COLLEGE OF AGRICULTURE & NATURAL RESOURCES

MAES | MARYLAND AGRICULTURAL EXPERIMENT STATION

WMREC Headquarters
Keedysville Facility

ROOTS IN RESEARCH

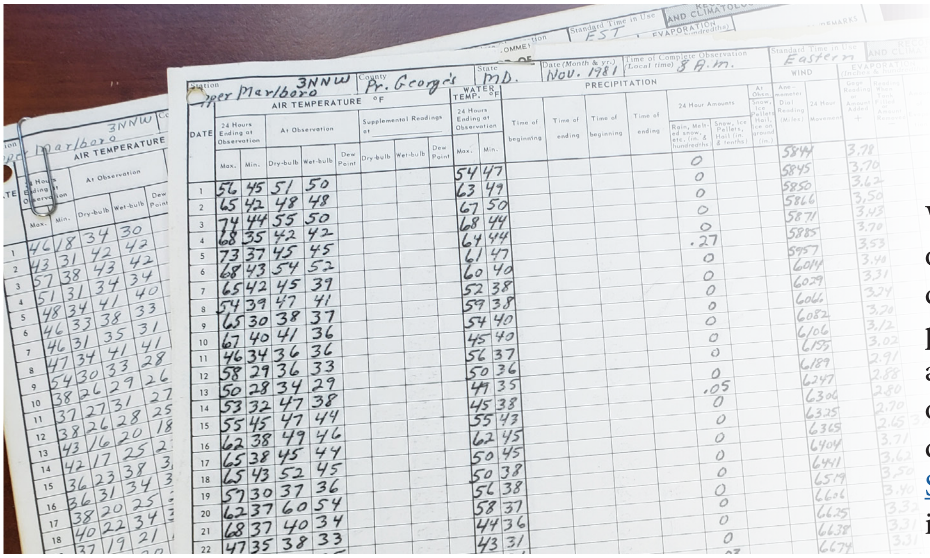
Yield of 2023

The 2023 growing season can be summed up in a single word: “dry.” Changes in rainfall patterns and hot, dry summers are just one of the stresses that MD farmers can expect to face under a changing climate. Many of the research projects carried out at the UMD RECs are helping to find solutions to help farmers cope with drought stress and other climate change factors. From genetic improvements to crops and alternative crop rotations, to cover crop management and climate monitoring, the studies carried out at our RECs are designed to ensure the success of MD agriculture through adaptive and resilient cropping strategies. Enjoy this summary highlighting the hard work that UMD researchers are doing in pursuit of solutions to agriculture’s most pressing problems.

Alan Leslie
MAES Center Director
WMREC | CMREC | LESREC

To view this newsletter electronically, scan the QR code!

In This Issue:



Keedysville Weather Station

Weather data for Keedysville is displayed on our website. 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 Susan Barnes and she will help to get the information you are requesting.

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.

UMD
BEE LAB

You can find Realtime results about these efforts at our database portals: https://research.beeinformed.org/state_reports/

Click here to purchase UMD Honey

Roots in Research
CMREC Beltsville, Clarksville, Turfgrass and Upper Marlboro, LESREC Poplar Hill and Salisbury, and WMREC Keedysville are published by the University of Maryland Extension

Elizabeth McGarry, Editor
emcgarry@umd.edu
301-226-7400
University of Maryland Extension

Sheila Oscar, co-Editor
soscar@umd.edu
410-742-1178 x301
University of Maryland

Optimizing Early Season Pest Management for Maryland Field Corn

Kelly Hamby, Associate Professor and Extension Specialist, Department of Entomology
Maria Cramer, Ph.D. Candidate, Department of Entomology

Field corn insect pest management decisions begin before planting, including selecting hybrids with or without different plant incorporated protectants and/or insecticide seed treatments. At planting, in-furrow insecticides can also be used. These products vary in their efficacy and residual control as well as impacts to beneficial natural enemies that feed upon pests. In addition, they redundantly target many of the same sporadic early season insect pests while potentially not controlling others. We compared pest management efficacy and pest pressure between an untreated control (bare seed), Poncho® 250 (clothianidin 0.25 mg/seed) treated seed, and an in-furrow application of Capture LFR® (bifenthrin 13.6 fl oz/acre.) This experiment was conducted in both a Bt hybrid with a plant incorporated trait package for above ground caterpillars and a non-Bt hybrid, with three replicate plots of each treatment at three farms over three years. Poncho more consistently reduced insect damage than Capture (which did reduce insect damage in non-Bt corn) and also improved stand. However, neither insecticide improved yield even in the one year and location where wireworms were controlled. To better understand their impact on natural enemies, particularly carabid ground beetles that may feed upon slugs, we also compared carabid beetle and slug abundance. In addition, we measured natural enemy feeding activity (predation) by placing sentinel caterpillars in the field overnight and evaluating how many were killed. Predatory carabid beetles commonly occurred and predation ranged from 0-100% across individual sentinel prey cards, with around 16% of the caterpillars killed on average. The insecticide treatments did not impact slugs captured in shelter traps, slug damage, carabid beetle abundance, or amount of predation (caterpillars killed overnight). Ultimately, untreated non-Bt corn yield well at all sites and years of our experiment and the pest pressure we observed did not reach treatment thresholds. Using foliar insecticides to target specific issues as they reach levels of economic concern more effectively and economically controls insect pests.

For more results and details see our Agronomy News Article: https://blog.umd.edu/agronomynews/2023/11/28/optimizing-early-season-pest-management-for-maryland-field-corn/

We would also like to thank the Maryland Grain Producers and Utilization Board for providing funding for this work.

Biological Control Introductions Targeting Spotted-Wing Drosophila

Kelly Hamby, Associate Professor and Extension Specialist, Department of Entomology

Ganaspis brasiliensis wasps being released.

Wasp emerging from SWD pupa

Since its introduction to the continental U.S. in 2008, spotted-wing drosophila (SWD, *Drosophila suzukii*) has become the key insect pest of soft-skinned fruit crops. It can make use of a relatively broad range of crop and non-crop fruits to feed upon and reproduce and populations can build very quickly. Therefore, it is very difficult to manage. After many years of testing in quarantined laboratories to evaluate the risks and benefits of a release, permits were approved to introduce a biological control agent that was found it in its native range: *Ganaspis brasiliensis. G. brasiliensis* are tiny wasps lay their eggs inside SWD larve.
The wasp larva feeds inside the fly larva, which continues to develop until the pupal stage before the wasp larvae kills it. After finishing development, an adult wasp emerges from the pupa instead of SWD. With the help of USDA's Beneficial Insects Introduction Research Unit (USDA-BIIRU) in Newark, DE, we have been releasing *G. brasiliensis* and determining whether they are establishing and parasitizing SWD in non-crop areas and mixed small fruit plantings at the Western Maryland Research and Education Center. Thus far, we have not only found the wasps we released, but also another wasp species, *Leptopilina japonica*, which parasitizes between 0-37% of the SWD pupae collected from different fruit at WMREC.

Research Update: Effect of Soil Fertility on Triticale Yield and Quality

Amanda Grev PhD, Forage and Pasture Specialist, University of Maryland Extension
Jeff Semler, Principal Agent, University of Maryland Extension

It is well known that cover crops can provide many benefits in terms of soil health and nutrient retention, but in addition to this, winter forages can also serve as a high yielding and high quality forage crop for feeding livestock. Winter forages like triticale have been found to yield 2 to 6 tons of dry matter per acre and can produce forage with 180+ RFQ (relative forage quality) and 17 to 20% CP (crude protein). As a result, triticale silage has become a popular forage choice for many dairy producers to increase forage supply.
Given this, triticale has the potential to be not only a high quality forage but also a good source of protein for livestock, potentially even a more economical alternative compared to other feed ingredients such as soybean meal for meeting ration protein needs.
To produce this high yielding, high quality forage, good management is essential. The yield potential for winter forages is largely based on planting date and fall nitrogen availability; these two critical factors determine the number of fall tillers, which sets the yield potential for the following spring. To support these higher yields while maintaining high forage protein concentrations, winter forages require adequate nitrogen and sulfur fertility. Previous research evaluating nitrogen fertility rates for triticale found that providing

additional spring nitrogen was not only successful, but economically advantageous as a means to increase forage protein content and offset soybean meal costs.
With that, the objectives of this study were 1) to investigate the effect of increasing nitrogen (N) fertility rates with and without sulfur (S) on triticale yield and quality, 2) to evaluate production implications when incorporating the forage into dairy cow diets, and 3) to assess the economics of this strategy as a means to meet ration protein needs. This was accomplished via an initial field trial to assess soil nutrient status, forage quality, and forage yield of triticale under varying nitrogen and sulfur fertility treatments, followed by a feeding study to assess dairy cow milk production and performance when fed the resulting forage, and finally an economic analysis to assess the effectiveness of the system.

Methods
Field trials were completed during the winters of 2020-2021, 2021-2022, and 2022-2023. In September of each year, triticale was established in replicated fields at both the Central (Clarksville) and Western (Keedysville) Maryland Research and Education Centers. Fertility treatments included increasing levels of nitrogen with and without the addition of sulfur and are depicted in Table 1. Fertility treatments were applied in March of each year, and soil nitrate samples were collected before and after fertilizer application to test for potential losses due to nitrate leaching. Triticale plots were harvested when forage reached the boot stage in late April. At both locations, plots were harvested mechanically using a forage harvester (Figure 1). Harvested forage was weighed for yield determination and subsamples were taken for forage quality analysis.

