



# ROOTS IN RESEARCH



**Yield of 2022**

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2022 will definitely be a year to remember. Abundant rainfall and great growing conditions produced some of the highest crop yields we have ever had. Even more importantly, this past year marked the end of a career for two of our employees and the beginning of a new chapter for another. Bill Eversfield and Ronnie Wood both worked their last day for the University in 2022 and we thank them for their years of service. We were fortunate enough to hire back Michael Perise to fill the position vacated by Bill. You can read about Michael on page 3. Michael's passion for the crops that we grow is undeniable and he will help lead us into an even brighter future. As always, our Faculty, Staff, and students have worked tirelessly to bring this important information to you. Please enjoy this latest edition of Roots in Research while hopefully gaining some very useful knowledge.

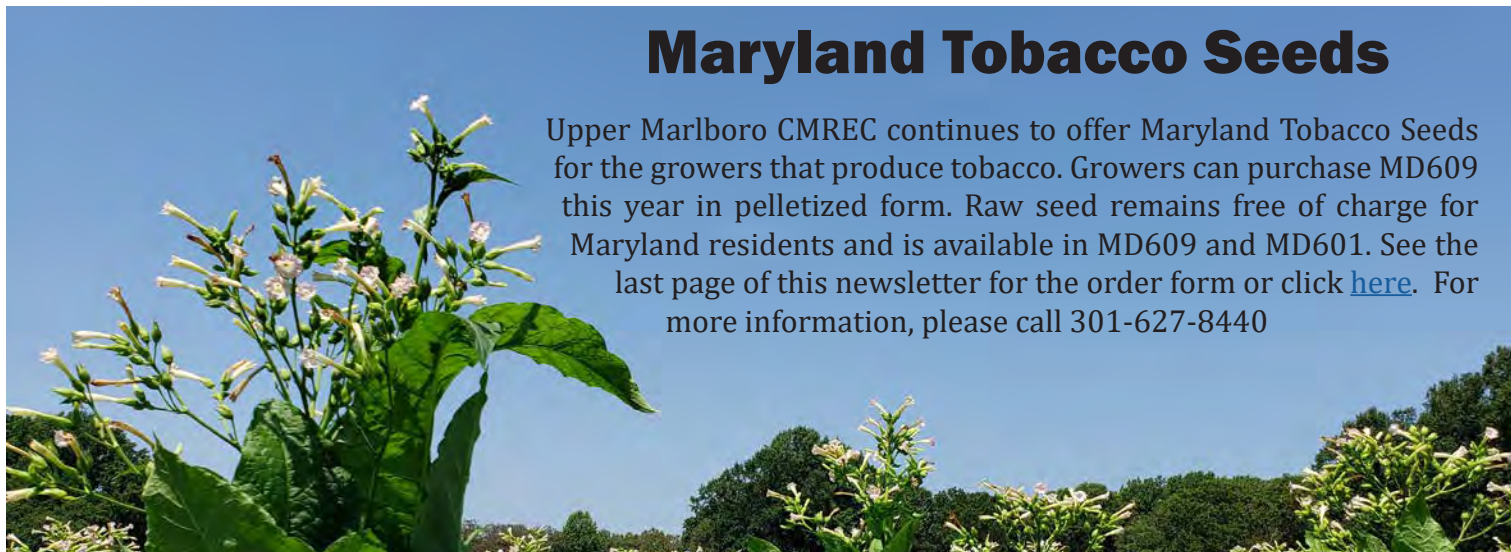
Donald Murphy, Facility Manager

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# 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



DATE	24 Hour Air Temp (F)	24 Hour Precip (in)	24 Hour Wind (mph)	24 Hour Humidity (%)	24 Hour Clouds (%)	24 Hour Dew Point (F)	24 Hour Frost (in)	24 Hour Rain (in)	24 Hour Snow (in)	24 Hour Sleet (in)	24 Hour Hail (in)	24 Hour Ice (in)	24 Hour Fog (in)	24 Hour Thunder (in)	24 Hour Tornado (in)	24 Hour Other (in)
1	56	0	5	65	100	54	0	0	0	0	0	0	0	0	0	0
2	65	0	4	62	100	63	0	0	0	0	0	0	0	0	0	0
3	74	0	3	44	100	67	0	0	0	0	0	0	0	0	0	0
4	68	0	3	35	100	64	0	0	0	0	0	0	0	0	0	0
5	73	0	3	37	100	61	0	0	0	0	0	0	0	0	0	0
6	68	0	3	43	100	60	0	0	0	0	0	0	0	0	0	0
7	65	0	4	42	100	52	0	0	0	0	0	0	0	0	0	0
8	54	0	3	39	100	59	0	0	0	0	0	0	0	0	0	0
9	65	0	3	42	100	54	0	0	0	0	0	0	0	0	0	0
10	67	0	4	40	100	48	0	0	0	0	0	0	0	0	0	0
11	46	0	3	36	100	56	0	0	0	0	0	0	0	0	0	0
12	58	0	2	36	100	50	0	0	0	0	0	0	0	0	0	0
13	50	0	2	38	100	44	0	0	0	0	0	0	0	0	0	0
14	53	0	2	47	100	45	0	0	0	0	0	0	0	0	0	0
15	55	0	4	45	100	55	0	0	0	0	0	0	0	0	0	0
16	62	0	3	38	100	62	0	0	0	0	0	0	0	0	0	0
17	65	0	3	45	100	50	0	0	0	0	0	0	0	0	0	0
18	65	0	3	43	100	50	0	0	0	0	0	0	0	0	0	0
19	57	0	3	30	100	56	0	0	0	0	0	0	0	0	0	0
20	62	0	3	37	100	58	0	0	0	0	0	0	0	0	0	0
21	62	0	3	37	100	44	0	0	0	0	0	0	0	0	0	0
22	47	0	3	38	100	43	0	0	0	0	0	0	0	0	0	0

## Upper Marlboro Weather Station

Weather data for Upper Marlboro is displayed on our website from 1956 to current. The information 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.



Front Cover photo: UM CMREC staff assist 4-H youth and parents with a tobacco project

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## CMREC Upper Marlboro Welcomes Back Michael Perise

Michael Perise of Huntingtown is a graduate of the University of Maryland in which he majored in Sustainable Ag at the Institute of Applied Agriculture, class of 2016. Michael is not new to the facility. During his time at UMD he was an intern here with the Terp Farm project. Following his graduation, Michael worked for the College of Agriculture for 6 years at the Beltsville and Upper Marlboro facilities. His personal knowledge and background in tobacco, poultry and vegetable production made him a suitable fit for the facility. As a seasoned outdoorsman Michael does not shy away, partaking in diligent jobs that are essential in the daily operations on the facility, in addition to doing a little fishing during his lunch breaks.



## 4-H story for my 2022 Record Book, Excerpt Ashtyn DeVries, Calvert County 4-Her

Our Calvert County Heritage 4-H Club grew at the University of Maryland farm in Upper Marlboro, and learned all the steps to growing and harvesting tobacco. The project kicked off with Dave Conrad, retired UME tobacco specialist, coming to our club meeting and teaching us the history of tobacco.

For planting, first off, you have to plant the seedlings. We used a machine where the plants go into a small slot then they are put into the ground. Then as the plants mature, we had to check the plants for a certain type of bug. Then we had to take the tops off the plants, this is called topping.

As the plants are finally mature, we then had to manually cut down all the plants and let them dry for about thirty minutes. Then we speared the plants onto tobacco sticks. Then we had to load all the sticks full of tobacco onto trailers for transport. Each stick had an average of four plants.







Then the fun part of the whole journey was hanging all these plants into a barn. It was about a fifteen-person process. Two or three people working up in the loft rafters, then three or four people passing sticks up into the loft rafters. There were three or four people unloading the trailers and three or four people bringing the unloaded sticks to the people who were passing them up.

The last part of the tobacco project was going back after the tobacco had dried. We then put the tobacco in order and made bundles out of it for the fair. Each bundle could not have more than thirteen leaves. We tried to pick the best leaves for our bundles. We entered in bundles of tobacco and tobacco on the sticks. My mom told me some of the older retired tobacco farmers were in the barn on the day that she took the tobacco to the fair. They had heard our 4-H club had raised tobacco. They were excited to see our finished product and were happy to see the most tobacco hanging at the fair after so many years of barely any entries.



Overall, all this project was a very good learning experience and a brand-new exposure to the hard work of raising and hanging tobacco.





# The Magical Lessons of Sweet Potatoes

**Meredith B. Epstein, Senior Lecturer and Advisor, Sustainable Agriculture Epstein**

Terp Farm and the Upper Marlboro Research and Education Center are always the first field trip of the year for students in INAG123 People, Planet & Profit: Digging Into Sustainable Agriculture. This course, taught by the Institute of Applied Agriculture, includes many students earning their two-year Certificate in Applied Agriculture, but also draws students from majors far and wide. INAG123 can satisfy one of the many General Education requirements that the University has for all degree-seeking students, and it can count toward the most popular minor on campus – Sustainability Studies.

While some students in the course grew up riding tractors and harvesting crops, for many the field trip is their first time ever setting foot on a farm. Not only do they tour the facility and learn about how both agronomic and horticultural crops are grown, they get to take part in the process themselves. In 2022, students harvested sweet potatoes destined to be served in campus dining halls – and eaten by their peers.

Many crops are exciting to harvest, but when they pop out of the soil beneath a mowed field, it can feel magical. When Terp Farm Manager Guy Kilpatric unearthed the first cluster of tubers, the “oohs!,” “aahs!,” and “whoas!” from the audience sent the whole class into a giggling fit. The students excitedly jumped in to get their hands dirty. In a matter of twenty minutes, they had pulled, clipped, and packed 200 row-feet of sweet potatoes. The students were visibly proud of their harvest, and even more excited to learn that they could take a few home with them.

Many thanks to Facility Manager Donny Murphy and Terp Farm Manager Guy Kilpatric for their time spent with the students!





# Evaluation of Hot-Set Tomato Cultivars to Fill the Summer Slump in Southern Maryland

Ben Beale, Extension Educator, St. Mary's County  
Alan Leslie, Extension Educator, Charles County



Figure 1. 2022 field experiment at CMREC-Upper Marlboro. Trial was arranged as a randomized complete block design with four replicates (rows). Taller plants are the indeterminate variety Bejo 3345 (Carole). Yellow Roma tomatoes were planted in between neighboring varieties to help keep varieties separate during harvests.

Similar to the 2021 growing season, transplants were grown out by a commercial greenhouse grower in St. Mary's County, and most of the transplants went to cooperating farmers to trial on their own operations. Survey results from these farmers are still being compiled and summarized. A formal, replicated trial was carried out at CMREC-Upper Marlboro, where multiple harvests were measured from each variety, and all fruit were counted and weighed according to size class. This field experiment was planted June 7 in four raised beds covered in white plastic, each row serving as a replicate. Varieties were randomly located within each replicate bed, and six transplants of each variety were planted together, separated from the neighboring variety by a yellow Roma tomato variety to help to separate neighboring varieties. Plants were trellised using the stake-and-weave system, and the indeterminate variety (Carole) received extra-tall posts to support a taller final plant size.

During the 2022 growing season, we trialed 15 tomato cultivars that show promise as varieties that will produce high yields during the hottest periods of field tomato production in Maryland. This trial builds upon initial work done in 2021, where 13 tomato varieties were trialed. This year we included two new varieties: Bejo 3353 (Patsy), and Dixie Red. Patsy is a new variety that was developed specifically for growing conditions on the East Coast, and we were hopeful that it would have the same disease resistance characteristics as Bejo 3345 (Carole), but maybe produce larger fruit. Dixie Red was a variety favored by some of the local farmers in Southern MD, and was included in the trial to see how it stacked up against these newer releases.



Figure 2. Example of yield of Bejo 3347 (Carrie). Good quality fruit of uniform size, mostly firmly within the large/extra large size class, with few jumbo-sized fruit.

Growing conditions for 2022 were stressful for mid-season tomato production, and the plant growth and overall yields were lower than 2021. Immediately following transplanting, cool and cloudy conditions slowed the establishment and initial growth of the plants. Prolonged periods of extremely high temperatures during the harvest period apparently stressed the plants further, but also provided a good test of the heat tolerance of the different varieties. Harvests were conducted on four separate dates between August and September, where all fruit showing any breaking color were picked and separated into three size classes: Small/Medium (< 2.5”), Large/Extra Large (2.5” – 3.5”), and Jumbo (> 3.5”).

For the 2022 growing season, Bejo 3437 (Carrie) produced the highest total marketable yield, following its performance as the second highest yielder in 2021. Rounding out the top three yielders for 2022 were Bejo 3345 (Carole) and Red Morning. Interestingly, Dixie Red produced the lowest yields, though it did tend to produce relatively large fruit. In terms of largest average fruit size, Red Snapper produced the largest fruit, followed by STM 2255, XTM 5187 (Thunderbird), and Rambler. All of the varieties on trial tended to produce larger fruit than Red Mountain, a current grower standard.

