plant, if it is not then poor pollination may be the cause. My HTs produced around 18 lbs/plant and I conducted some trials to try and increase my pollination success using an air-blower that was passed over the plants every few days for just a few seconds after they started forming flowers. My per

Fig. 2 Bumblebee visiting tomato flower results in pollination.

Fig. 3 Top flower not visited by bumblebees; bottom flower was a few times.

plant yields went from 18 lbs to 28 lbs and I was able to increase my marketable yield by 35-50% just by increasing pollination and fertilization in my tomato plants.

You do not have to use an air-blower to achieve better pollination and fruit set, most growers use bumblebees, which use sonication or buzz pollination. The bees will fly up to a flower and grasp the anthers with their mouth parts and hold tightly. They then vibrate their wing muscles which causes pollen to drop from the anthers onto the stigma causing pollination and at the same time the bumblebee gets to collect some of the pollen (fig. 2). This grasping of the tomato flower by the bee leaves a mark on the flower (fig. 3) and can be used by growers to see if bumble bees are visiting their tomato flowers. Studies have shown that just 1-2 visits by bumblebees to tomato flowers will result in greater than 80% fruit set vs no visits which result in approximately 30% fruit set.

The bottom line is that tomato pollination is a delicate balance between the correct temperatures and having enough flower vibration to ensure good pollen drop. If you are getting only 15-16 lbs/plant or less in your HT tomatoes you may want to examine how well your plants are being pollinated and just what your fruit set is like.

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Maryland Tobacco Seed Order Form

For 2020

MD 609 is available this year in pelletized form

Raw Seed Only:
Raw seed remains free of charge for Maryland residents and is available in the following varieties:
MD609 and MD601

Growers can purchase seed by completing the form below and mailing it with payment to:

University of Maryland CMREC
Upper Marlboro Facility
2005 Largo Road
Upper Marlboro, MD 20774

Please pay by check made payable to:
University of Maryland

Seed will be mailed to you by the postal service or UPS, so please provide a valid address that can accept packages.

For more information, please call 301-627-8440.

Primed pelletized MD609 seed - $18.00 per bottle of 10,000 seeds

Number of bottles needed _____(10,000 seeds per bottle)

__X $18.00__(Price per bottle in 2020)

Total amount enclosed $_____

Shipping Information:

Name:_____

Street or PO Box:_____

Town, State, Zip:_____

Phone Number:_____