Treatment	Nitrogen	Sulfur
	——— *lb/A* ———	
CON	0	0
SUL	0	15
NLOW	50	0
NSLOW	50	15
NMED	100	0
NSMED	100	15
NHIGH	150	0
NSHIGH	150	15

Table 1. Fertility treatments applied to replicated triticale plots

Figure 1. Harvesting triticale forage plots in Keedysville, MD on April 21, 2021

In the fall of 2020 and 2021, triticale was also established in three 5-acre fields at the Clarksville location to provide forage for two feeding studies. The NLOW, NMED, and NHIGH fertility treatments were applied to these fields in March of 2021 and 2022 and the resulting forage was chopped and ensiled using ag bags in late April of each year. With this forage, two feeding studies were completed using Holstein dairy cows at the University of Maryland dairy in Clarksville. Each feeding study was set up as a replicated study design with 28 lactating cows and 4 dietary treatments. Cows were housed in a freestall barn equipped with a Calan door system to allow for individual animal feeding and intake measurements (Figure 2). The standard (ALF) diet contained 60% forage (48% corn silage, 22% alfalfa silage) and 40% concentrate (DM-basis). The LOW, MED, and HIGH diets were formulated by replacing alfalfa silage with NLOW, NMED, or NHIGH triticale silage at a rate of 18-20% of diet DM (Table 2). Cows were randomly assigned to treatments and were fed their respective diet for 21 days before rotating to another treatment; this rotation continued until all cows consumed each dietary treatment. Feed intake, bodyweight, milk production, and milk components were measured throughout each feeding study.

Figure 2. Cows consuming TMR from Calan door system at UMD dairy in Clarksville, MD

Treatment	Corn Silage	Alfalfa Silage	Triticale Silage	Ground Corn	Soybean Meal	Mineral Meal
	% DM					
ALF	48.1	21.9	—	16.4	2.2	11.4
LOW	47.2	—	17.5	16.1	8.0	11.2
MED	47.2	—	18.0	16.1	7.6	11.2
HIGH	47.2	—	19.9	16.1	5.6	11.2

Table 2. Dietary treatments used for dairy feeding studies

Results

Analysis of the results for this study are in progress, but some preliminary results from the first field season (2020-2021) and first feeding study (2021) are presented here. Forage yields for the fertility treatments that included nitrogen were similar but were increased compared to the CON and SUL control treatments (Figure 3). This pattern held true at each location, with yields averaging 2.0 T/A at Clarksville and 2.7 T/A at Keedysville.

At both locations, forage crude protein (CP) concentrations were lowest for the CON and SUL treatments (average 8.7% CP) and increased with increasing fertility, with the NHIGH and NSHIGH treatments containing the greatest amount of protein (average 18% CP; Figure 4). Across all fertility treatments, the addition of sulfur did not further increase forage CP concentrations, likely because fields were not limiting in sulfur prior to this experiment.

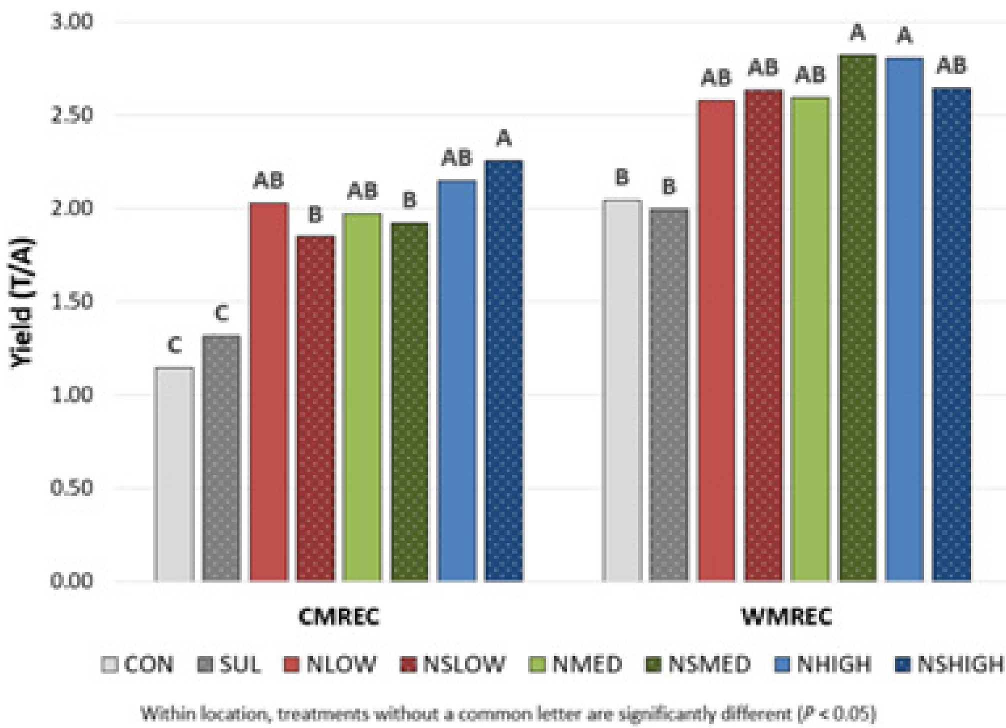


Figure 3. Forage yield for triticale forage plots in Clarksville (CMREC) and Keedysville (WMREC) harvested April 2021

Neutral detergent fiber concentrations did not differ between fertility treatments at either location, averaging 51% across all locations and treatments. Similarly, total digestible nutrients did not differ between fertility treatments at either location, averaging 65% across all locations and treatments. At both locations, nitrate concentrations in soil samples taken both pre- and post-fertilizer application remained minimal, indicating no additional nitrogen losses due to leaching.

Feeding study results found no difference in feed intake or milk production across any of the dietary treatments (Figure 5). Across all treatments, feed intake averaged 51 lb DM/d and milk yields averaged 73 lb/d. Milk components were also similar across dietary treatments, with no differences in milk fat or milk protein concentrations.

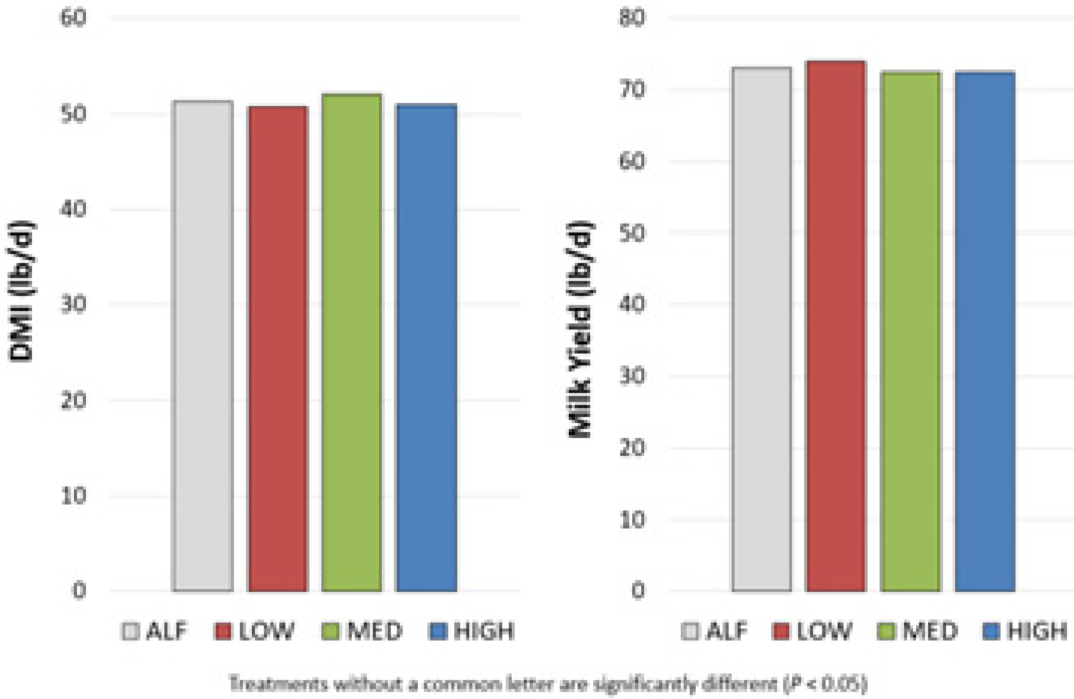


Figure 5. Dry matter intake (left) and milk yield (right) for dairy cows consuming the control (ALF) or triticale (LOW, MED, HIGH) dietary treatments.

Take Home & Conclusions

Overall, these preliminary results indicate that additional nitrogen fertility in the spring does not produce a consistent yield gain for triticale forage. This was not unexpected; as mentioned earlier, it has been shown that spring yield potential is largely set based on planting date and fertility management in the fall. However, results did show that additional spring nitrogen fertility can influence forage protein, with forage protein concentrations increasing from 9 to 18% as additional nitrogen fertilizer was applied. Additionally, low soil nitrate-N concentrations both pre- and post-fertilizer application indicate that there were no leaching losses and that this additional nitrogen was taken up by the triticale forage.

Results from this study also indicate that triticale forage can be used as an alternative to alfalfa silage without affecting milk production or components. Increasing the protein content of triticale silage through nitrogen fertilization did reduce the amount of soybean meal required to maintain dietary crude protein concentrations.

Future Plans

Moving forward, a full analysis of all three years of this study will be completed. Along with this, an economic analysis comparing the cost of meeting ration protein needs through increased soil fertility (i.e. increased triticale protein concentrations) versus through traditional sources such as soybean meal or alfalfa will also be completed. Future studies may compare these triticale fertility treatments against a triticale-annual rye-grass and/or triticale-legume combination.

Acknowledgements

We are grateful for the assistance provided by the staff at both the Clarksville Dairy Farm and the Western Maryland Research and Education Center in support of this study. This study was partially funded by the Maryland Agricultural Experiment Station Competitive Grants Program.

How We Came to Have the 'Monocacy' Hop

Bryan Butler, Agriculture and Food Systems, Carroll County, University of Maryland Extension, 700 Agriculture Center, Westminster, Maryland 21157
Tom Barse, Milkhouse Brewery at Stillpoint Farm, 8253 Dollyhyde Road, Mount Airy, Maryland 21771
Nahla Bassil, USDA-ARS, National Clonal Germplasm Repository, 33447 Peoria Rd., Corvallis, OR 97333
Kim Lewers, USDA-ARS, Beltsville, Agricultural Research Center-West, Genetic Improvement of Fruits and Vegetables Laboratory, Bldg. 010A, 10300 Baltimore Ave. Beltsville, MD 20705

Acknowledgements
This project was funded by USDA Specialty Crop Block Grant Program through the Maryland Department of Agriculture's SCBGP Agreement Number 221501-01, and by the USDA-ARS Projects 2072-21000-049-000-D and 8042-21220-257-00-D.