Now most of these varieties have been tested for two field seasons, there are a few varieties that have emerged as consistently top performers under different categories. Bejo 3437 (Carrie) produces reliably high yields of good quality tomatoes with little cracking, splitting, or other damage that would render fruit unmarketable. The one drawback to this is that Carrie tends to produce relatively small fruit on average. Bejo 3345 (Carole) also produces relatively high yields of good quality fruit, but has the drawback of being an indeterminate variety. This variety may work well for certain types of high-tunnel production, but it produces a plant that is too large to manage in the field setting. STM 2255 is another variety that consistently produces high yields, even under less-than-ideal growing conditions. The largest fruit on average were produced by Rambler, Red Snapper, and XTM 5187 (Thunderbird), so if your target market is the jumbo size class, these varieties will produce more of those larger fruit. Finally, Scarlet Red is another variety that received honorable mention for producing a high proportion of marketable fruit, with relatively few culls over the two years in the trial.

Several of the varieties included in this trial are now recommended varieties for commercial production in the Mid-Atlantic Commercial Vegetable Production Recommendations guide. The new additions include: Bejo 3437 (Carrie), Bejo 3345 (Carole), Bejo 3353 (Patsy), Rambler, Roadster, and XTM 5187 (Thunderbird). Rambler and Roadster are recommended for early season production, while the rest are recommended for mid-season production.

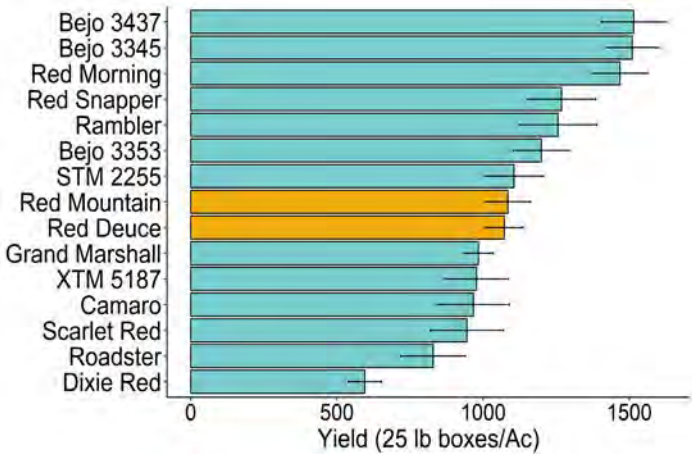


Figure 3. Total marketable yield of different varieties as number of 25 lb boxes per acre. Error bars represent standard error of the mean.

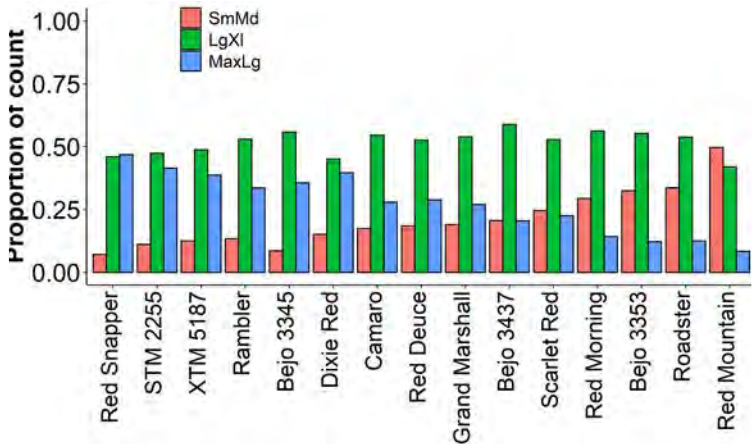


Figure 4. Proportion of marketable fruit in different size classes of all varieties in the trial. Varieties are arranged on the x-axis in the order of the largest average fruit size on the left to the smallest average fruit size on the right.



# Using a biostimulant, silicon and plant resistance in pumpkin production systems to reduce plant disease loss

Jerry Brust, IPM Vegetable Specialist

**Objective:** Evaluate a plant biostimulant (Stimplex) alone and in combination with silicon and powdery mildew resistance on foliar and soil borne diseases and yield of pumpkin.

**Material and Methods:** Two studies were conducted. The first study examined foliar disease problems. Treatments were: Stimplex, Calcium silicate and a powdery mildew resistant (tolerant) pumpkin variety (Charisma) vs. a similar non-resistant variety (New Rocket, same days to harvest and same wt per pumpkin as Charisma). Calcium silicate was applied at a rate of 4,000 lbs/a before bed formation to 4 rows in a plot (25x50 ft area). Lime was applied to the other 4 rows in a plot to bring soil pH up to 6.8-7.0. Within each split plot a 2x2 experiment was run with the two varieties of pumpkin at two 'rates' of Stimplex (applied or not applied). This created a 2x2x2=8 treatment factorial study. There were 8 rows of plastic (2 pumpkin varieties, two rates of silicon (applied or not) and two rates of Stimplex (applied or not)) 50 feet long on 6 ft row middles with drip irrigation. There were 4 reps. Pumpkin seeds were planted 8 June at a 3 ft spacing, 16 plants/row. Stimplex was applied at the rate of 1.5 qts/a via drip irrigation on 22 June, 14 July, 28 July, 18 August and 6 September. Foliar diseases (powdery and downy mildew) were evaluated in late June, and in mid-July, August and September by examining the percentage of leaf area infected by a pathogen. A rating system of 1-5 was used with 1=1-10%; 2=11-25%; 3=26-50%; 4=51-75%; 5= >76% of foliage infected. No fungicides were used in this study. Pumpkins were harvested and weighed on 15 September. Data were analyzed using 2x2x2 factorial ANOVA and means were separated using Orthogonal Contrasts (SAS, 2009). Pumpkin plants can succumb to downy mildew very quickly (fig. 1). The second study examined soil disease problems. Calcium Silicon and Stimplex were used in a 2x2 study. Both were applied as described above into 4-row plots with four reps. Gladiator pumpkin seed was planted 3 ft apart in 50 ft long rows on 6 ft centers on 8 June. A field was selected in which *Fusarium* spp and *Phytophthora* spp had been found infecting squash plants three years prior to the 2010 trial with pumpkin. This field had a corn-soybean-corn rotation for the last three years. Foliar applications of Bravo (3 apps), Curzate (2 apps) and Ranman (1 app) were applied to control foliar disease. The percentage of plants killed by soil borne pathogens was recorded on 18 August and 15 September. Pumpkins were harvested and weighed 22 September. Data were analyzed using a 2x2 factorial ANOVA and means were separated using Orthogonal Contrasts (SAS, 2009).



Fig. 1 Downy mildew hits quickly: field on left on August 7 on right same field on August 15



**Results/Discussion:** Throughout May and June we had record rainfall, with May setting a new record and June coming in second. From 1 April 2010 through the end of June we recorded 25.2 inches of rain at Upper Marlboro, which is 11.6 inches above average for this time period.

**Foliar disease study: Powdery Mildew.** The main factors of powdery mildew (PM) resistance vs not and the presence of silicon vs not were both significant ( $P<0.05$ , presence of either was significantly better than not present). Any treatment in which silicon was applied had reduced powdery mildew foliar problems (Table 1). Adding silicon to a PM resistant pumpkin variety significantly increased the tolerance of plants to powdery mildew infection (Table 1) compared to PM resistance alone. Stimplex did not increase the tolerance of the varieties to PM.

Table 1. Interaction of PM resistance, silicon and Stimplex on powdery mildew infection in pumpkin. “+” sign means treatment was applied, “-” sign means treatment was not applied

PM Resistant	Silicon	Stimplex	June	July	August
+	-	-	1.8a	2.7a	3.3bc
+	+	-	1.2ab	1.4b	1.7a
+	-	+	1.4a	1.7ab	2.2ab
+	+	+	0.8b	1.3b	1.5a
-	+	-	1.6a	2.0ab	2.1ab
-	-	+	1.9a	2.3a	2.6bc
-	+	+	1.3ab	1.8ab	2.0ab
-	-	-	2.1a	3.1a	4.5c

Ratings are 1-5, with 1=1-10%; 2=11-25%; 3=26-50%; 4=51-75%; 5= >76% of foliage infected

Means with different letters are significantly different at the  $p<0.05$  level; orthogonal contrasts

**Downy Mildew.** None of the main effects of PM resistance, silicon or Stimplex were significant for downy mildew (DM). However, the interaction of silicon and Stimplex significantly increased plant resistance to DM infection (Table 2).

Table 2. Interaction of PM resistance, silicon and Stimplex on downy mildew infection in pumpkin. . “+” sign means treatment was applied, “-” sign means treatment was not applied

PM Resistant	Silicon	Stimplex	July	August	September
+	-	-	0.6a	3.7a	4.2a
+	+	-	0.5a	3.4a	4.1a
+	-	+	0.6a	2.9ab	3.9ab
+	+	+	0.2a	1.3b	3.2b
-	+	-	0.6a	3.1a	4.0a
-	-	+	0.4a	2.3ab	4.2a
-	+	+	0.2a	1.8ab	3.5ab
-	-	-	0.7a	3.9a	4.6a

Ratings are 1-5, with 1=1-10%; 2=11-25%; 3=26-50%; 4=51-75%; 5= >76% of foliage infected

Means with different letters are significantly different at the  $p<0.05$  level; orthogonal contrasts

**Yields.** Using PM resistant pumpkins increased yields compared with not using PM resistance. Using silicon or Stimplex alone did not significantly increase yields, except vs the control - no PM resistance, no silicon and no Stimplex, but having both present did increase yields compared with using only PM resistance or no resistance. While silicon reduced infection of PM it did not reduce DM infection and DM was particularly virulent this season. Therefore, while yields were better with silicon, they were not significantly different from using PM resistance. When silicon and Stimplex were applied together was there a yield boost in pumpkin which could be due to Stimplex increasing the nutrient content of pumpkin or interacting with silicon to reduce foliar diseases or both.



Table 3. Interaction of PM resistance, silicon and Stimplex on pumpkin yields. “+” sign means treatment was applied; “-” sign means treatment was not applied

PM Resistant	Silicon	Stimplex	Pumpkin yield (lbs)
+	-	-	368.3 b
+	+	-	404.4 ab
+	-	+	389.8 ab
+	+	+	441.5 a
-	+	-	372.2 ab
-	-	+	381.6 ab
-	+	+	424.8 a
-	-	-	315.2 c

Means with different letters are significantly different at the P< 0.05 level; orthogonal contrasts

**Soil borne pathogen study.** *Fusarium solani* f. sp. *cucurbitae* was the overwhelming pathogen recovered from wilted pumpkin plants. Plants began to wilt approximately 4 weeks after emerging. Silicon did little to reduce soil borne pathogen infection and death. Stimplex alone significantly reduced disease problems and the interaction of silicon and Stimplex was significant (Table 4).

Table 4. Interaction of silicon with Stimplex in reducing soil disease problems in pumpkin. “+” sign means treatment was applied; “-” sign means treatment was not applied

Silicon	Stimplex	% dead plants	
		August	Sept .
-	-	18.3a	24.6a
+	-	15.6ab	19.2ab
-	+	9.5bc	13.6b
+	+	4.2c	6.1c

Means with different letters are significantly different at the P< 0.05 level; orthogonal contrasts

**Yields.** Using silicon did not increase yields. Using Stimplex did increase yields and using silicon and Stimplex together significantly increased yields compared with not using silicon or Stimplex or using either by itself (Table 5). How silicon and Stimplex interacted to reduce soil-born pathogen problems is not known at this time. Each may stimulate a separate systemic acquired resistance (SAR) pathway or the same pathway, in which they stimulate it beyond what one can normally do. Stimplex may increase root growth and nutrient uptake as well as increase an SAR pathway and silicon helps to facilitate this increase. Using the biostimulant, silicon and powdery mildew resistant cultivars creates the best chance for increasing pumpkin yields in the Mid-Atlantic (fig. 2).



Fig. 2 Nice pumpkin field ready for harvest

Table 5. Interaction of silicon and Stimplex on yield of pumpkins with soil borne disease problems. “+” sign means treatment was applied; “-” sign means treatment was not applied

Silicon	Stimplex	Pumpkin yield (lbs)
-	-	265.8 a
+	-	291.6 ab
-	+	357.7 b
+	+	485.4 c

Means with different letters are significantly different at the P< 0.05 level; orthogonal contrasts



# Environment, Technology, and Economy (ETE) program of College Park Scholars returned to CMREC for the 20<sup>th</sup> year

**Tim Knight , Director - Environment, Technology, and Economy, College Park Scholars**

On August 26, 2022, the students of the Environment, Technology, and Economy (ETE) program of College Park Scholars returned to CMREC for the 20<sup>th</sup> year. Sponsored by the College of Agriculture and Natural Resources, ETE teaches incoming students about sustainability and food systems as they transition to the University of Maryland. To begin that process, we volunteer at CMREC and the nearby Claggett Farm, giving students a chance to form friendships even before classes start.