Discovery
The hop plant was found in the yard of Green Spring Farm in Frederick County, Maryland, in the late 1960's by veterinarian, Dr. Ray Ediger. Green Spring Farm is located at 10521 Old Frederick Rd., Frederick, MD, 21701-1955, at latitude 39.3123N, longitude 77.2341W, and an elevation of 106 m. Although this hop plant's prior history, origin and age are unknown, Green Spring Farm has been continuously farmed by the family of Dr. Ediger's wife, Louise, since 1886 (more than 135 years). The farm is part of the original Carrollton Manor, once owned by Charles Carroll, a signer of the Declaration of Independence. The Edigers took over farming at Green Spring in 1992 upon the death of Louise's mother, Daisy Stull. Initially, it was a dairy and crop farm; the dairy cattle were subsequently replaced with beef cattle. When Dr. Ediger moved to the property and began to clean up the overgrown grounds around the farm buildings, he noticed the hop plant, recognizing it as a hop plant, and not just a vine-like weed, because he had grown up in Oregon and handpicked hops on a local farm in his youth to earn extra money during the summers. He thought it was interesting to have a hop plant in his yard, so he left it alone and allowed it to grow. The hop plant was very fortunate to be found by someone who recognized it. At the time, there were very few hop plants in Maryland and no hop yards. Although, prior to prohibition, approximately 10-20 % of the hops used in the breweries in Baltimore were grown in this area. Following prohibition, the production of hops left Maryland as well as most of the mid-Atlantic and moved to the Pacific Northwest and did not return until the early 2000s.

Dr. Ediger did not realize at the time how rare it was to have a hop plant growing on his farm. He allowed it to grow on the fence along the farm lane and then subsequently up and over the yard he built for his chickens and other farm fowl. The hop provided shade in the hot summer and died back each fall allowing the sun to shine into the yard, warming the area in the pen. The plant grew well and produced hop cones every year with no specific management other than clearing the dead bines in the spring. The plant received no insect, mite, or disease control whatsoever from the 1960s to the present and more than likely, nothing before then either. Dr. Ediger simply enjoyed the seasonal maturation and development of the plant each year and did not use the cones.

The plant is located near a farm lane that had been used to move cattle to and from the barn. The hop likely was planted in the corner of a cottage garden between the house and the barn, as was the practice. The soil the hop is growing in is a Readington silt loam with a 3-8 percent slope. The soil is deep to very deep, moderately well drained, and formed from weathered noncalcareous shale, siltstone, and fine-grained sandstone. It is medium textured with a strong medium granular structure, friable and slightly sticky. The mean annual precipitation is 43 inches, and the mean annual temperature is 53 ˚F.

Initial use in brewing

When Tom Barse, an avid home brewer since 1972, and Carolann McConaughy bought their farm in Mount Airy, Maryland, in the Spring of 2008, a one-acre hopyard of 'Cascade' and 'Chinook' hops was planted. Working with other Maryland farmers, brewers, and local elected officials, Tom helped get Maryland's Farm Brewery law enacted in 2012 (https://maryland.lawi.us/2012-regular- session-hb-1126/). Shortly thereafter, Milkhouse Brewery at Stillpoint Farm was established, and the tasting room opened in June 2013. Tom and Carolann had established Maryland's first Class 8 farm brewery.

Figure 1. Dr. Ray Ediger (left) and Mr. Tom Barse (right) standing in front of the original 'Monocacy' hop plant discovered on Green Springs Farm in Maryland.

In March, 2013, at an event honoring former Frederick County Farm Bureau president Tom Browning at Linganore Wine Cellars in Frederick County, Tom Barse met Dr. Ray Ediger and shared his interests in increasing his use of Maryland ingredients at his brewery (Fig. 1). Dr. Ediger shared the information about his hop and offered Tom some hop cones in exchange for a beer if Tom would use the hops in brewing. Tom brewed a few beers with it and felt the hop made a good addition to some of the beers at the Milkhouse Brewery due to its spicy, floral, and fruity aromatic qualities. Tom Barse shared his interest in the Green Spring Farm hop plant with some home brewers, who made a few very small batches of beer with a limited supply of cones combined with cones from other hops sources.

Propagation

Tom dug up a few rhizomes of the Green Spring Farm hop, and he and a couple of home brewers tried to grow the hop with somewhat limited success. The hop showed promise but was not being grown in a commercial setting where it could be managed to maximize quality and quantity. Although it does make rhizomes, it is somewhat more challenging to propagate through standard methods than some other commercial varieties.

In 2017, Bryan Butler, with the University of Maryland Extension (UME) propagated the Green Spring Farms hop using indoor two-node vegetative propagation from new bine growth. Vigorously growing bines were cut to two nodes and four leaves with the lower two leaves removed and one of the upper leaves removed. The lower ½ inch of the bine was moistened, dipped in Take Root Rooting Hormone, a 0.1% powder of Indole-3-butyric acid (United Industries, St Louis, MO, USA), and plugged into Southern States Premium Tobacco and Vegetable Mix potting soil (Southern States Cooperative Richmond, Va. USA) in 48-cell plug trays. The plugs were moistened and covered with clear plastic sandwich bags for 10-14 days to prevent the wilting while the roots developed on the bine plugs. Plants stayed in the plug tray for two more weeks and were then transplanted into 4-inch pots for at least four

Figure 2. 'Monocacy' hop plants, four to six weeks old, growing in 4" pots.

weeks to develop a strong root system that would begin to fill the pot (Fig. 2). The potted plants were hardened off by moving them outside to a shady area where the received about two hours of full sun per day and were transplanted to a field about two weeks later. This type of propagation proved to be much more effective than growing the plant from rhizomes.

Hop yard establishment

The Green Spring Farms hop plants were established in an existing Maryland hop trial in 2018 with 23 other varieties at the Western Maryland Research and Education Center (WMREC) in Keedysville, Maryland (Butler, 2018). Initially, collecting material to propagate was a bit of a challenge, and other factors played a role in delaying the first meaningful harvest until 2020. Unfortunately, two weeks prior to harvest, a severe storm destroyed the entire ½ acre hop yard making harvest of any quantity impossible. A new hop yard was established in 2022 at WMREC with approximately 200 plants of the Green Springs Farm hop genotype alone and managed as a commercial hop yard.

Plant description

Like 'Centennial,' the Green Springs Farm hop has a clavate growth form (general thickening towards the distal ends). The hop grows primarily from a central crown and does not make many rhizomes; it is not a prolific spreader. The Green Springs Farm hop has noticeably robust bines, with a diameter two to four times that of 'Centennial'. The hop is tall, growing 20 ft high in Maryland (Fig. 3); for comparison, a commercially grown hop in the Pacific Northwest is considered tall at 16 ft. The bines have very long lateral branches often exceeding 3m, much larger than 'Centennial' at around 0.6 to 1.3 m. The plants are large enough to slide down the support wires in a hurricane or thunderstorm but can easily be propped up again afterwards. The extensive lateral development has presented a challenge at times with mechanical harvest using a Hopster 5P (MitoTechnologies, Rochester, New York) but a WHE 170 hop harvester (Wolf Hop Harvesters, Wilków, Lubelskie Province, Poland) is capable of harvesting these large plants. Continued work on management, including plant spacing, support structures, pruning, shearing, and especially crowning is needed to increase yield and refine the optimal maturity time. Crowning in Maryland is done in early May to remove old growth from the previous year and the current year's new growth. Most conventional varieties grown in Maryland mature in early to mid-August, but the Green Springs Farm hop has been harvested over a month later in late September to early October. Although the planting and its management must be maintained for this longer period, the harvest process is more pleasant in the cooler weather, and the less humid conditions facilitate drying.

The Green Springs Farm hop is more resilient than other cultivars in Maryland's highly variable weather. It is tolerant of two-spotted spider mites, potato leafhoppers, and hop downy mildew caused by Pseudoperonospora humuli. This hop does become infected by powdery mildew, especially when it is not grown in an open environment; however, when infected, it does not appear to suffer a significant loss of vigor. To this point, successful control has been achieved with applications of 1 or 2% horticultural oil sprays (Damoil, Drexel Chemical Co., Memphis, Tennessee). The Green Springs Farms hop is easy to care for and makes a good photographic background or ornamental hop for a brewery entrance.

The large plant size represents the potential for very high yields. Indeed, the first harvest from Maryland hop plants is typically just a few ounces per plant, while the first yield from the Green Springs Farm hop wand almost a pound per plant. The true yield potential is not yet known, because measurements so far were conducted on plants that were not crowned.

The Green Springs Farm hop produces medium to large, open cones in large loose clusters on the laterals of the plant (Fig. 3B). They are distributed in the upper, outside half of the plant. Seedless cone average diameter is 18.6 mm and the length is 33.6mm. The average wet weight is 0.80g with 24% dry matter (DM); the average dry weight is 0.182g at 10% moisture. Cone bracts tend to be brown on the tips at maturity and average 15.8 mm long; the bracteole measurement averages 17.3 mm. The abundant yellow lupulin (the hop pollen containing the aromatic acids and oils that contribute unique scents and flavors to a beer) develops evenly from tip to base of the cones. The hop cones have an herbal-floral aroma.

Molecular fingerprinting

The robust growth, visually different architecture, and mildew and insect pest resistance of the hop plant found at Green Springs Farm made it stand out from the two hops cultivars grown by Tom Barse, 'Cascade' and 'Chinook'. When Tom first found out about the hop, he initially believed it was probably an old 'Cluster' variety from one of the hop farms in Frederick County that existed in the 19th century. The hop plant at Green Springs Farm also was noticeably different from the several cultivars that were growing in the storm-damaged research plot at WMREC. Even so, it would not have been surprising to find that the hop plant found at Green Springs Farm was identical to an old cultivar previously used in Maryland brewing.