This year, one group labeled 1,680 honey jars (70 cases) that were used for the Kids Growing with Grains project at the Maryland State Fair and 4H events. One Terp Farm group harvested about 500 lbs of basil. That, along with what others will harvest from that field is expected to be enough to supply all of the pesto that will be served in dining halls on campus this year. The butternut squash group harvested about 2500 lbs of butternut squash, which will be served in the dining halls and donated to the campus pantry. The group working with Alan Leslie harvested about a ton of tomatoes of different varieties, which will be served at the dining hall and donated to the campus pantry. The groups working with Mariah Dean and Cerruti Hooks harvested about 400 pounds of tomatoes and peppers, all of which will be donated to a pantry in Prince George's County. The Claggett groups harvested 1300 lbs of tomatoes, which will be donated to the Capital Area Food Bank and distributed in the Claggett CSA. In addition, students worked together, formed friendships, and started to build the bonds that make ETE special and will stick with them through college and their lives.





# Crops Twilight Tour and Ice Cream Social

Wednesday, August 3, 2022 4 - 9pm



The Crops Twilight Tour, Barbecue & Ice Cream Social was an absolute success with 94 in attendance!

The weather was pleasantly hot, nearly perfect for the evening activities and the wagon tour - The farm looked spectacular! A special thanks to Donald, Alfred, and Ronald.

The stops we made in 2022 were:

- Basil Downy Mildew, *Alan Leslie, Agent, UME*
- Artisan Tomato Trial, *Ben Beale, Principal Agent, UME*
- Tomato Management during Extreme Weather, *Jerry Brust, Vegetable IPM Specialist, UME*
- Hot Set Tomato Variety Trial, *Ben Beale, Principal Agent*
- Using Spring-Seeded Cover Crops to Reduce Herbicide Inputs in Plasticulture Systems, *Dwayne Joseph, Agent, UME*
- Using Biosolarization to Suppress Soil-borne Pests and Improve Weed Control, *Dwayne Joseph, Agent, UME*
- Using Living and Dead Cover Crops to Suppress Weeds in Sweet Corn, *Cerruti Hooks, Professor, ENTM*
- Blackberry and Raspberry Trial, *Alan Leslie, Agent, UME*





# Downy Mildew Resistant Basil Trial

Alan Leslie, Extension Educator, Charles County

Basil downy mildew (BDM) is a disease that was first reported in the United States in 2007. Prior to its introduction, basil plants could be reliably grown with little or no pesticide inputs. However, in late summer, BDM infection can devastate a basil crop and quickly render it unmarketable. We carried out a trial to test several varieties basil for their resistance to BDM infection during the summer. We tested six varieties with and without known resistance. Four varieties were developed from the Rutgers breeding program and have BDM resistance: Passion, Devotion, Obsession, and Thunderstruck. These varieties were all released between 2018 – 2020, so this trial tested whether there has been any breakdown in the resistance or if there is any variation in the levels of resistance between varieties. Other varieties included in the trial were Aroma and Emerald Towers, both are Genovese basil varieties with no known BDM resistance.

This trial was conducted during the summer of 2022 at CMREC-Upper Marlboro. Four replicates of each variety were planted on black plastic, where each row of plastic made up a separate replicate, and varieties were randomized within each row. Six plants of each variety were planted together for each replicate, with an in-row spacing of 1' and a between-row spacing of 4'. Transplants were placed in the ground on June 16 and any dead plants were replaced June 21. Yield was measured from a single harvest on August 18, where entire plants were cut at approximately 3" above the soil line. Plants were weighed for total yield, and assessed for signs of BDM infection. Where BDM infection was suspected, sample leaves were moist incubated in the dark for 24 h to stimulate sporulation.



Figure 1. Obsession, a basil variety developed by Rutgers with resistance to basil downy mildew.



Figure 2. Aroma, a Genovese basil variety with no resistance

Figure 3. Average total yield from a single harvest of different basil varieties. Values represent mass of six plants combined per replicate, and error bars represent standard error of the mean. Different letters signify statistically significant differences between the means.

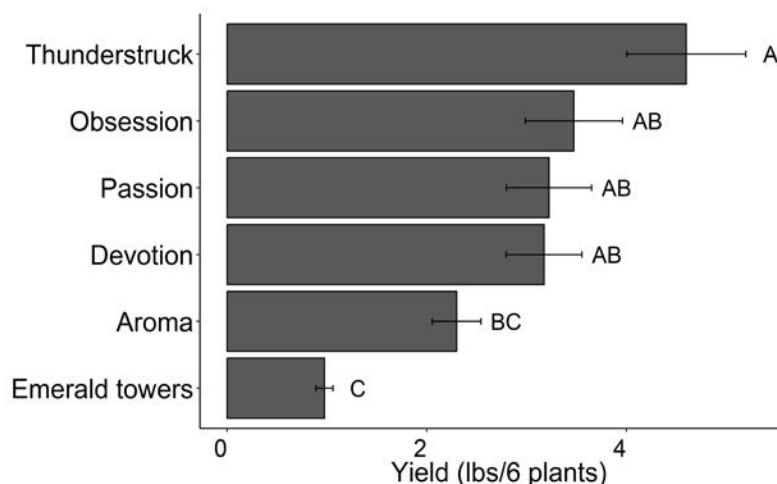






Figure 4. Yellowing of leaves, sharply bordered by leaf vein margins, which is a sign of basil downy mildew infection.

Yields were fairly similar among all of the BDM resistant varieties, ranging from 4.6 lbs for Thunderstruck to 3.2 lbs for Devotion, as yield averaged per six plants within a replicate. Emerald Towers had significantly lower yield than all of the BDM resistant varieties with 1.0 lbs per six plants. Aroma produced 2.3 lbs per six plants, which was significantly less than Thunderstruck, but not statistically different from the other varieties. Symptoms of BDM were found in all replicate plots of Aroma and Emerald Towers, and was confirmed by the fine, gray sporulation on the undersides of leaves. The level of BDM infection left all but a single plot of Emerald Towers unmarketable. A single plot of Devotion also had leaf discoloration that resulted in plants being unmarketable, but no sporulation could be stimulated by incubating leaves, so BDM could not be confirmed. Overall, the BDM resistant varieties seem to still be very effective in preventing infection during the late summer, while other susceptible varieties became unmarketable. A full summary of this trial and several others carried out across the state can be found in the May 2023 issue of inside GROWER magazine: <https://www.inside-grower.com/>.



Figure 5. Light gray, fuzzy sporulation on the undersides of basil leaves, which was used to confirm the presence of basil downy mildew when other leaf symptoms were detected.



# UMD Bee Lab and the New UMD Bee Squad

<https://www.umdbeelab.com/> <https://umdbeesquad.com/>



## About The Lab

The Honey Bee Lab at the University of Maryland has diverse personnel with multidisciplinary scientific backgrounds who bring a fresh perspective to solving problems. 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 recurring 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.

Our team has led and managed the [USDA APHIS National Honey Bee Disease Survey](#) since 2009. We are also a 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.

You can find Realtime results about these efforts at our database portals: [https://research.beeinformed.org/state\\_reports/](https://research.beeinformed.org/state_reports/)

Click [here](#) to purchase UMD Honey

## Donations

If you are able to help support our mission to improve honey bee health, we greatly appreciate whatever you can give.

You may donate online using the [University of Maryland "Giving to Maryland" Honey Bee Lab Donation Site](#).

Thank you for your support!





# Wednesday Water Webinars

## Drinking Wells, Water Quality and Septic Systems

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!

### 1/19/22 - [Warning Signs that a Septic System is not be Working Effectively](#)

How can you tell if your system is losing its effectiveness and approaching the end of its life expectancy? In addition, how can these signs guide you to help maintain its function? This webinar will present various signs or signals that your system is not working, as it should and what are possible remedies/practices.

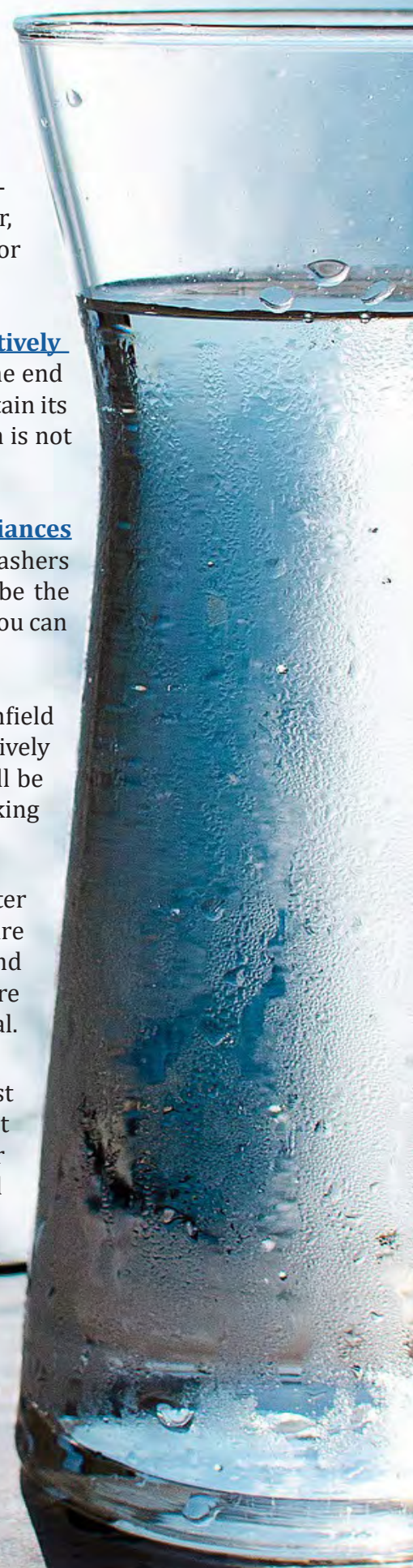
### 2/16/22 - [Corrosive Water Impact on Water Quality, Plumbing, and Appliances](#)

Ever wonder why you have to replace appliance such as water heaters, dishwashers or clothes washer more frequently than anticipated. Corrosive water may be the cause. This webinar will discuss characteristics of corrosive water and what you can do to reduce the impacts.

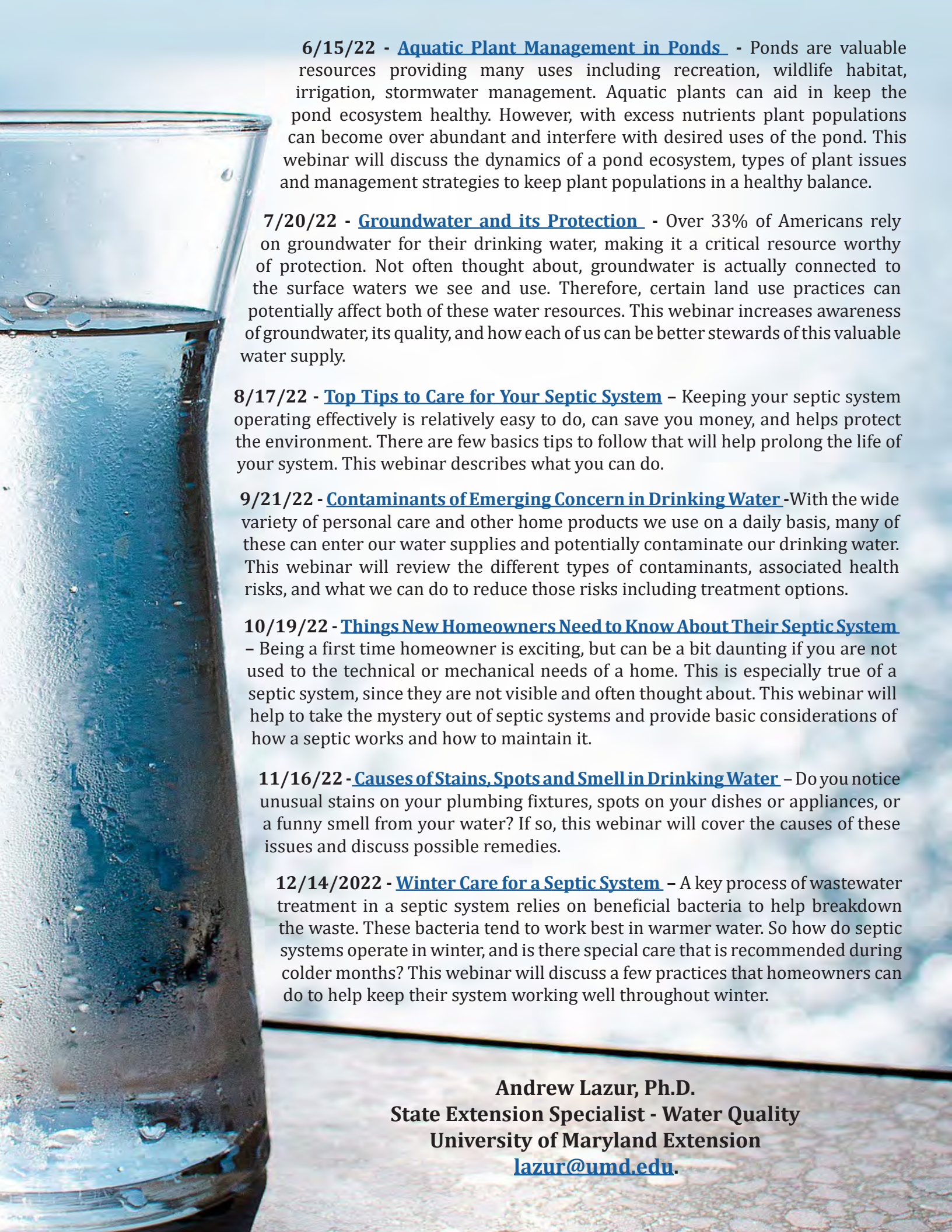
3/16/22 - [Septic System Maintenance](#) - Repairs or replacement of a drainfield or entire septic system are expensive! Maintaining a system is actually relatively simple and much less costly than repairs. The top maintenance practices will be presented to help you protect your investment and keep your system working longer.

4/20/22 - [Simple Steps to Protect your Water Well](#) - Your drinking water well is a valuable asset to your home and your health. Following basic care practices of your well and wellhead can help reduce risks of bacterial and chemical contamination. This webinar will cover the basics of how to care for a well including homeowner tips and when to contact a well professional.

5/18/22 - [How a Septic System Works](#) - Your septic system is the most expensive appliance or mechanical device in your home. Understanding how it works can help you keeping it operating effectively for many years saving your money and protecting both environmental and public health. This webinar will provide the basics of how the various types of septic systems (conventional, mound and advanced treatment or best available technology) work.







6/15/22 - [Aquatic Plant Management in Ponds](#) - Ponds are valuable resources providing many uses including recreation, wildlife habitat, irrigation, stormwater management. Aquatic plants can aid in keep the pond ecosystem healthy. However, with excess nutrients plant populations can become over abundant and interfere with desired uses of the pond. This webinar will discuss the dynamics of a pond ecosystem, types of plant issues and management strategies to keep plant populations in a healthy balance.

7/20/22 - [Groundwater and its Protection](#) - Over 33% of Americans rely on groundwater for their drinking water, making it a critical resource worthy of protection. Not often thought about, groundwater is actually connected to the surface waters we see and use. Therefore, certain land use practices can potentially affect both of these water resources. This webinar increases awareness of groundwater, its quality, and how each of us can be better stewards of this valuable water supply.

8/17/22 - [Top Tips to Care for Your Septic System](#) - Keeping your septic system operating effectively is relatively easy to do, can save you money, and helps protect the environment. There are few basics tips to follow that will help prolong the life of your system. This webinar describes what you can do.

9/21/22 - [Contaminants of Emerging Concern in Drinking Water](#) - With the wide variety of personal care and other home products we use on a daily basis, many of these can enter our water supplies and potentially contaminate our drinking water. This webinar will review the different types of contaminants, associated health risks, and what we can do to reduce those risks including treatment options.

10/19/22 - [Things New Homeowners Need to Know About Their Septic System](#) - Being a first time homeowner is exciting, but can be a bit daunting if you are not used to the technical or mechanical needs of a home. This is especially true of a septic system, since they are not visible and often thought about. This webinar will help to take the mystery out of septic systems and provide basic considerations of how a septic works and how to maintain it.

11/16/22 - [Causes of Stains, Spots and Smell in Drinking Water](#) - Do you notice unusual stains on your plumbing fixtures, spots on your dishes or appliances, or a funny smell from your water? If so, this webinar will cover the causes of these issues and discuss possible remedies.

12/14/2022 - [Winter Care for a Septic System](#) - A key process of wastewater treatment in a septic system relies on beneficial bacteria to help breakdown the waste. These bacteria tend to work best in warmer water. So how do septic systems operate in winter, and is there special care that is recommended during colder months? This webinar will discuss a few practices that homeowners can do to help keep their system working well throughout winter.

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# Evaluation of New Artisan Type Tomato Cultivars in Southern Maryland, Year 2

Alan Leslie, Center Director WMREC, CMREC, LESREC

Growing heirloom tomatoes is an attractive option for local markets, because they offer superior flavor characteristics and typically produce fruit that are large with unique colors and shapes. In farmers markets, roadside stands, and CSAs, consumers will pay premium prices for good quality heirloom-type tomatoes. By definition, heirloom tomatoes are older varieties that are open pollinated and have indeterminate growth. Although these varieties have excellent flavor and texture, they often lack other characteristics of commercial tomato varieties, such as a high, concentrated yield, and disease resistance. Recently, hybrid varieties have been developed that produce fruit similar to heirloom varieties, but with hybrid genetics that impart improved yield and disease resistance. In 2022, we conducted a second year of a variety trial testing some of these newer hybrid heirloom-type tomatoes against a commonly grown true heirloom.

The 2022 trial included six different varieties. Cherokee Purple was used as the true heirloom variety for comparison purposes. Cherokee Purple is widely grown in Maryland, has deep red to black colors with distinctive green shoulders, and has no advertised disease resistance. The remaining five varieties were all hybrids. Big Beef Plus is an improved version of an older hybrid beefsteak variety that maintains excellent flavor characteristics while improving disease resistance. The newer hybrid varieties tested were Marbonne, Marnero, Marnouar, and Medusa. Marbonne is a variety that produces large fruit that are bright red and deeply ribbed. Marnero, Marnouar, and Medusa all produce large fruit that are similar in appearance to Cherokee Purple. Marbonne and Marnero require long days, with at least 13 h of daylight, to produce fruit, while Marnouar and Medusa produce fruit with shorter day lengths. Seed for Cherokee Purple and Big Beef Plus generally cost less than \$0.10/seed, while the newer varieties cost between \$0.50 – \$1.60/seed.



Figure 1. Tomato plants at the CMREC site growing on a double-leader trellis system.

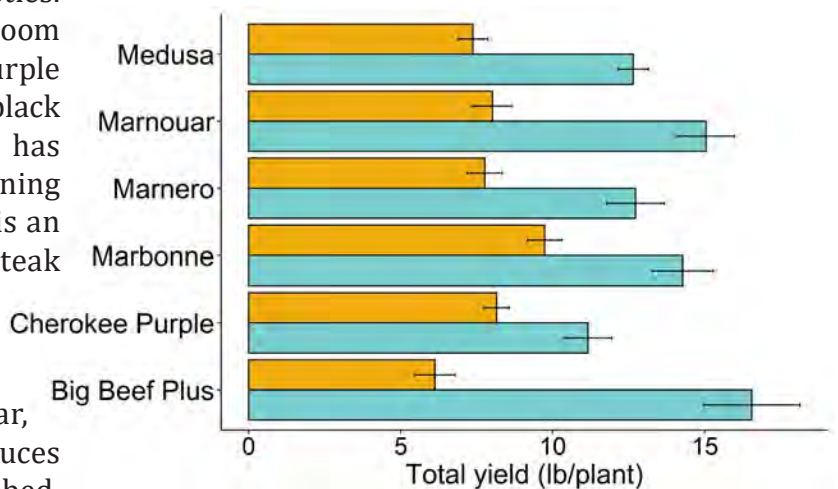


Figure 2. Total yield as average pounds of tomato per plant from the CMREC (blue) and St. Mary's (orange) sites. Different letters indicate statistically significant differences between tomato varieties within each of the sites.



Separate trials were planted at CMREC-Upper Marlboro and at the St. Mary's County Extension Office. At each site, plants were grown in high tunnels, with four (CMREC) or three (St. Mary's) replicates, as rows. Transplants were placed in the ground April 24 at CMREC and April 18 at St. Mary's. Plants were trellised using a single leader at St. Mary's and a double leader at CMREC. All suckers were removed on a regular basis, and all leaves were pruned from the base of the vines following harvest of the first few tomato clusters. Tomato fruit were harvested when fully ripe, and all fruit were counted, graded by size, and weighed over five harvests at CMREC and seven harvests at St. Mary's.

All varieties grew well, and put on vigorous vegetative growth early in the season. In terms of total yield, there were not great differences in the performance of different varieties. At CMREC, Big Beef Plus (16.5 lbs/plant) had significantly higher yield than Cherokee Purple (11.2 lbs/plant), and all other varieties were intermediate in yield (12.6 – 15.0 lbs/plant). At St. Mary's, Marbonne (9.7 lbs/plant) had significantly higher yield than Big Beef Plus (6.1 lbs/plant), and all other varieties were intermediate in yield (7.4 – 8.2 lbs/plant). There were not statistically significant differences in the average fruit size for the different varieties, and the average size ranged from 7.8 oz for Big Beef Plus to 9.2 oz for Medusa.

Overall, we did not see a significant benefit of planting any of these newer improved hybrid varieties over the conventional heirloom Cherokee Purple or the older hybrid Big Beef Plus. All of the varieties had issues with cracking and splitting, which are common for larger, soft-skinned tomato varieties. Neither site had any history of tomato disease pressure, which may have resulted in better performance of the newer hybrids with enhanced disease resistance. However, the high price of seed for the new improved hybrids did not result in higher yields or better-quality fruit in this trial. In cases where there is known disease pressure, grafting resistant rootstocks onto the traditional heirloom cultivars may provide a more economical solution, and may also result in improved yields.

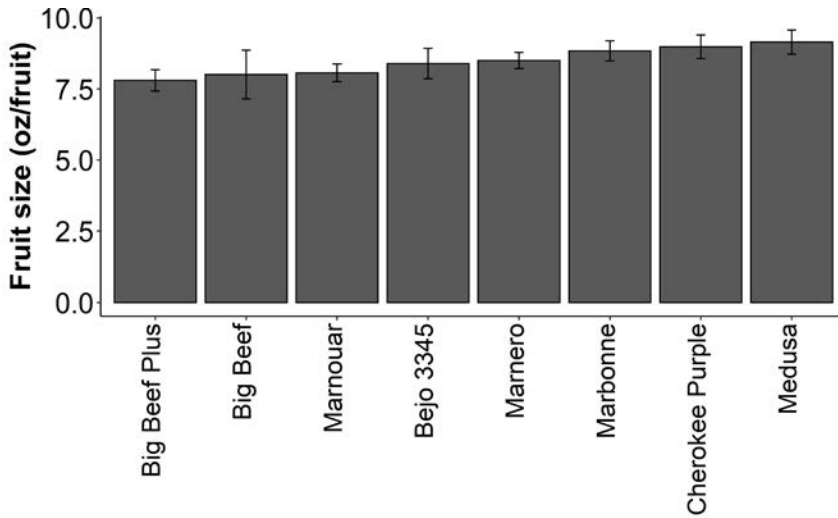


Figure 3. Average fruit size of different varieties. Average fruit size was not statistically different between tomato varieties. Graph includes data on varieties planted in 2021.



Figure 4. Example of cracking and splitting common in all varieties of heirloom and hybrid tomatoes.





# Choosing What To Grow On Terp Farm

Guy Kilpatric, Terp Farm Manager

At the top of the list of frequently asked questions by people hoping to learn more about Terp Farm is about how decisions are made about what crops to grow. It's a question that is usually preceded by asking what the farm currently grows - which in the present season consists of baby-leaf salad mix, basil, napa cabbage, daikon and storage radishes, sweet potatoes, watermelon, roma tomatoes, hot peppers, pumpkins, and several varieties of winter squash. At first, crop selection for the farm was an exercise in trial and error. The farm was initially modeled after a small-scale direct-market vegetable farm - one that might market its products through a subscription-based distribution, or retail markets like a roadside stand. However, one thing that has always been clearly defined is that the singular marketing outlet for Terp Farm products is the Dining Services program at UMD's College Park campus, which has caused the production model to change a bit over the years.



Over nearly ten years of operation, Terp Farm has tried growing dozens of different types of crops and likely hundreds of cultivated varieties. Crop rotation plans in the past relied on frequent successive plantings in order to provide consistent availability of products over the course of the season. But with a footprint of less than five acres, there isn't enough space to scale up so many successive plantings to ensure that the yield at each harvest could be impactful in proportion to the tremendous volume required by the dining halls. One of the primary goals of the program is to show a connection between food and farming, and in order to do that the products of the farm must also be visible and recognizable in the dining halls. Producing limited quantities of a lot of different crops just wasn't having the impact that it needed to have and so different considerations had to be made when deciding what to grow.