The US hop collection is maintained by USDA-ARS National Plant Germplasm System at Corvallis, Oregon in the National Clonal Germplasm Repository (NCGR). There, the identity and relatedness of hop plants are established through molecular fingerprinting by Dr. Nahla Bassil, a Plant Molecular Geneticist. Earlier, another hop plant had been donated to the University of Maryland Extension Service program by a family in Washington County, MD. The family thought the plant predated prohibition and had been grown and used by their family for several generations. Dr. Bassil determined that plant was in fact 'Centennial', released in 1991 by Washington State University (Kenny and Zimmerman, 1991).

Dr. Bassil compared the DNA from the hop plant found at Green Springs Farm to that of 629 genotypes representing the majority (354) of the USDA ARS National hop collection, 249 diverse accessions from the USDA-ARS hops breeding program at Corvallis, and 26 from the University of Nebraska. The hop plant from Green Springs Farm was unlike all other genotypes in the comparison, was unrelated to the included cultivars, and was most similar to wild American accessions from the NCGR (Fig. 4).

Figure 3. Large attractive 'Monocacy' hop plants (A, B). Cones of the original 'Monocacy' plant growing on Dr. Ediger's Green Springs Farm (B).

Dr. Ediger, Tom Barse, and Bryan Butler decided to name the hop plant from Green Springs Farm 'Monocacy', because the plant was found in the Monocacy River Watershed, and all three individuals have farms in the watershed. Dr. Ediger donated the hop now known as 'Monocacy' to Bryan Butler and Tom Barse to research and determine the usefulness of this hop for brewers in Maryland, and beyond, for its characteristics for bittering, aroma, or for breeding to increase tolerance to Mid-Atlantic climate and pest pressures. 'Monocacy' is available from the NCGR for research purposes, and information about it, under PI 700807, CHUM 1646.001, is available at https://npgsweb.ars-grin.gov/gringlobal/accessiondetail?id=2138182.

Chemical composition

Once it was determined that 'Monocacy' was unique, its cones were tested for chemical (acids and oils) composition, and additional chemical composition tests have been made each year to ensure consistency. The hops were tested by Advanced Analytical Research (AAR) of Madison, Wisconsin. The hop has unique acid and oil components, which suggested that a lighter beer, using several different hopping methods would best reveal its contributions to flavor. The total oil content was 0.31 ml/100g. The hop had a 0.56 ratio of alpha to beta acids; alpha acid was 2.73% and beta acid was 4.88%. Cohumulone composition was 52.5% and colupulone was 74%. The 0.54 to 0.59 ratio of alpha to beta acids has not been problematic in the brewing process so far, but it is rather unusual, a reverse of most hops, and could contribute to a beer that is not overly bitter. With low alpha acids, the hop seems appropriate to be a potential aroma hop like U.S. Saaz, Fuggle, or Crystal, but with the very high beta acid it might have some bittering potential in certain lighter bodied beers.

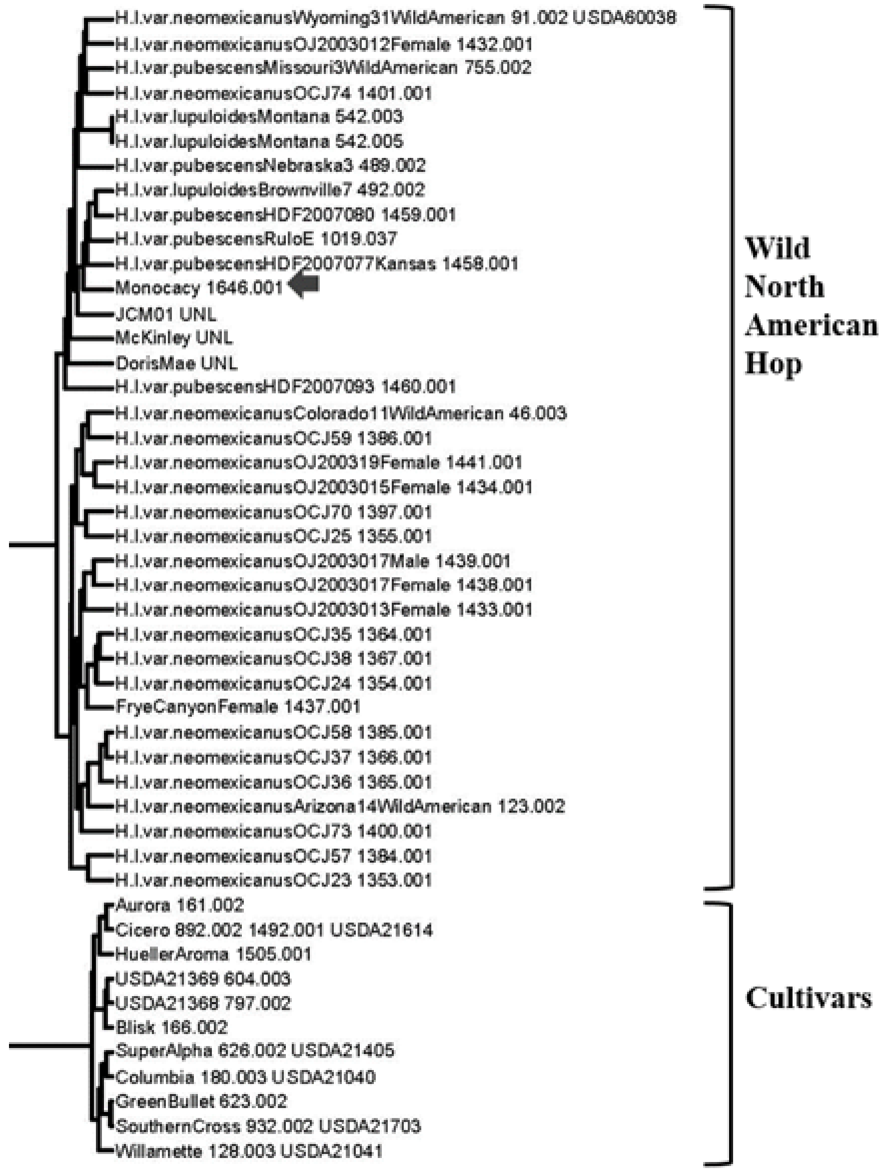


Figure 4. This image shows that 'Monocacy' (indicated by black arrow) groups with wild North American genotypes that were tested yet has a unique molecular fingerprint. It did not group with hop cultivars. This tree contains the North American genotypes and some of the cultivars from Figure 3 of Driskill et al., 2022 available at https://journals.plos.org/plosone/article/figure?id=10.1371/journal.pone.0257746.g0033.

Essential oils include unusually high myrcene and caryophyllene components, which tend to lend a strong "hoppy" aroma of fresh hop, an earthy flavor and clove-like spicy note, as well as a stone-fruit sweetness in the aroma of a beer. The composition of the major essential oils for 'Monocacy' averaged 12.85% myrcene, 1.39% humulene, and 38.13% caryophyllene. The caryophyllene qualities can get lost with heat and do best in a dry hop environment in most beers. The higher myrcene and caryophyllene suggest a similar oil composition to Central European "Saazer" type of hops, which are also spicy and floral in character, as well as very low in alpha acid.

Additional use in brewing

Brewing evaluations of 'Monocacy' have been favorable. The floral, spicy, and fruity characteristics are more evident in lighter beers compared to other Maryland grown hops. Prior to chemical analysis by AAR, the hop was utilized by Milkhouse Brewery as a finishing hop in pilot batches, frequently in the whirlpool, or more often as a dry-hop to finish various cask ales served at the brewery. 'Monocacy' added an earthy and spicy note to lighter beers, and in some beers when used as a dry hop it added a light fruity note on the pallet in the finish.

The first single hop beer was made with 'Monocacy' in the Fall of 2020. To maximize the flavor and aroma components of 'Monocacy', a medium bodied "American Style" pale ale was brewed using all Maryland grown grain and using 'Monocacy' for all phases of the brewing process including in the boil for bittering, at flame-out in the whirlpool for flavor, and for dry-hopping in the fermenter for aroma. This beer was brewed as a half-barrel experimental brew. Hops for this brew were hand-picked in late September/early October 2020 from the original 'Monocacy' plant on Green Springs Farm. The hop cones contained 26 per cent dry matter when harvested and were dried in an oast to 92 per cent dry matter over screens with air flowing at 100 ˚F. After drying, the hop cones were not overly friable and maintained reasonable shape and continued to be highly aromatic. Hops were vacuum sealed and kept at 38 ˚F. until brew day.

The beer was brewed on October 26, 2020. The grain bill included Maryland-grown and -malted pale malt, as well as Maryland-grown and -malted Pilsner, Munich and malted wheat. The brewing process started with an infusion mash at 150 degrees Fahrenheit for one hour, then ½ hour vorlauf (circulation of wort), and after sparging (rinsing the grains to remove sugar from the grains while transferring the wort into the brew kettle), the kettle-full original specific gravity reached 1.041. Due to the low alpha acid content of 'Monocacy', wort was boiled for 60 minutes with the equivalent of 1.55 lbs. of the hop per barrel. Then the equivalent of 0.775 lbs./barrel of hops were added at flame-out (turning off the heat) during whirlpool (spinning the wort so the solid matter collects at the center and falls to the bottom of the brew kettle). Wort was chilled to 68 ˚F, fermented through primary fermentation and the equivalent of 0.775 lbs. of hops were added for dry hopping. After fermentation was complete, final specific gravity was 1.006. Then it was transferred to the bright tank to clear. The beer was carbonated to 2.8 volumes of CO_2 and bottled in 500 ml bottles for release in December of 2020.

The beer's final alcohol by volume (ABV) is 4.5, and international bitterness unit (IBU) is 23. The beer had a medium-light body with a bisquity malt aroma and delicate "spicy/hoppy" nose. The flavor was lightly malt forward (more malt than bitterness) with a noticeable earthy hop flavor, mild bitterness, and a spice note at the beginning of the pallet with a distinct but light stone fruit sweetness at the back of the pallet. The hop notes were reminiscent of a mix of 'American Saaz' and 'Southern Cross' from New Zealand. First impressions of brewing exclusively with this hop were that it is worth much more study. It has good finishing characteristics, and should make an interesting addition to any lighter beer such as a Kolsch, pale ale, lighter lagers, amber ales, lighter Belgian style ales, etc.