The Dining Services culinary team and the farm management team have a close relationship that relies on close communication and feedback. Production cost is a big concern for both operations, with the culinary team having to take into account the handling and processing needs of the whole produce they receive just as the farm has to consider the labor cost of planting, crop maintenance, and harvesting. This is why something like garlic doesn't make the cut, because the reality is that peeling garlic cloves is too costly for the culinary team to undertake. Similar considerations were made when selecting winter squash varieties. In order to be selected, varieties must be able to be handled in one of two ways - either halved and roasted such as with acorn squash or delicata; or in the case of the butternut squash variety, to have a much larger proportion of easily processable neck flesh over the more difficult to process seed cavity.

In terms of on-farm production it makes the most sense to grow crops that are easily scaled up and are not too challenging to grow or have high labor requirements. There is only one full-time person dedicated to the production and most of the other labor is performed by seasonal student employees, so emphasis is placed on crops that can be managed largely with the use of tractors and generally culminate in a single or few harvests. The exception of course is the roma tomatoes which require a lot of maintenance and harvesting labor and are a big focus of the work of seasonal student workers. Large one-off harvests like that of sweet potatoes or winter squash are usually performed by larger volunteer groups that are excited to get involved at the start of the academic year, which is perfectly timed for fall harvests.





Today's sauces are made with ingredients fresh from Terp Farm!

**Build-Your-Own Pasta**

**Choose 5 Ingredients**

**Choose Your Sauce**  
 smoked marinara • basil pesto  
 southwest chipotle pesto

**Choose Your Pasta**  
 semolina • whole wheat

**Breadstick**



Maria's

With visibility and recognition being important factors, it became clear that signature recipes containing Terp Farm products was the most conducive way to make those connections. So actually deciding what scale at which to produce a crop is now largely determined by how much of a said crop is needed to fulfill the recipe needs for the menu item associated with that crop. A perfect example of this is with the house-made pesto, which is now produced with virtually 100% Terp Farm basil. If every single menu item containing pesto throughout the entire school year is made from Terp Farm basil, then it becomes really simple to communicate the message that this food being eaten by Terps, was grown on a farm by Terps. Other recipe-based crop selections include napa cabbage and daikon radish grown specifically for kimchi, and roma tomatoes grown specifically for house-made marinara.

So if you ever find yourself dining on campus in one of the dining halls, look for some of these menu items and you will likely find a poster or menu card nearby that tells the story of how the food was grown at Terp Farm.

Website: [terpfarm.umd.edu](http://terpfarm.umd.edu) Email: [terpfarm@umd.edu](mailto:terpfarm@umd.edu)  
 Instagram: [@terp.farm](https://www.instagram.com/terp.farm)





# Evaluating Biosolarization, Cover Cropping and Strip Tillage as an Integrated Pest Management Tool in Eggplant

Dwayne Joseph - University of Maryland Extension Educator, Kent County

Alan Leslie - University of Maryland Extension Educator, Charles County

Kurt Vollmer - University of Maryland Extension Specialist-Weed Management

Cerruti Hooks - Professor Department of Entomology, University of Maryland

An integrated weed management approach is imperative in vegetable production. Fewer herbicides are registered in vegetables compared to row crops. Furthermore, many herbicides don't offer full-season weed control and producers are at an increased risk of crop injury if not applied as labelled. Organic farmers consistently list weeds as a top production constraint as they invest great amounts of time and labor to manual and mechanical weed control. Our research has shown the utilization of a living mulch and strip-tillage increases weed control between rows however, the soil disturbance may lead to a weed flush within the cultivated row. To this end, biosolarization may provide an effective solution to control weeds within the strip-tilled row. Biosolarization is a soil disinfection technique similar to solarization but involves the addition of organic amendments to the soil prior to it being covered with transparent plastic tarp. The tarp facilitates the passive solar heating of the moist, amended soil, promoting the release of allelochemicals and other organic acids into the soil via increased microbial activity. The biosolarization process is performed for about ten days then the tarp is removed and the soil is allowed to aerate for about seven days prior to crop transplant.

Research has shown that biosolarization can increase weed seed mortality and decrease soil pathogens. Moreover, biosolarization is compatible with organic farming practices and can be used in suboptimal climates where solarization wouldn't be effective. For example, to achieve optimum results from solarization, soils must reach a daily maximum temperature of above 110°F, and the plastic tarp must remain in place for at least four to six weeks. Contrarily, biosolarization utilizes organic soil amendments to decrease soil treatment time by increasing heat accumulation in the soil, thereby producing chemical factors that inactivate soil-borne pathogens and weed

seed.



Fruit processing by-products (pomace) are promising soil amendments for biosolarization because they are rich in organic compounds, don't pose any biohazard safety risks, and can be relatively abundant and inexpensive (Figure 1). In this study, the biosolarization potential of a combination of apple and grape pomace combined with a living mulch was investigated as an integrated pest management technique. We hypothesized that the fermentative by-products released during biosolarization will reduce the establishment, growth and/or survival of plant parasitic nematodes and weeds. Furthermore, the study objectives were to demonstrate the use of biosolarization, conservation-tillage and cover cropping to: 1) reduce nematode, weed and insect pests, 2) enhance crop growth and marketable yield, and 3) improve soil quality and health.





Figure 1. A) Dried apple pomace before application, and B) before incorporation in Biosol treatment.

## Methods

**Study layout.** Treatments were arranged in a randomized complete block split-plot design and were replicated four times. Whole plot treatments included eggplant: 1) grown on living mulch + no-till (LM-NT), 2) interplanted with cover crops (LM), 3) grown in solarized soil (Sol), or 4) interplanted with a cover crop and grown in biosolarized soil (Biosol). To evaluate the direct impact of whole plot treatments on eggplant growth and yield in the absence of weeds, three 5 ft × 8 ft subplot treatments were established in each plot. Weed management (hand-weeding) in these subplots included: weed-free for the entire study (WF), weed-free until nine weeks after planting (WF-9WAP), and no weed management (weedy) for entire study (WD).

**Fall plot preparation.** In early fall, red clover + cereal rye mixture was planted in Biosol, Sol and LM treatment plots at 6-inch row spacing. In LM-NT plots, the red clover and cereal rye was seeded in separate, alternating rows. One row of red clover was planted at each border and internal rows were alternated between six rows of cereal rye and four rows of red clover.

**Spring plot preparation.** In Biosol plots, the entire plot was mowed, the within-row areas (where eggplant was transplanted) was strip rotovated 40-inch wide. The apple and grape pomace mixture (3:1) was spread onto the soil surface and incorporated (rotovated), then transparent plastic tarp and drip lines were laid in rotovated zones (Figure 2). The biosolarization process proceeded for 12 days then the plastic tarp was removed and the soil was remediated for seven days before eggplant transplant. In LM-NT plots, the cereal rye was terminated with a roller crimper. In Sol plots, the entire plot was mowed and rotovated. The transparent plastic tarp and drip lines were laid in intra-row areas. In LM plots, the entire plot was roller crimped to terminate cereal rye. The within-row areas were strip-rotovated (40-inch wide) prior to transplanting eggplant. Eggplant seedlings were transplanted into all plots on the same day with a within and between-row spacing of 4 ft and 5 ft, respectively. Organic fertilizer was applied (side-dressed) according to crop nutrient requirement throughout the season.



**Data Collection.** Individual weed counts (species & number) were taken at 2, 4, 6 and 9 weeks after planting (WAP) from four randomly (two within- and between-row) placed 100 in2 quadrats within each plot. At 9 WAP; data for weed biomass was taken by harvesting (clipping at soil level) weeds present within two (one within- and between-row) randomly placed quadrats. Every seven days after planting, 10 plants were randomly chosen and inspected for beneficial and herbivorous arthropods. Natural enemy and epigeal predator counts were taken at seven-day intervals. To determine the effects of treatments on soil nematode presence, soil samples were collected prior to treatment applications, at eggplant transplant, and at first and final fruit harvest. Eggplant yield data was recorded from plants within the three internal rows in each plot, and all plants in each subplot. Harvested eggplant was characterized as marketable or un-marketable conforming to USDA standards.



### Results

The following results are from data that was collected and analyzed from this past season. Data involving the insect and nematode aspect of this study are yet to be finalized and are not presented. Weeds present were grouped and are presented as grass, sedge and broadleaf. Also, data from within and between crop rows are presented separately because of differences in plot preparation.

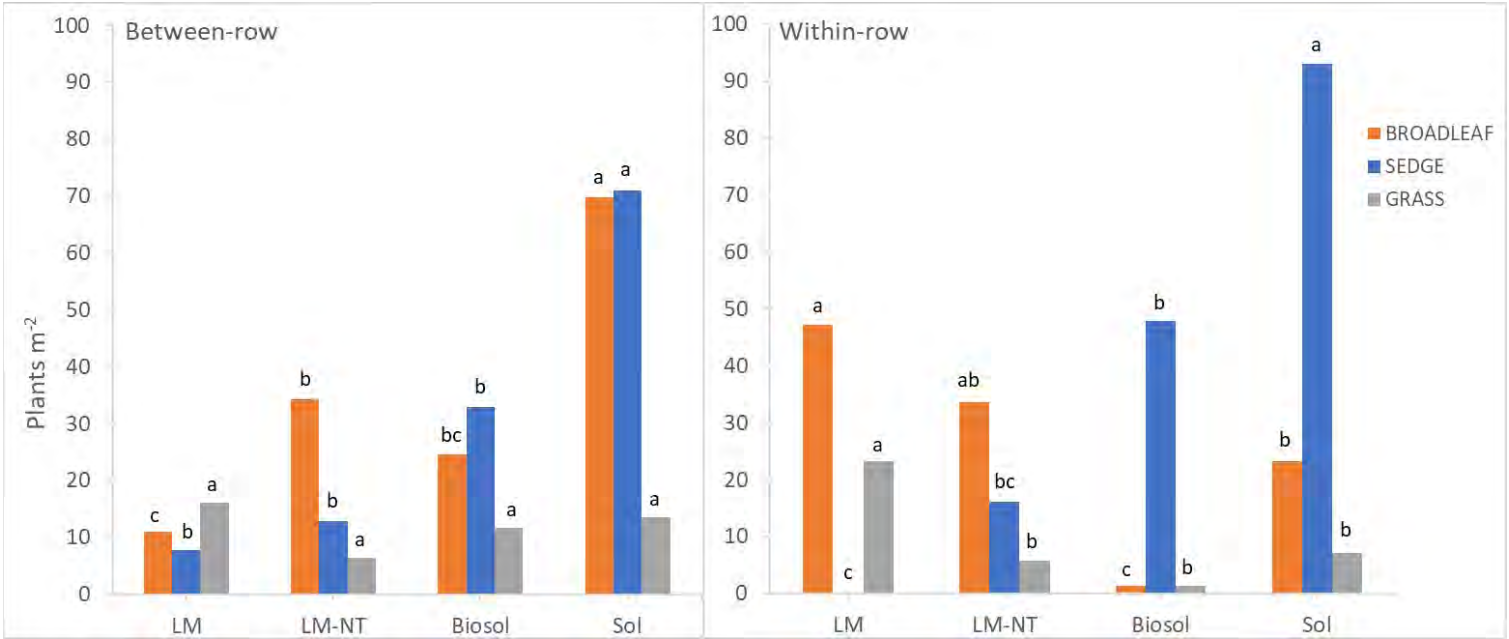


Figure 3. Between- and within-row weed abundance at 2 WAP in LM, LM-NT, Biosol and Sol treatments. Values with the same letter within the same species and area are not significantly different according to Fisher’s LSD ( $\alpha = 0.05$ )



Within-row. Biosol plots had the lowest mean number of broadleaf weeds with 1.3, 1.3, 3.2 and 0 plants m<sup>-2</sup> at 2, 4, 6 and 9 WAP, respectively; and grass weeds with 1.3, 1.3 and 7.8 plants m<sup>-2</sup> at 2, 4 and 6 WAP, respectively. Broadleaf weeds were greatest in LM plots throughout the study (all rating times). At 2 WAP, LM plots contained significantly more broadleaf weeds than Biosol and Sol plots (Figure 3). Sedge weeds were significantly greater in Biosol and Sol plots compared to LM and LM-NT plots at all rating times. There were 94% more sedges in Sol plots than Biosol plots at 2 WAP (Figure 3). There were significantly more grass weeds in LM plots than LM-NT, Biosol and Sol plots at 2 (Figure 3) and 4 WAP (Figure 4). However, at 6 (Figure 5) and 9 WAP (Figure 6) Sol plots contained significantly