Launch

One 7 February 2023, the Brewers Association of Maryland, Milkhouse Brewery at Stillpoint Farm, the University of Maryland Extension, and Grow & Fortify hosted the inaugural tapping of three beers made with 'Monocacy' hop: an American Lager, a Vienna Lager, and a pale ale. Present were several dignitaries, including the Maryland Secretary of Agriculture, Mr. Kevin Atticks. Samples were distributed to participants for sensory evaluation using spider charts. Each participant was allowed to select a bottle of their favorite of the three ales to take home (Fig.5).

Figure 5. The label of the American Lager evaluated for sensory evaluation at the inaugural tapping of three beers made from 'Monocacy' hop.

2023 Maryland Soybean Fungicide Efficacy Trials

Andrew Kness, Senior Agriculture Extension Agent
University of Maryland Extension
akness@umd.edu

JUSTIFICATION

Fungicides are becoming increasingly popular in full season soybean production. These trials provide data that soybean producers can benefit from, such as: fungicide efficacy for managing common fungal diseases of soybean, monitor fungicide resistant pest populations, and track the economic impact of foliar fungicide applications over multiple years and environments unique to Maryland.

RESEARCH OBJECTIVES

1. Evaluate the efficacy of select foliar fungicides on full season soybeans grown on two research farms in Maryland by measuring foliar disease incidence and severity.
2. Determine any greening or green stem effects of the fungicides.
3. Monitor fungicide active ingredient efficacy over time and identify any fungicide insensitive foliar fungal pathogens.
4. Determine the yield impact of foliar fungicides and their economic impact.

METHODS

Plot Design
Field trials were established at three University of Maryland Research farms: Western Maryland Research & Education Center in Keedysville, MD (WMREC), Wye Research and Education Center in Queenstown, MD (WYE), and Central Maryland Research & Education Center (CMREC). Plots were 11’x30’ arranged in a randomize complete block design with five replicates. Planting details are outlined in Table 1. Plots were planted behind soybeans in order to create conditions conducive for developing foliar diseases on soybean.

Project supported by the Maryland Soybean Board

Table 1. Planting and harvest specifications.

	WMREC	CMREC	WYE
Seed:	**-------------------------Soybean, Mid-Atlantic Seed 3220E3-------------------------**		
Previous Crop:	**--Soybean--**		
Tillage	**---No till---**		
Plant Date: **Planter:** **Row Spacing:** **Population:**	**5/16/2023** **John Deere 1750** **30"** **150,000 seeds/acre**	**5/22/2023** **John Deere 1590** **7.5"** **150,000 seeds/acre**	**5/18/2023** **Great Plains EWNT-10** **7.5"** **150,000 seeds/acre**
Harvest Date:	**11/9/2023**	**11/7/2023**	**10/24/2023**
Harvester:	--------------------------------Almaco R1 research combine--------------------------------		
Harvest Area:	----------------------------------30' from Center 5' of plot-------------------------------------		

Fungicide Applications

Fungicides (Table 2) were applied at the R3 growth stage (August 9 at WMREC and CMREC and August 2 at WYE) using a CO2 powered backpack sprayer equipped with TeeJet 8003 nozzles calibrated to deliver 20 GPA at 35 psi to the center 80 inches of each plot. Some plots had two fungicide treatments, the first at R3 and the second 14 days later with (R3+14 days). These applications were made on August 16 at WYE and August 23 at WMREC and CMREC.

Table 2. Fungicide treatments.

Treatment	Product Name Active Ingredient(s)	Application Rate (& Timing)
Non-treated Control	None	N/A
Headline	Headline 2.09 EC/SC *Pyraclostrobin*	12.0 fl oz/A (R3)
Veltyma	Veltyma *Mefentrifluconazole + Pyraclostrobin*	10.0 fl oz/A (R3)
Priaxor	Priaxor 4.7 SC *Pyraclostrobin + Fluxapyroxad*	8.0 fl oz/A (R3)
Lucento	Lucento 4.17 CS *Bixafen + Flutriafol*	5.5 fl oz/A (R3)
Topguard EQ	*Topguard EQ 4.29 EC* *Azoxystrobin + Flutriafol*	8.0 fl oz/A (R3)
Revytek	Revytek *Fluxapyroxad + Pyraclostrobin + Mefentrifluconazole*	15.0 fl oz/A (R3)
Revytek @ R3+14 days	Revytek *Fluxapyroxad + Pyraclostrobin + Mefentrifluconazole*	5.0 fl oz/A (R3 and R3+14 days)
Adastrio	Adastrio 4 SC *Azoxystrobin + Fluindapyr + Flutriafol*	5.5 fl oz/A (R3)
Adastrio @ R3+14 days	Adastrio 4 SC *Azoxystrobin + Fluindapyr + Flutriafol*	5.5 fl oz/A (R3 and R3+14 days)

Disease Rating
Foliar diseases were rated prior to fungicide application at R3 and approximately every two weeks following until approximately R6. Disease severity from frogeye leaf spot (FLS; Cercospora sojina) was visually rated as the percent leaf area infected in the upper canopy from the center rows of each plot (four rows for 15-inch row spacing plots and two rows of the 30-inch row spacing plots). Frogeye leaf spot is typically the most prevalent foliar fungal disease in Maryland soybean production..

Harvest and Statistics
Yield data were collected by harvesting the center 5 feet of each plot using an Almaco R1 research combine. All yields reported are adjusted to 13% moisture. Harvest dates are shown in Table 1. Statistics related to profitability and economics were calculated using the local cash market price for soybean of $13.05 per bushel at the time of analysis. Data were analyzed using ANOVA and significant differences between treatments were separated using Fisher's Least Significant Difference (LSD; α=0.10).

RESULTS & DISCUSSION

Disease Rating
Growing conditions were generally not favorable for disease development and we did not observe any ratable fungal diseases at any of the three trial locations. This is likely due to the weather conditions around pod fill, as well as the resistance package in the soybean variety; Mid-Atlantic Seed '3220E3' has a frogeye leafspot resistance rating of 6 on a 10-point scale (10 being the most resistant). This is now the third year in a row where no ratable foliar diseases were present in these plots.

Yield
Yields (Figure 1 and Table 2) varied greatly between locations. Yield average at WMREC was 45.5, 61.2 at CMREC, and 74.7 bushels per acre at WYE. Yields at WMREC were suppressed due to the drought in western Maryland. Statistically, there were no significant differences between fungicide treatments and the non-treated control at any of the trial locations (P=0.4331 at WMREC, P=0.6580 at CMREC, and P=0.4056 at WYE). There were also no significant differences in grain moisture or test weight.

	WMREC			CMREC			WYE		
Treatment	Yield (bu/A)	Moisture (%)	Test Wt. (lbs)	Yield (bu/A)	Moisture (%)	Test Wt. (lbs)	Yield (bu/A)	Moisture (%)	Test Wt. (lbs)
Control	42.4	11.6	55.5	60.6	14.7	57.5	73.0	12.4	57.7
Headline	46.6	11.8	56.9.	63.8	14.3	57.1	76.0	12.3	57.8
Veltyma	49.8	11.7	59.1	60.8	14.4	56.5	77.2	12.2	57.6
Priaxor	47.4	11.8	55.3	63.1	14.3	58.2	74.7	12.3	56.8
Lucento	46.7	11.9	58.5	58.8	14.6	58.0	78.0	12.2	57.4
Topguard EQ	42.2	11.9	58.3	57.6	14.7	57.1	72.4	12.5	57.1
Revytek	45.7	11.9	58.7	66.8	14.1	57.9	74.5	12.3	57.6
Revytek @ R3+14 days	43.4	11.9	59.0	58.8	14.7	57.5	77.6	12.2	57.6
Adastrio	47.8	11.9	58.8	63.6	14.3	57.8	72.0	12.4	57.4
Adastrio @ R3+14 days	43.3	11.8	56.3	56.9	14.7	58.2	72.0	12.4	57.5
P Value	0.4331	0.8806	0.7567	0.6580	0.3267	0.6191	0.4046	0.2030	0.7071

Table 2. 2023 Harvest Data.

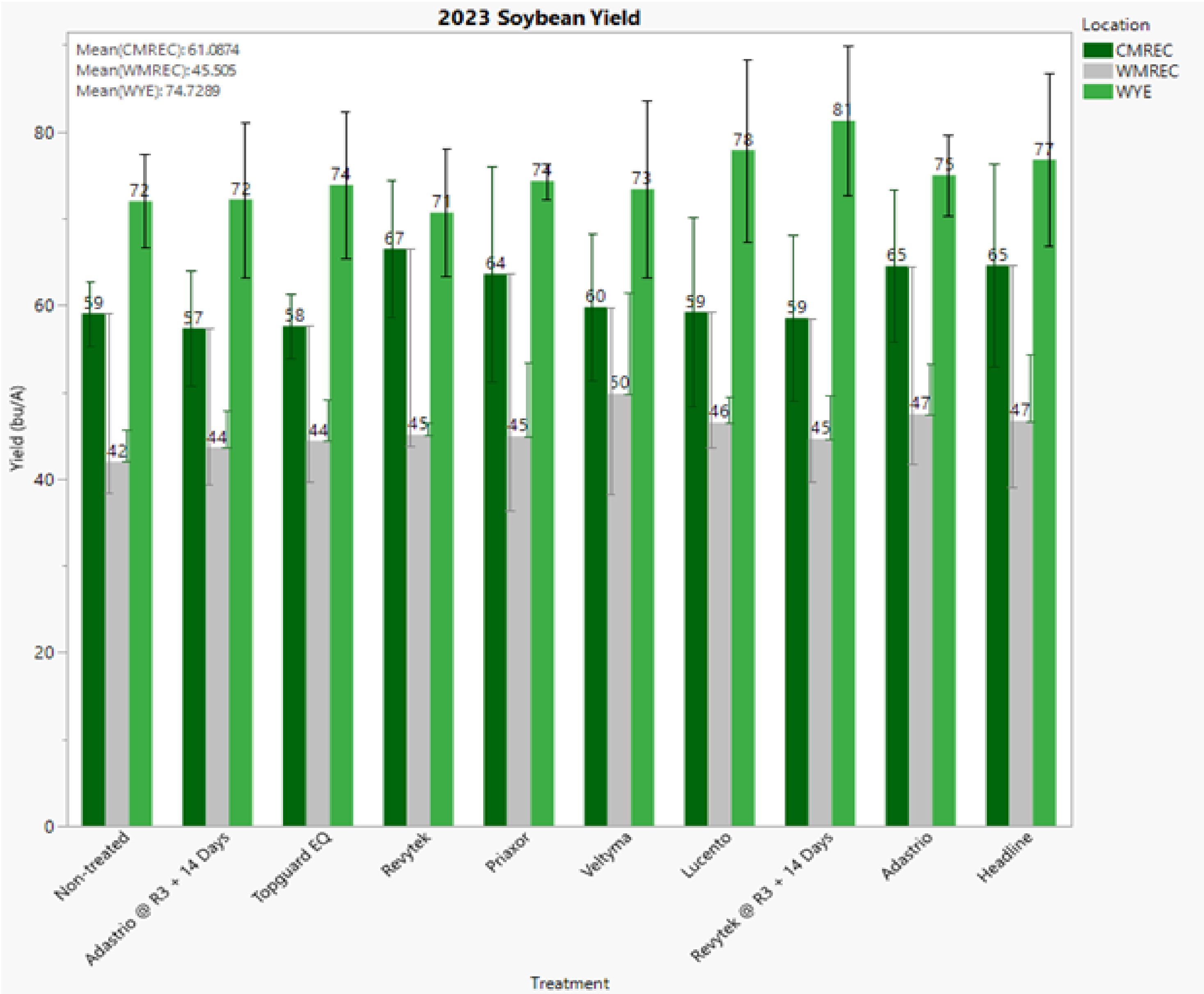


Figure 1. Soybean grain yield by location. Each error bar is constructed using 1 standard deviation from the mean. No significant differences between treatments at each location (α=0.10).

Since there was a significant difference in yield between locations (P<0.0001), relative yield was calculated and used to compare yields across locations. Relative yield was calculated by dividing the plot yield by the non-treated control plot yield and reported as a percentage. Values greater than 100 represent a yield greater than the control and values less than 100 represent a yield less than the control. When data were combined this way, no significant differences were observed between treatments (P=0.6901, Figure 2).

Green Stem

It is common for fungicides to keep plants greener for longer, and we observed a significant difference in plant greenness prior to harvest in plots that received a fungicide application. Both the single application at R3 and the double application at R3 and R3+14 days significantly increased green stem compared to the non-treated control (p=0.0221).

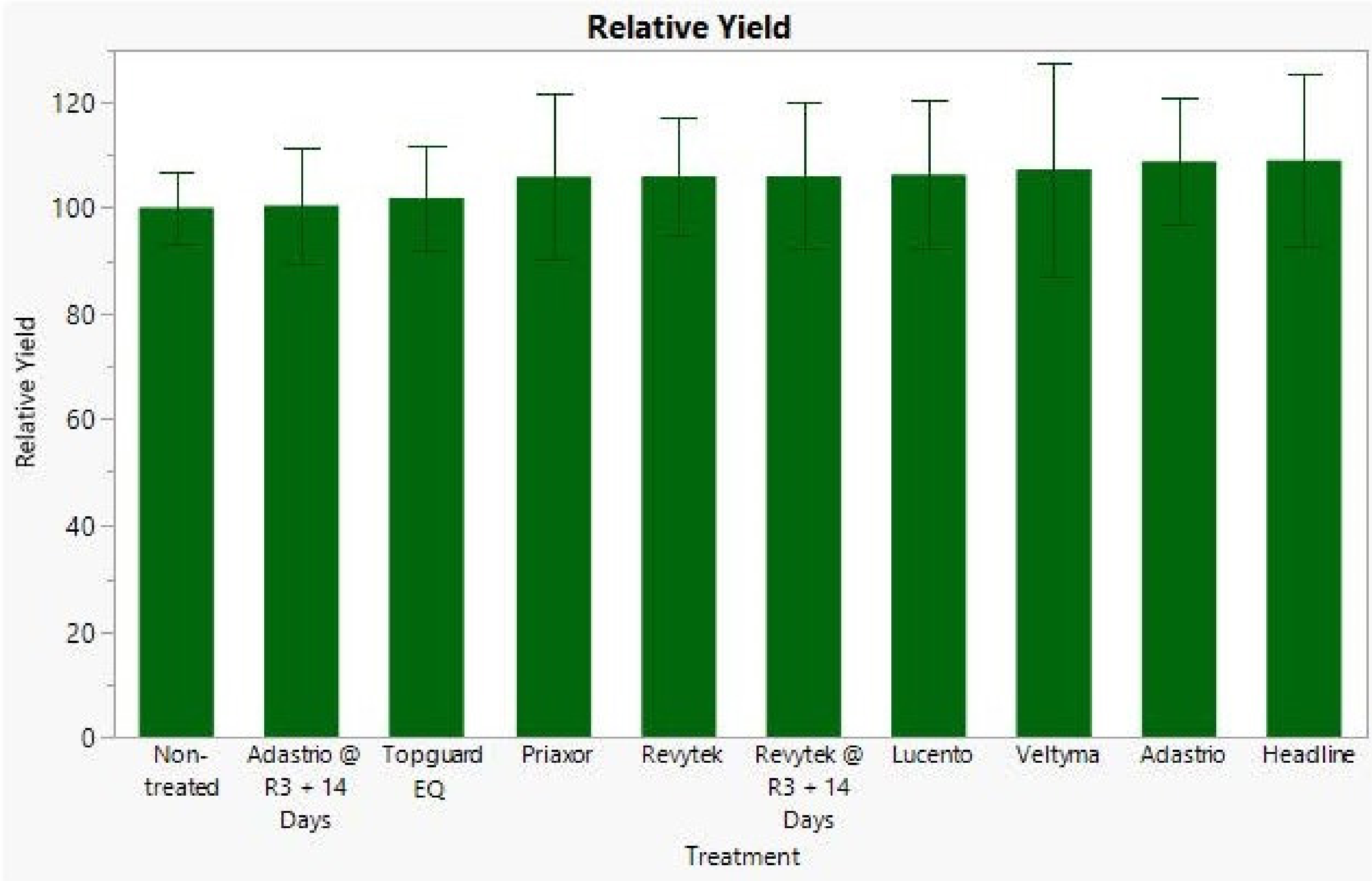


Figure 2. Relative grain yield of all site locations combined. Each error bar is constructed using 1 standard deviation from the mean. No significant differences between treatments (α=0.10).

CONCLUSIONS, IMPLICATIONS, AND FUTURE WORK

In previous years of this study, foliar fungicide applications with the selected products tested provided some benefit related to improved seed quality and yield in situations where FLS disease pressure was present at measurable levels (2018-2019). Fungicides also significantly increased plant greenness and delayed senescence.

During the 2023 growing season, however, none of the treatments tested yielded significantly different than the non-treated control. This is likely due to the fact that no ratable foliar fungal diseases were present in the plots this year. Without the presence of a pathogen, fungicides have reduced odds of improving yields over non-treated plots.

Relative net profit was calculated by multiplying the bushel increase over the non-treated control by the cash market price for soybean at the time of analysis (13.05/bu for December 2023) and subtracting the cost of application. A flat rate of $26.00 per acre was used for 2023 data; for plot with two applications, $52.00 was used. This metric, net profit, was used to compare the economics of the fungicides while accounting for yield, market prices, and the cost of application. Figure 3 shows net profit for each treatment; there are no significant differences (P=0.6838).

When net profit was analyzed by treatment timing (R3, R3 + 14, and none) across all years (2021-2023), the single R3 application was provided a significantly greater profit margin ($29/acre) than two treatment program (-$26/acre) and the non-treated control (P=0.0231; Figure 4). These data indicate that a single fungicide application at R3 provides the greatest yield increase and profit margin compared to a two-pass program.