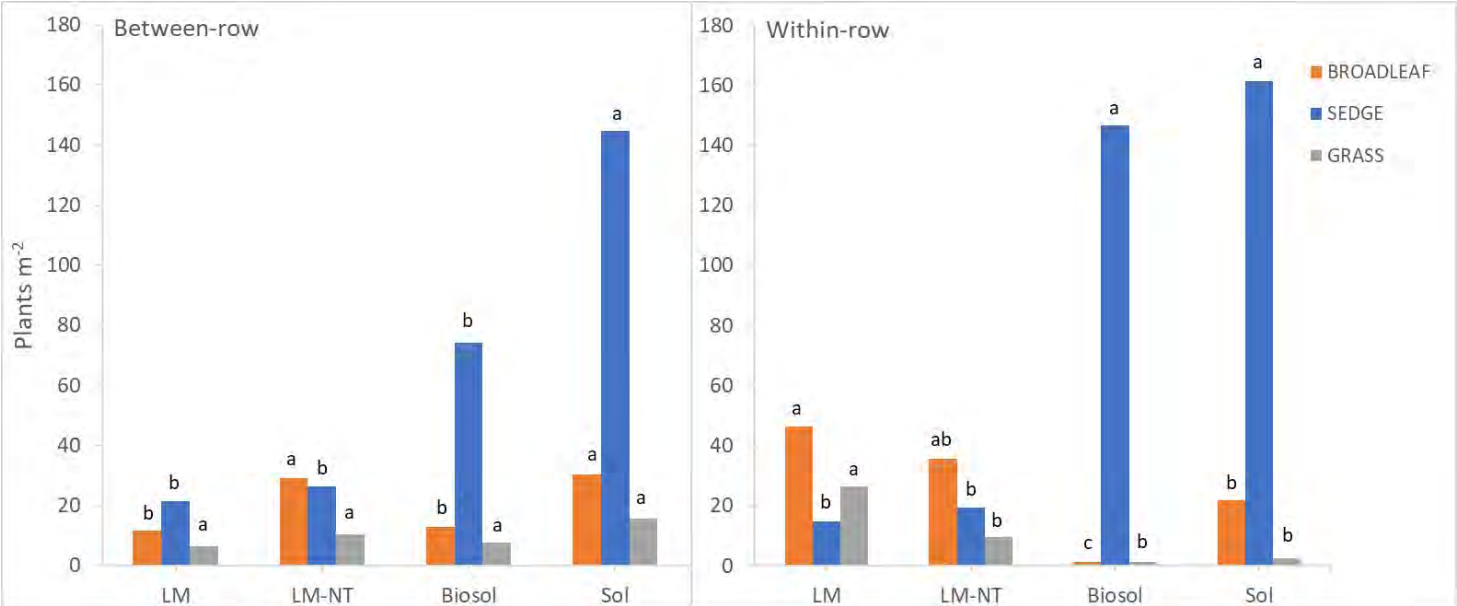


Figure 4. Between- and within-row weed abundance at 4 WAP in LM, LM-NT, Biosol and Sol treatments. Values with the same letter within the same species and area are not significantly different according to Fisher’s LSD ( $\alpha = 0.05$ )

*Between-row.* There were significantly more sedges in Sol plots compared to the other treatments at 2 and 4 WAP. Sedges were greatest in Biosol and Sol plots at 6 and 9 WAP. LM plots contained the lowest number of sedges at all rating times compared to the other treatments. There were no significant differences in grass weeds in all treatment plots at 2 and 4 WAP however, at 6 WAP, Sol plots contained significantly more grass

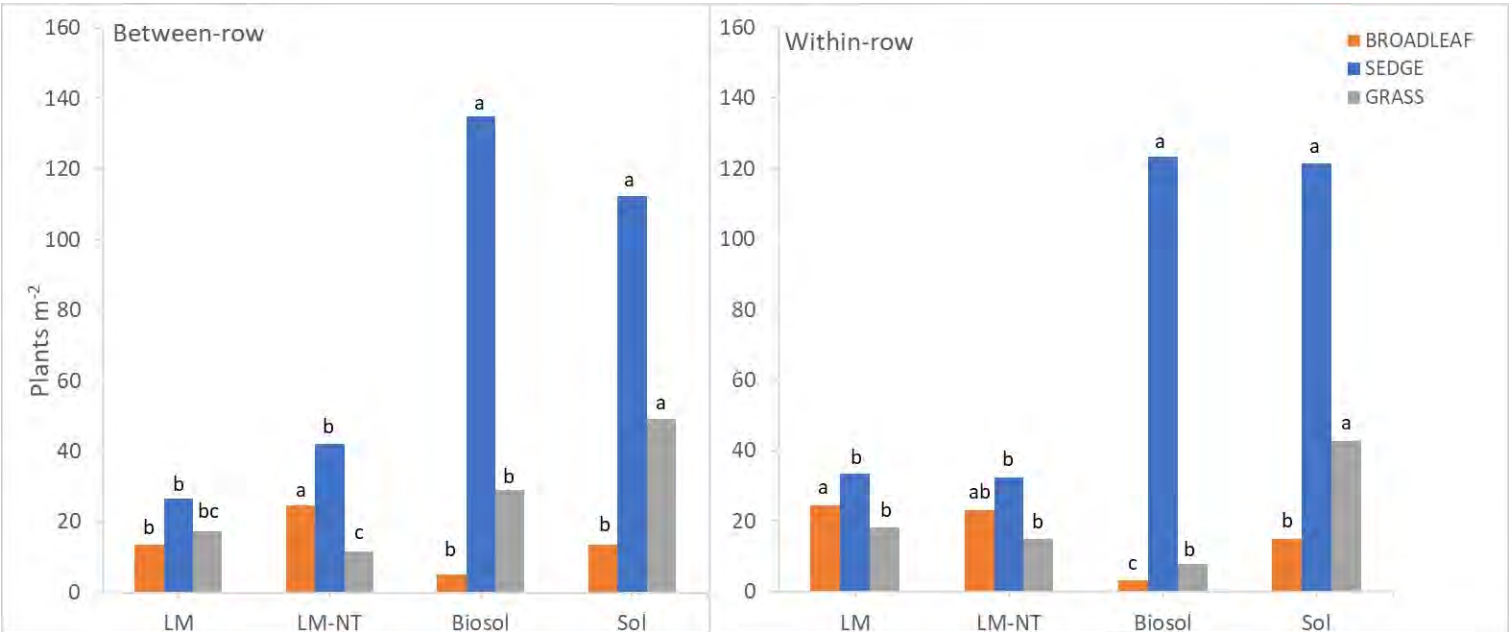


Figure 5. Between- and within-row weed abundance at 6 WAP in LM, LM-NT, Biosol and Sol treat-  
ments. Values with the same letter within the same species and area are not significantly different  
according to Fisher’s LSD ( $\alpha = 0.05$ )



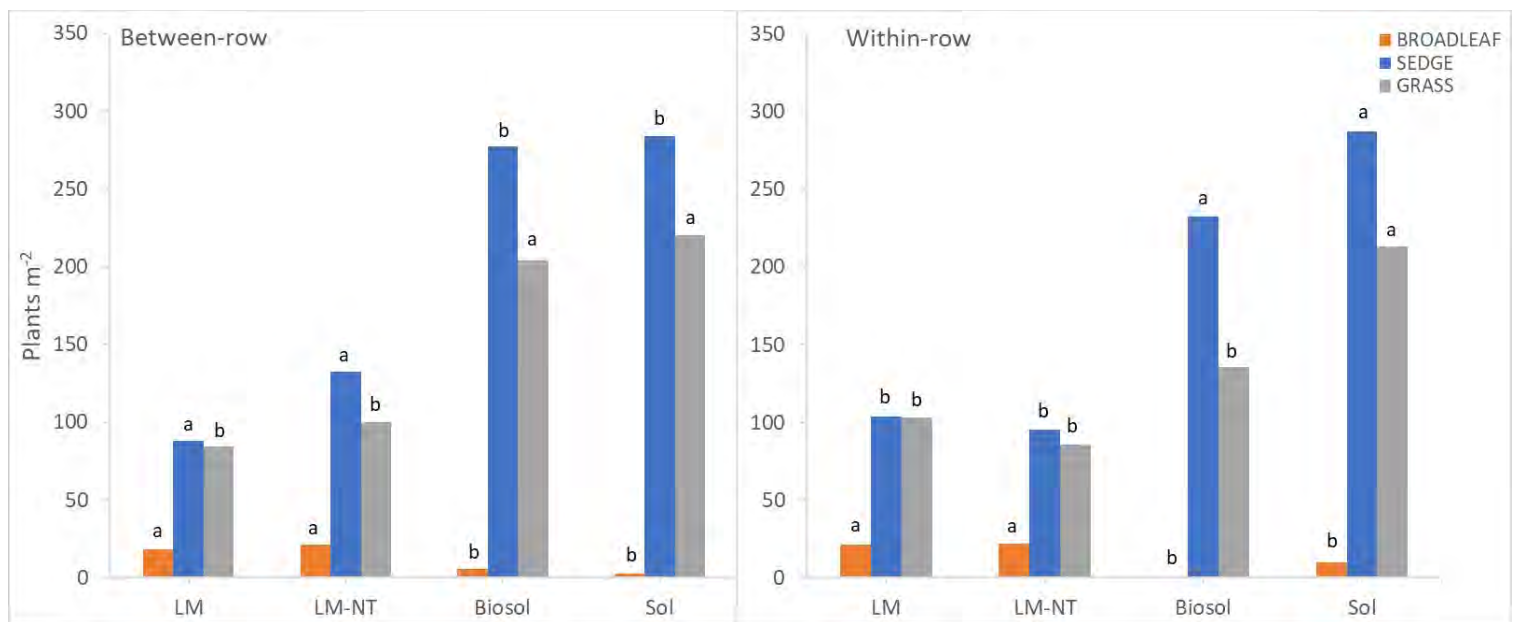


Figure 6. Between- and within-row weed abundance at 9 WAP in LM, LM-NT, Biosol and Sol treatments. Values with the same letter within the same species and area are not significantly different according to Fisher's LSD ( $\alpha = 0.05$ )

## Discussion and Conclusion

Two main points can be highlighted from the within-row results: 1) the Biosol treatment was the most effective at controlling broadleaf weeds, and 2) the Biosol treatment wasn't effective at controlling sedges. Moreover, the results show that broadleaf weed seed were effectively inactivated by biosolarization however, sedge control was minimal. This is mainly because of the two different ways in which these types of weeds reproduce and emerge. The broadleaf weeds present in the study were mainly pigweeds, carpetweed and horsenettle. These weeds are all annuals that reproduce via seed. The main sedge weed present in plots was yellow nutsedge which is a perennial that reproduces primarily from tubers that grow from creeping rhizomes. The results suggest that neither solarization nor biosolarization had a negative effect on the tubers of yellow nutsedge. Additionally, the increased tillage and heat generated by the passive solar heating process may have contributed to the emergence of yellow nutsedge. Conversely, the conservation tillage plots (LM and LM-NT) were better at yellow nutsedge suppression. This may be due to the lack of soil disturbance specifically in the no-till treatment. Also, the rye residue keeps the soil relatively cool and blocks the light stimuli that's required for the buds on nutsedge tubers to emergence. Grass weeds present in the plots were mainly from foxtails, crabgrass and goosegrass. These grasses are all annuals that reproduce via seed, therefore biosolarization was effective at inactivating their seeds leading to early-season grass control. However, at the last rating time, the efficacy of biosolarization in managing grass weeds decreased substantially.

The high nutsedge pressure in the field contributed to the greater amount of sedge observed in all plots however, Biosol and Sol plots contained significantly more nutsedge than the conservation tillage plots at different rating times when observing the between-row areas. This may be attributed to various factors related to the spring preparation of Sol and Biosol plots. In the spring, the cover crop in Sol and Biosol plots were mowed unlike the LM-NT and LM plots. The red clover remained in those conservation tillage plots and aided in suppressing nutsedge emergence. Although the red clover between the row in Biosol plots eventually came back as the season progressed, it wasn't enough to inhibit nutsedge emergence as was observed in conservation-till plots where the cover crop remained for the entire study.

Results of this study suggest biosolarization can be a viable option for weed management within the crop row. Furthermore, biosolarization can be an effective IWM technique in organic vegetable production. Future work may include exploring different sources of pomace, different soil amendment rates and optimizing the timing and duration of the biosolarization process.



# Allele frequencies of *Culex pipiens* bioforms vary across an urban to rural gradient in Greater Washington D.C.

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University of Maryland Department of Entomology

Landscape heterogeneity driven by land use, including urbanization, creates diverse habitat and resources for mosquito vectors of disease. Understanding the role of urbanization on mosquito vectors is important because vectors impact the dynamics of pathogen transmission to humans and pose risks to public health. *Culex pipiens* mosquitoes are important vectors of West Nile virus (WNV) in eastern North America, and are subjects of vector surveillance and abatement efforts across the region. All *Cx. pipiens* are associated with human land use. Within the species, there are two bioforms, *Cx. pipiens f. pipiens* and *Cx. pipiens f. molestus*, that demonstrate different behavioral, physiological, and ecological characteristics.