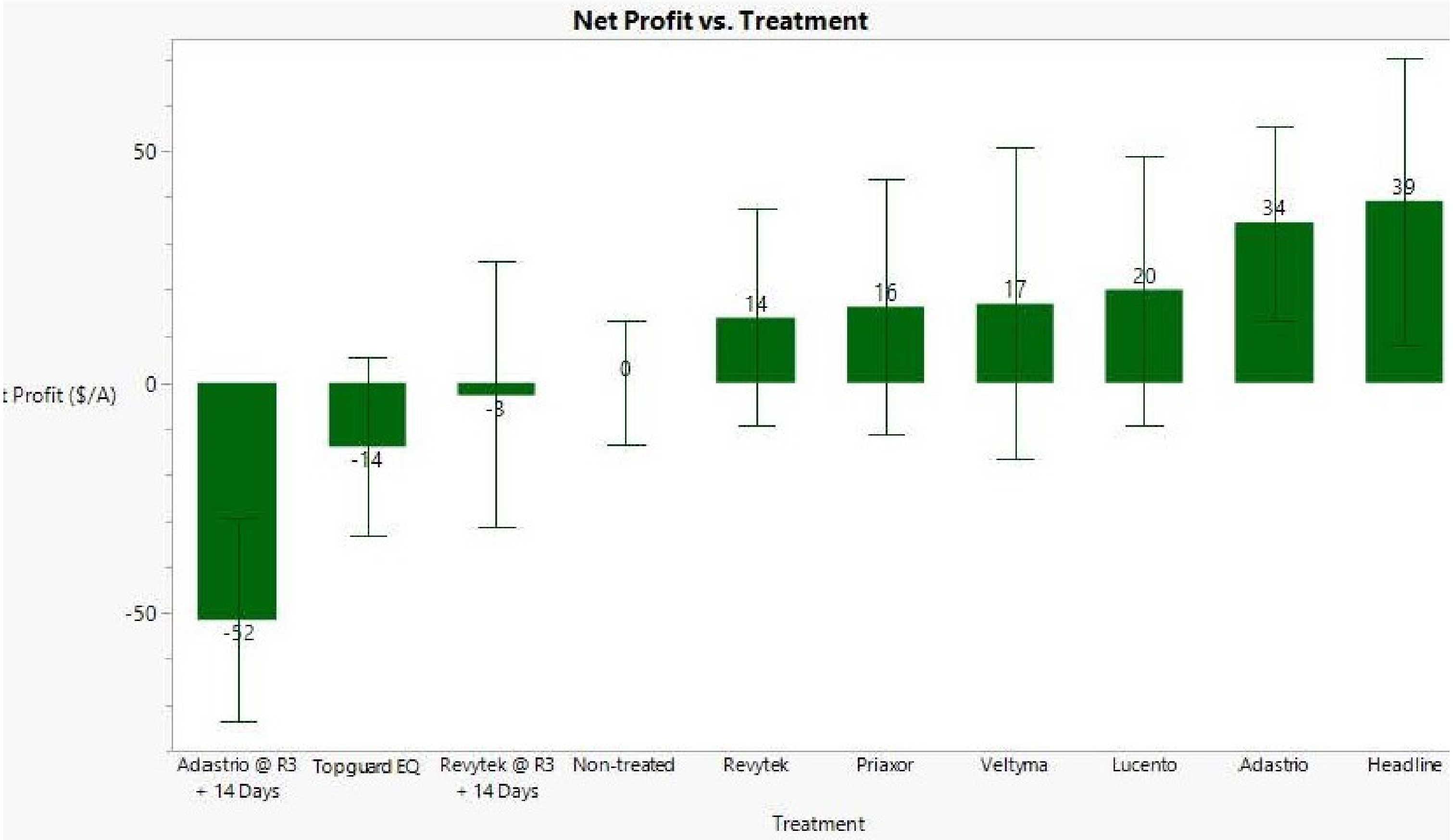
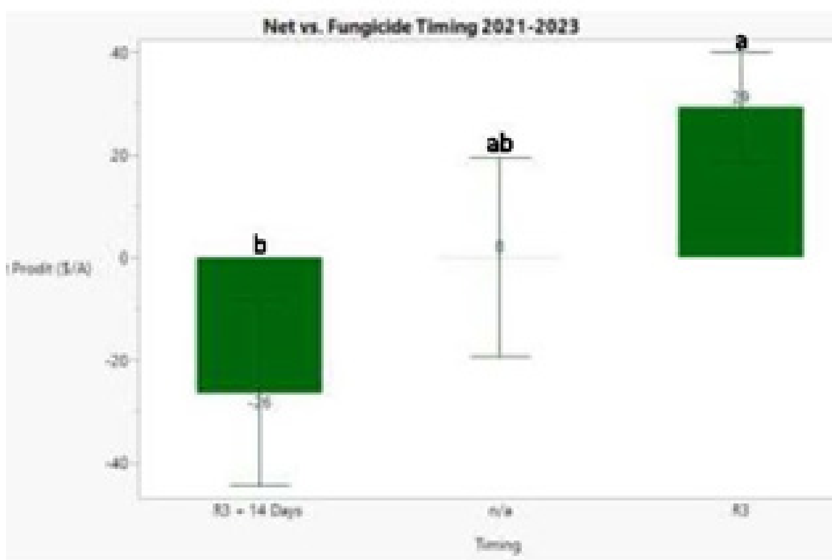


Figure 3. Net profit of 2023 fungicide treatments. Each error bar is constructed using 1 standard deviation from the mean. No significant differences between treatments (α=0.10).

Figure 4. Net profit by fungicide timing of 2021-2023 treatments combined. Each error bar is constructed using 1 standard error from the mean. Treatment timings connected by the same letter are not significantly different (α=0.10).



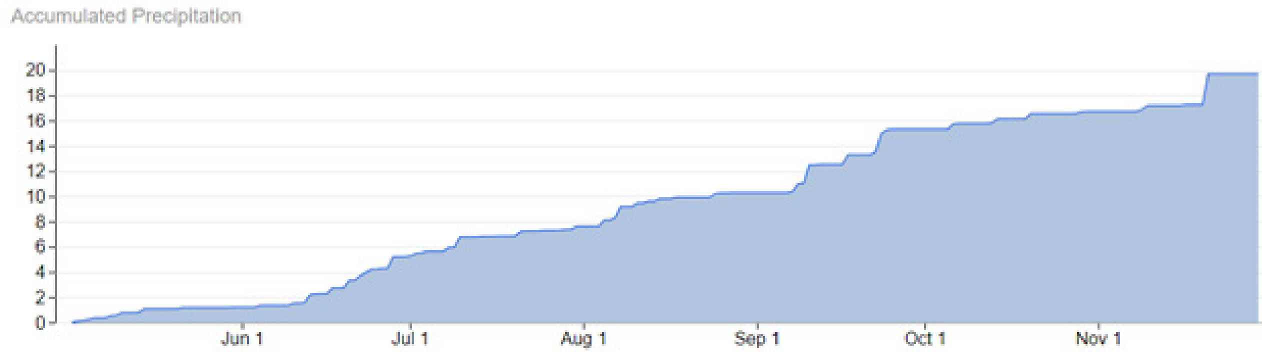
Future work will be focused on replicating similar experiments over more plot-years to gather more data for Maryland's unique growing conditions and to track pathogen resistance and fungicide profitability over time.

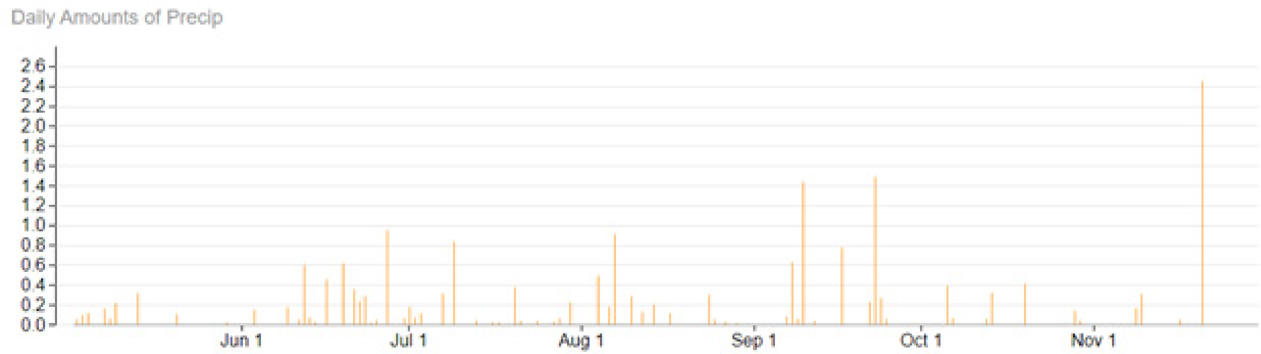
ACKNOWLEDGEMENTS

This work is supported by grant funding through the Maryland Soybean Board and in-kind support from BASF, Bayer, Corteva, FMC, and Syngenta. Special thanks to the Maryland Agriculture Experiment Station and research farm crew at the Western Maryland Research & Education Center, Central Maryland Research & Education Center, and the Wye Research and Education Center for making this research possible.

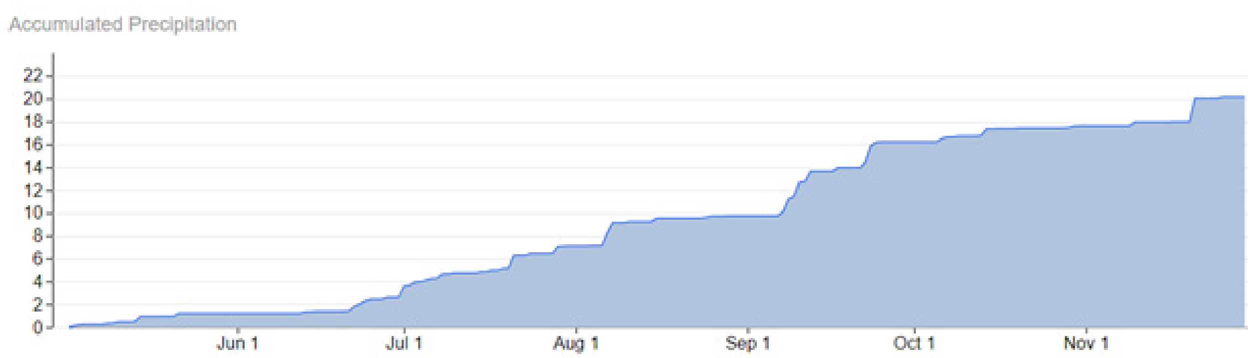
APPENDIX

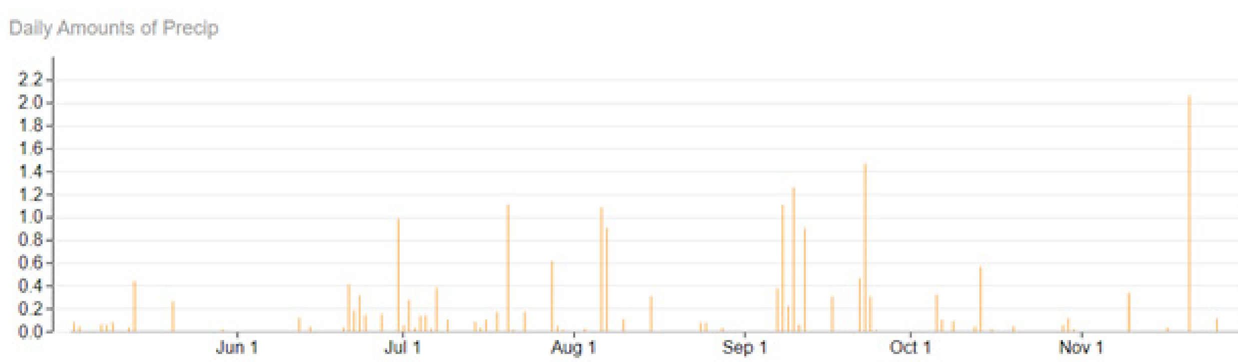
Precipitation WMREC (May 1-November 30, 2023)