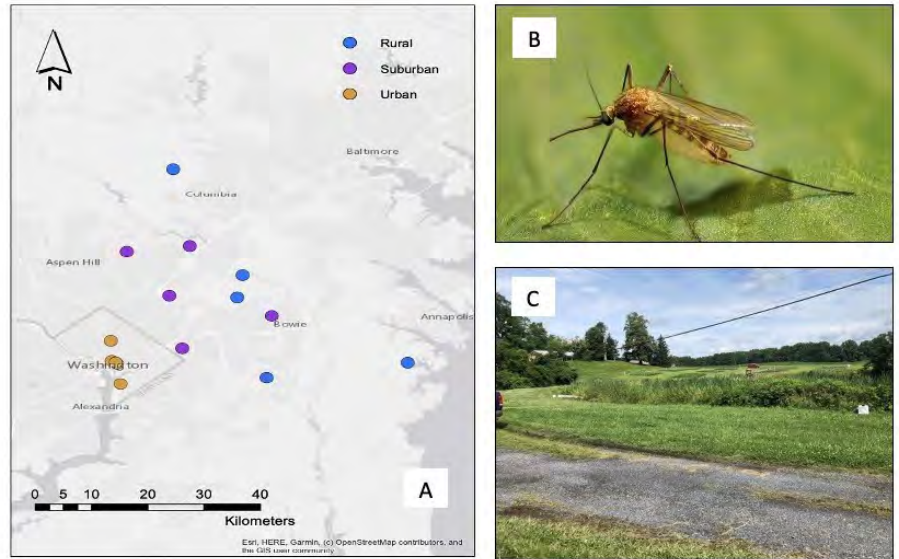


Figure 1. A. Map of greater Washington, D.C. collection sites. Urban sites are in orange, suburban sites are in purple, and rural sites are in blue. B. A *Culex pipiens* mosquito. C. Mosquito trap set at an agricultural site (UMREC)

Differential selection pressures due to landscape heterogeneity may better support one bioform or the other across the landscape. For instance, *Cx. pipiens f. molestus* use below ground, isolated habitats and tend to take blood meals from mammals, and these behaviors may confer an advantage in urban environments. We predicted that more *molestus* ancestry would be present in urban environments compared to suburban or rural environments, and the proportion of *molestus* ancestry would decrease over an urban to rural gradient.

We used molecular techniques to measure *pipiens* and *molestus* allele frequencies in populations of *Culex pipiens* collected from five urban, five suburban, and five rural sites in metropolitan Washington, D.C. during the months of June-October, 2019-2020 (Fig. 1, N=271). Allele frequency distributions along the gradient were transformed to meet normality assumptions and analyzed by ANOVA. We also analyzed patterns of hybridization between *Cx. pipiens f. pipiens* and *Cx. pipiens f. molestus* across site classifications using a Hardy Weinberg Equilibrium (HWE) test. HWE describes the principle that genotype frequencies will remain consistent over generations if no evolutionary processes are occurring. We compare observed and expected frequencies of genotypes to calculate whether populations are in or out of equilibrium. If the observed values are significantly different from expected, this suggests one or more of the assumptions of HWE have been violated, including the assumption of random mating.

We found that *pipiens* alleles were outnumbered by *molestus* alleles at all but two sites in our study, which were both agricultural sites. The frequency of *molestus* alleles was significantly higher in urban environments compared to rural environments (Fig. 2). None of the populations across site classes were



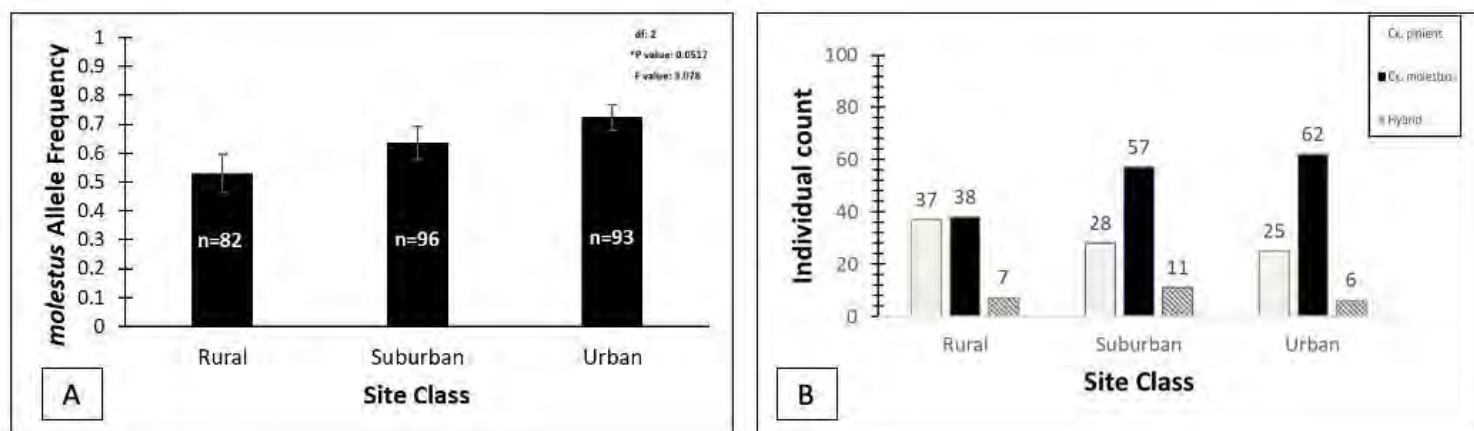


Figure 2. A. Form molestus allele frequency distribution by site class. (N=271) Mean molestus allele frequencies (+/- se) for each site class. Letters (a, b) indicate a significant difference in molestus allele frequencies (Tukey HSD). Rural:Urban has a post-hoc p-value of 0.0454. B. Individual count of pipiens, molestus, and hybrids by site class. Orange: rural, Blue: suburban, Green: urban. Grey: pipiens, Black: molestus, patterned: hybrid.

in Hardy Weinberg equilibrium due to less hybridization than expected. This suggests that bioforms are not mating randomly, perhaps due to adaptation and reproductive isolation, or habitat partitioning in the environment. Suburban sites had the greatest rates of hybridization between the bioforms, so perhaps the interface between urban and rural environments allows for more genetic mixing between bioforms than other habitat types (Fig. 2,3). We hypothesized that *Cx. pipiens* f. *molestus* characteristics may be advantageous in an urban environment, as they use below ground habitat, prefer mammalian hosts, and can survive in isolation over several generations, and we found that molestus alleles are common in the urban environment and hybrids are rare. Our work demonstrates the influence that human-mediated land use changes have on the distribution of *Cx. pipiens* bioforms, even on a fine geo-spatial scale. The distribution of *Cx. pipiens* bioforms and hybrids across a landscape has implications for WNV transmission because host use and host switching leads to epizootic spillover of WNV from avian hosts to humans.

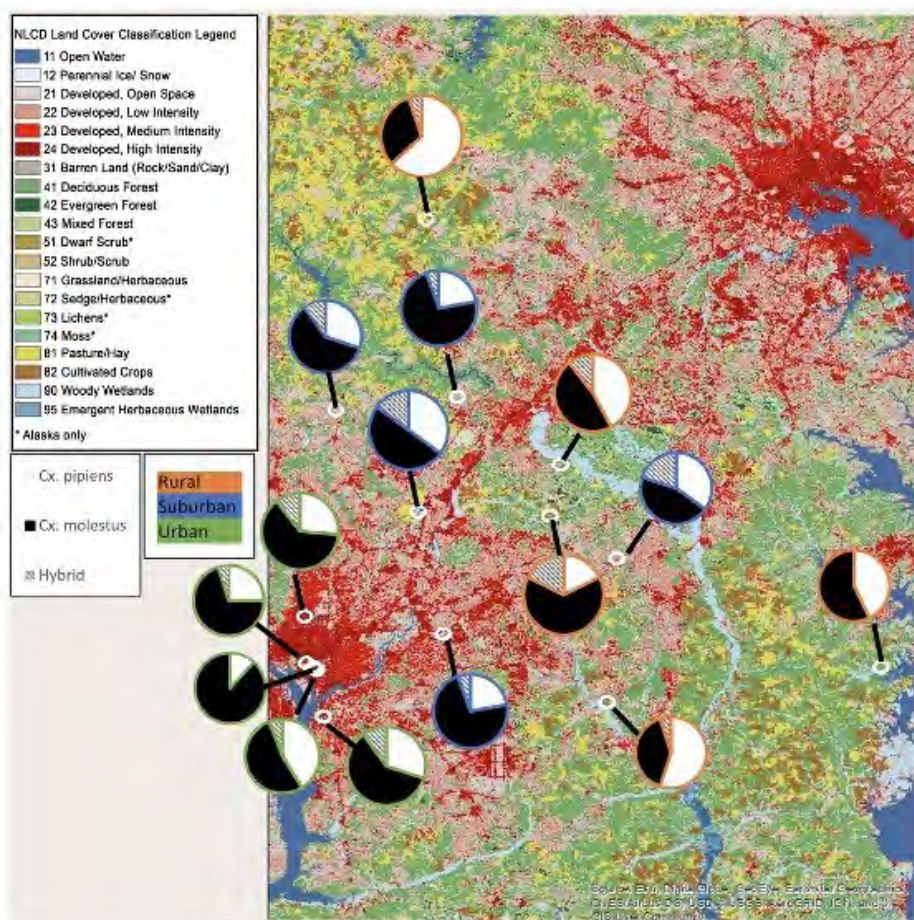


Figure 3. Individual count distribution of pipiens, molestus, and hybrids at each site, overlaid on the NLCD 2016 Land Cover Classification Map.



# Evaluating Late Season Burndown Options for Palmer Amaranth

Ben Beale, Extension Educator, St. Mary's County

Alan Leslie, Extension Educator, Charles County

A common question asked by farmers dealing with herbicide resistant Palmer amaranth is; What are the most effective burndown options in situations where Palmer amaranth is larger than the ideal 3-4 inch control range?" We often encounter this scenario in fields left fallow for a year, fields with delayed planting due to saturated soils, and double crop fields following wheat. In the summer of 2022, we undertook a study evaluating eight different treatments for control of larger Palmer amaranth in Southern Maryland. The study was completed at a site with a history of Glyphosate and ALS resistant Palmer amaranth. The field was fallowed through the spring and early summer, and mowed at a 8 inch height in mid July. At the time of herbicide applications on August 4th, Palmer amaranth was 5-8 inches tall and present at a high density. Most plants were not clipped. See Figure 1. Germination of Palmer amaranth was delayed due to a heavy cover of winter annual weeds. Other weeds present at the site at the time of application included annual foxtail and perennial broomsedge. Enlist soybeans were planted on August 3rd in order to evaluate any potential phytotoxicity or herbicide injury. We evaluated treatments with Roundup, Liberty, Enlist and Gramoxone with some using a non ionic surfactant or crop oil as the adjuvant. We also evaluated combinations of Liberty+Roundup or Liberty+Enlist.

## Treatments:

1. Glyphosate (Roundup Power Max) 32 fl oz/ac + Amm. Sulfate 48 oz/ac
2. Paraquat (Gramoxone SL 2.0) 48 fl oz/ac + Non Ionic Surfactant 6.4 fl oz/ac
3. Paraquat (Gramoxone SL 2.0) 48 fl oz/ac + Crop Oil 32 fl oz/ac
4. Glufosinate (Liberty 280 SL) 43 fl oz/ac + Amm. Sulfate 48 oz/ac + Crop Oil 32 fl oz/ac
5. Glufosinate (Liberty 280 SL) 43 fl oz/ac + Amm. Sulfate 48 oz/ac + Non Ionic Surfactant 6.4 fl oz/ac
6. 2,4-D choline (Enlist One) 32 fl oz/ac + Non Ionic Surfactant 6.4 fl oz/ac
7. Glufosinate (Liberty 280 SL) 43 fl oz/ac + Glyphosate (Roundup Power Max) 32 fl oz/ac + Amm. Sulfate 48 oz/ac + Non Ionic Surfactant 6.4 fl oz/ac
8. Glufosinate (Liberty 280 SL) 43 fl oz/ac + 2,4-D

A randomized complete block design with four replications was used. Plot size was 10 ft. by 30 ft., with 5 ft aisles separating plots and running checks on each side of the plots. Treatments were applied using a ATV plot boom sprayer utilizing TeeJet AIXR 11003 flat fan nozzles at 35 psi applying 20 gallons per acre of spray solution. Application was made on August 4th in the mid-afternoon with clear bright sunshine and air temperature of 90°F. Plots were evaluated for percent control of Palmer amaranth and grass weeds 10, 20, and 30 days after treatment.



Figure 1. Palmer amaranth plants were 5 - 8 inches tall at time of application

## Results:

### Palmer Amaranth Control:

As depicted in Figure 3, treatments containing Gramoxone either with crop oil or a non-ionic surfactant, and the tank mix treatment of Liberty and Enlist One performed well throughout the study. Liberty applied either with non-ionic surfactant or crop oil, and Liberty with Roundup only achieved around 50 % control of Palmer Amaranth. It is notable that all Liberty treatments saw reduction in the level of control as the season progressed. This was evidenced in the field by Palmer amaranth plants suckering out from the base and re-growing approximately 2 weeks after the



application. We did not observe suckering with the Gramoxone treatments or Liberty+Enlist treatments. Surprisingly, Enlist One treatments did not provide acceptable control of larger Palmer Amaranth plants in this study with an average control of around 25%. Enlist One control did gradually increase after the 10 day evaluation most likely due to the systemic nature of the product. As expected, we saw negligible control of Palmer amaranth with Roundup. The evaluation 20 days after treatment provided the clearest assessment of control, with no significant difference between Gramoxone treatments or the Liberty + Enlist One treatments. See Figure 4. Liberty+NIS and Liberty+Crop Oil and Liberty+Roundup were not significantly different from each other, but significantly less effective than Gramoxone or Liberty +Enlist one treatments. Enlist treatment was not significantly different than the Roundup treatment. We should also note that new Palmer amaranth seedlings began to emerge just 20 days after the burn down treatments. Palmer amaranth continues to germinate throughout the summer, especially in open areas where sunlight reaches the soil. Controlling this weed takes a season long approach.

**Grass Control:**

As depicted in Figure 5, all treatments provided a satisfactory level of grass control. While Roundup didn't have any efficacy on resistant Palmer amaranth, the enduring benefit of this product can clearly be seen in control of other tough weeds, such as grasses with 100% control in our study. We saw no reduction in control of the grasses present when Roundup was tank mixed with Liberty. The Gramoxone +NIS treatment had slightly lower grass control at 84%, and was significantly lower than Roundup treatments. Enlist only has activity on broadleaf and was omitted in the analysis for grass control. An interesting question for further study is the potential efficacy of Gramoxone+Roundup treatments.

Figure 3

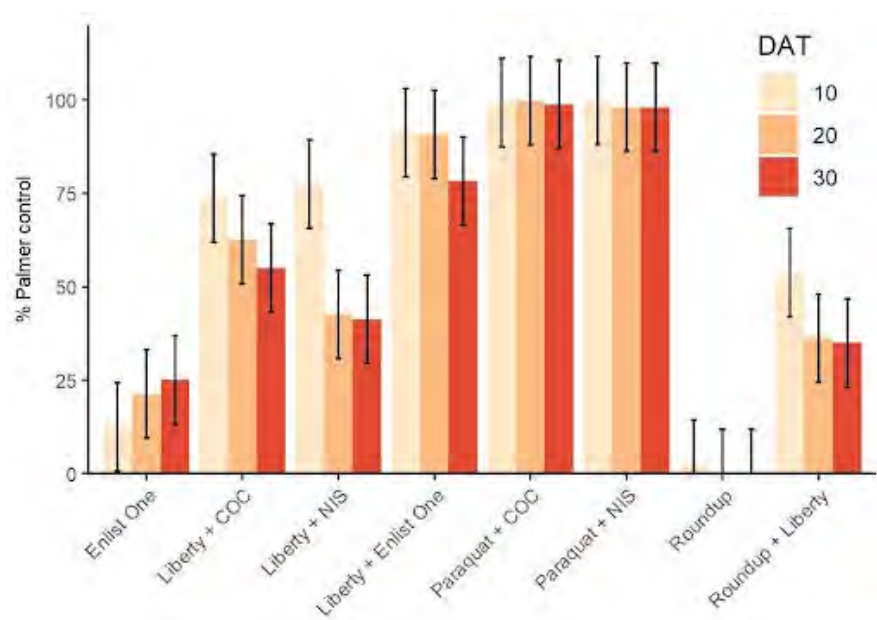


Figure 4

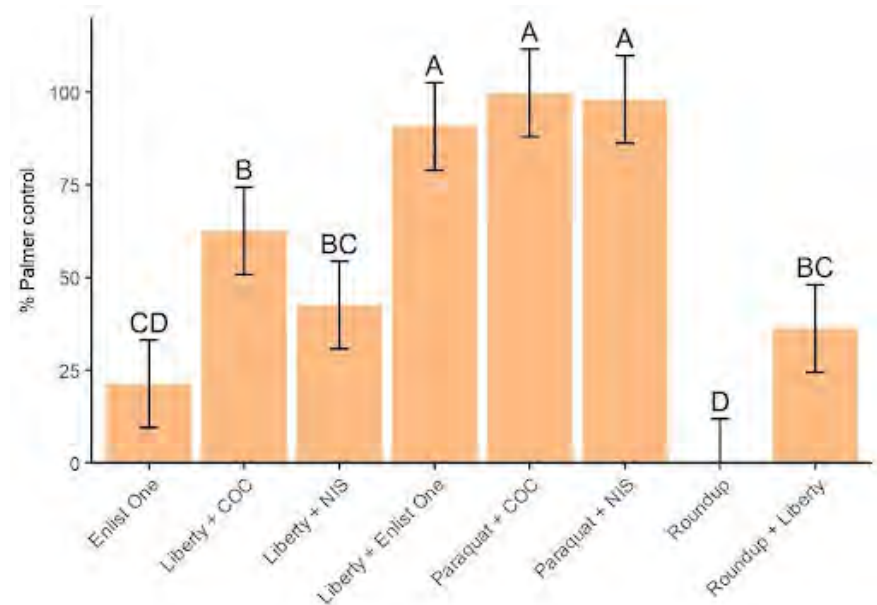
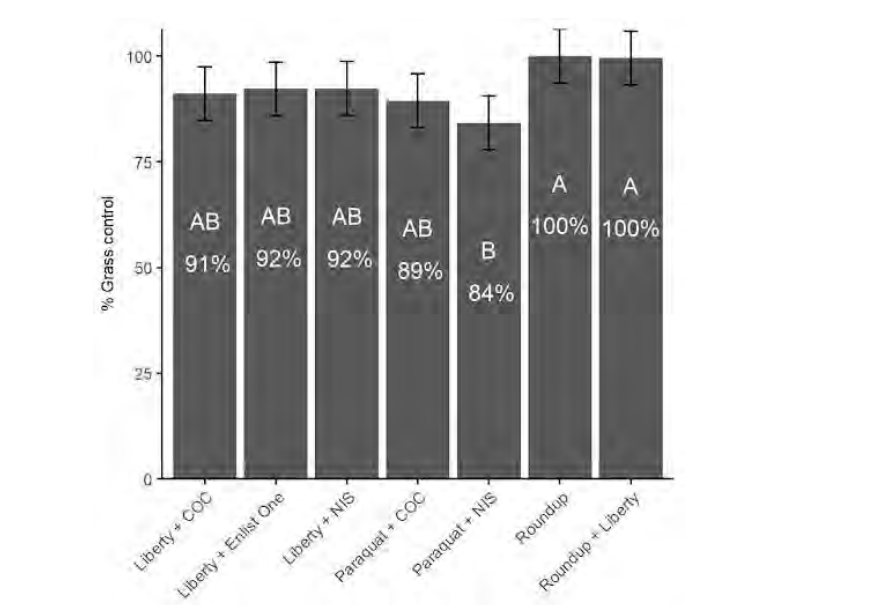


Figure 5





# Performance of blackberry varieties in Southern MD

Alan Leslie

Blackberries are a crop that holds potential for diversified fruit and vegetable operations in the Mid-Atlantic, with options for pick-your-own, direct sale, or wholesale outlets. In general, blackberries are well adapted to growing conditions throughout the Mid-Atlantic, but newer variety releases from state breeding programs in Arkansas and North Carolina have yet to be thoroughly tested in this area. This variety trial was established in 2018 to test six newer varieties at the Central Maryland Research and Education Center in Upper Marlboro, MD. Varieties include Arapaho, Freedom, Natchez, Osage, Ouachita, and Von. All varieties are thornless, floricanes-fruiting types, with the exception of Freedom, which is a thornless, primocane-fruiting variety. For this trial, Freedom was managed as a floricanes-bearing plant, since this variety is advertised as providing both types of harvests. Floricanes varieties produce fruit much earlier than primocane plants, and so one objective of this study was to determine whether these varieties produce fruit early enough in the season to overlap with or compliment the season of June-bearing strawberry production, which has been a staple crop for you-pick operations in Southern MD.

This trial included 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. Primocanes were tipped mid-summer to produce a plant height of around 7'. Spent floricanes were removed and new shoots were pruned in late winter ahead of the growing season.

Yield was measured weekly over the course of four weeks, where all ripe fruit were collected and weighed for each replicate plot. A subsample of fruit was also weighed and counted to produce a measure of the average berry size. The harvest period was initiated when there was enough ripe fruit to support you-pick clientele, and was terminated when ripe berries became scarce. For the 2022 season, the first harvest was on July 5 and the final harvest on July 26. In total, most varieties produced more fruit per plant in 2022 compared to previous years, following a three-year trend of higher yield. Natchez, Osage, and Ouachita all had yields between 2-3 lbs/plant, while Von averaged 4.9 lbs/plant. Freedom had the lowest yield at 0.2 lbs/plant, while Arapaho produced only 0.5 lbs/plant. Results from this third year of evaluation point to Natchez, Osage, Ouachita, and Von as being recommended varieties for local blackberry production in MD, but that the relatively late fruit production will not likely fill the void left at the end of June-bearing strawberry season for you-pick operations.

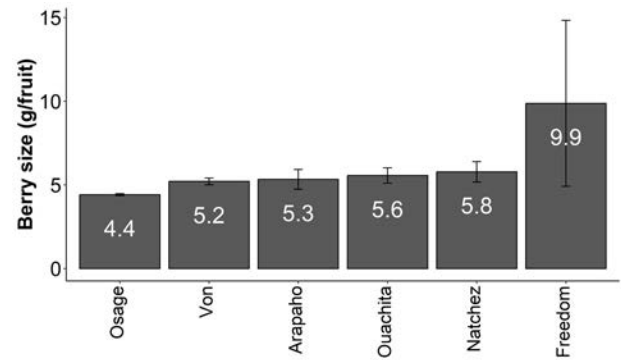


Figure 1. Average berry size measured from random subsamples of all harvested fruit.

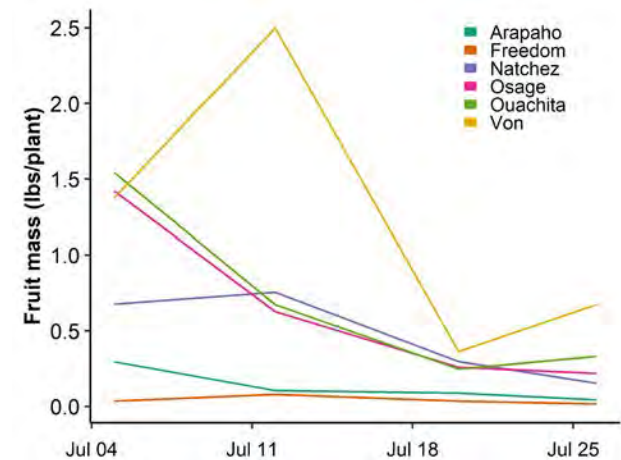


Figure 2. Average yield of each variety as measured across four weekly harvests.

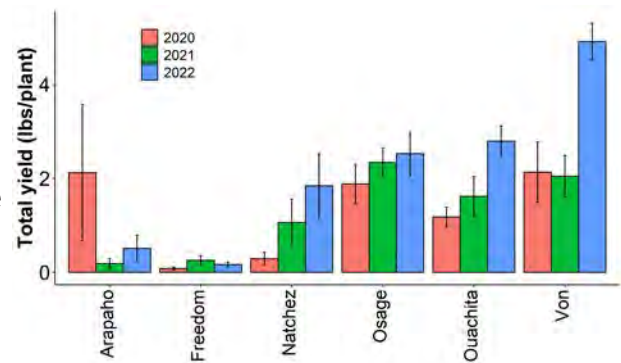


Figure 3. Average total yield per plant of each variety, as measured across three years of the variety trial.



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# Maryland Tobacco Seed Order Form

**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)

Total amount enclosed \$ \_\_\_\_\_

## Shipping Information:

Name: \_\_\_\_\_

Street or PO Box: \_\_\_\_\_

Town, State, Zip: \_\_\_\_\_

Phone Number: \_\_\_\_\_