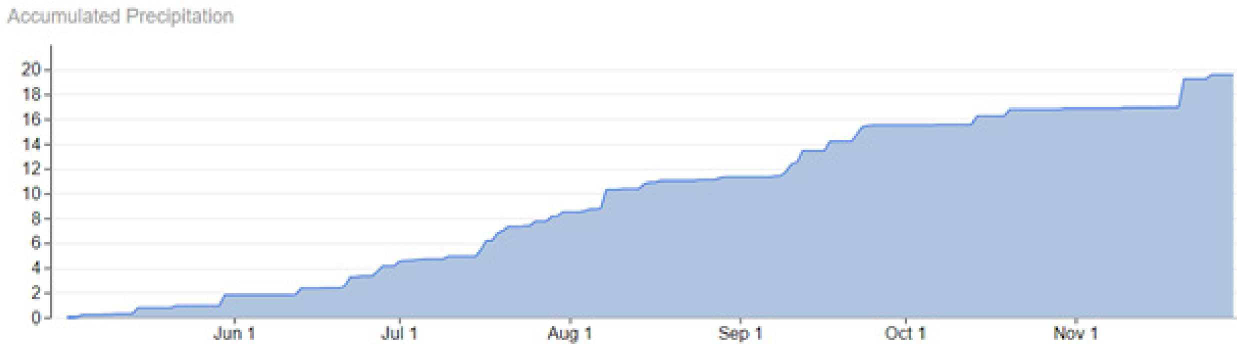


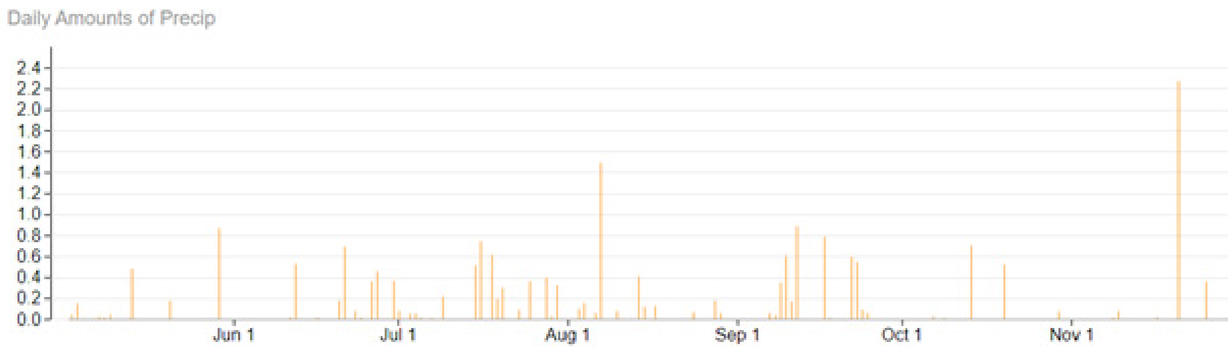
Precipitation CMREC (May 1-November 30, 2023)





Precipitation WYE (May 1-November 30, 2023)



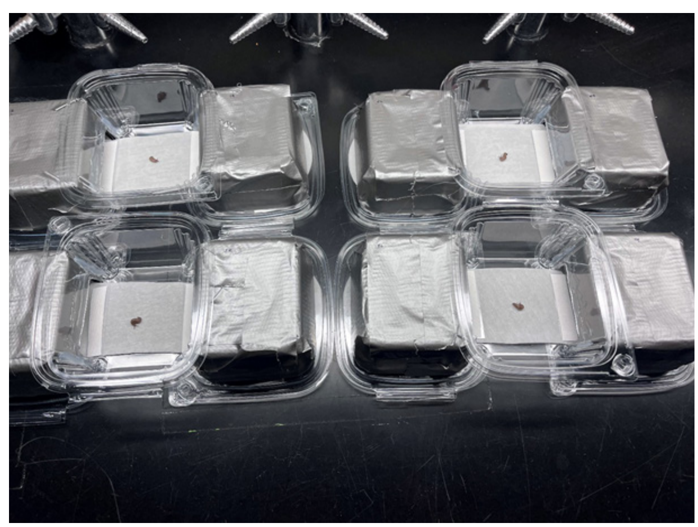


Do Slugs Detect and Avoid Ground Beetle Natural Enemies?

Kelly Hamby, Associate Professor and Extension Specialist, Department of Entomology
Maria Cramer, Ph.D. Candidate, Department of Entomology

Slugs choosing between two dark shelters in a laboratory choice test.

Multiple species of carabid ground beetle feed upon slugs and their eggs, helping reduce pest pressure by reducing the overall population. However, natural enemies can also reduce damage by causing pests to spend time avoiding getting eaten, reducing time spent feeding and/or population success. To determine whether slugs can detect and avoid their ground beetle predators, we conducted choice tests by providing slugs the option of two dark shelters one with and one without beetle chemical cues at the entrance. We collected live slugs and ground beetles from two research and education centers in the spring and summer. Slugs were used to establish a population for choice tests in the fall. Chemical cues were extracted from fresh beetles using ethanol as a solvent and held in the refrigerator until the experiment occurred. Slugs detected and avoided the chemical cues from one beetle species, a carabid ground beetle that likely feeds on slugs. The slugs showed no preference for treated or untreated shelters for three additional species of beetle, a generalist predator that may feed on slugs, a primarily seed-feeding control, and another control beetle that naturally feeds on decaying vegetation, bark, and leaves. Therefore, slugs can detect and may avoid some carabid predators, potentially making those predators even more effective for reducing slug damage.



We would like to thank the Maryland Grain Producers and Utilization Board for providing funding for this work.

Rootstock Effect on 'Buckeye Gala' Tree Performance, Maturity and Fruit Quality

Macarena Farcuh (PI)

This study was conducted in an NC-140 replicated trial that was planted in Spring 2019 and consists of 'Bukeye Gala' grafted on 10 different rootstocks. During the first growing season trees were set, trellises were built, and trees were trained to the tall spindle system as specified in the protocol. To date, we have almost 100% tree survival in this planting (except for one Gala tree grafted on G.935 rootstock).

We were interested in understanding the effects of rootstocks on tree performance and on Gala apple fruit maturity and quality at harvest. For achieving this we evaluated different parameters including tree performance measurements (tree size (TCA), yield and crop load), fruit internal ethylene production (IEC), and fruit physicochemical measurements such as fruit weight, skin and flesh color, index of absorbance difference (IAD), red blush percentage, flesh firmness, starch pattern index (SPI), SSC and titratable acidity (TA), on Gala fruit grafted on ten rootstocks at harvest.

From our results we were able to see that 'Buckeye Gala' scion grafted in a diverse panel of ten rootstock genotypes under Western Maryland environmental conditions showed that there was a trend for delayed fruit maturity, lower fruit weight and higher yield with increasingly vigorous rootstocks. This was demonstrated by the degree of associations of the different assessed parameters with the different evaluated rootstocks. We observed that Gala grafted on G.11 displayed the closest association with IEC, SPI, skin blush and weight, followed by fruit on M.9T337 and G.41that located close to the same parameters as G.11. Next, fruit grafted on NZ.2 displayed a lower association with IEC, SPI, and skin blush. Fruit grafted on B.10 showed a closer association with the parameters of fruit weight and SSC. Gala grafted on NZ.1 and G.814 associated with TCA, firmness, and skin hue angle, while fruit grafted on G.935 had a closer association to the parameters of flesh hue angle, IAD, TA and yield, as well as to TCA, firmness, and skin hue angle. Finally, fruit grafted on G.969 and M.26 presented the closest association with the parameters of skin and flesh hue angles, TCA, firmness, as well as to yield, IAD and TA, and the lowest association to the parameters of IEC, SPI, skin blush and weight.

From our study, we can conclude that rootstock impact must be considered when making management decisions in 'Buckeye Gala' fruit grown under Western Maryland conditions as they are critical in modulating fruit maturity and quality.

Effect of Potash Fertility on Orchardgrass Yield: 2023 Research Update

Andrew Kness and Erika Crowl

Orchardgrass is a popular pasture and hay forage species and it requires relatively high fertility levels, especially in a hay system where nutrients are being exported from the field. To test and demonstrate the importance of potash (potassium) fertility in orchargrass plantings, we established a replicated trial at the Western Maryland Research and Education Center. Three orchardgrass varieties were planted in a prepared seedbed at a seeding rate of 22 lbs pure live seed per acre using a drop-seeder on September 27, 2021. Plots were 6 feet wide by 20 feet long. Each variety received three fertility treatments: 1.) 0 lbs/A potash, 2.) 45 lbs/A potash (based on soil test), or 3.) 200 lbs/A potash, based on the potassium removal rate of 4 ton/A orchardgrass yield.

Three cuttings were taken from the trial in 2022; after each cutting, 50 lbs/A nitrogen was top dressed to all plots, as well as 50 lbs/A at green up. Potash (0-0-62) was top dressed on select plots after each cutting to reach 200 lb/A on the 200 lb/A plots and a single 45 lb/A application was made after first cutting on the plots receiving 45 lb/A potash.

Yield data was compiled and analyzed in JMP statistical software package, differences were separated using Fisher's Least Significant Difference (α=0.10).

Table 1. 2023 Orchardgrass yields.

Potash Fertility	Yield/ Cutting (Tons/A)	Combined Yield (Tons/A)
0 lbs/A	1.16 a	2.31 a
45 lbs/A	1.18 a	2.36 a
200 lbs/A	1.28 a	2.57 a
p-value	*0.0150*	*0.003*

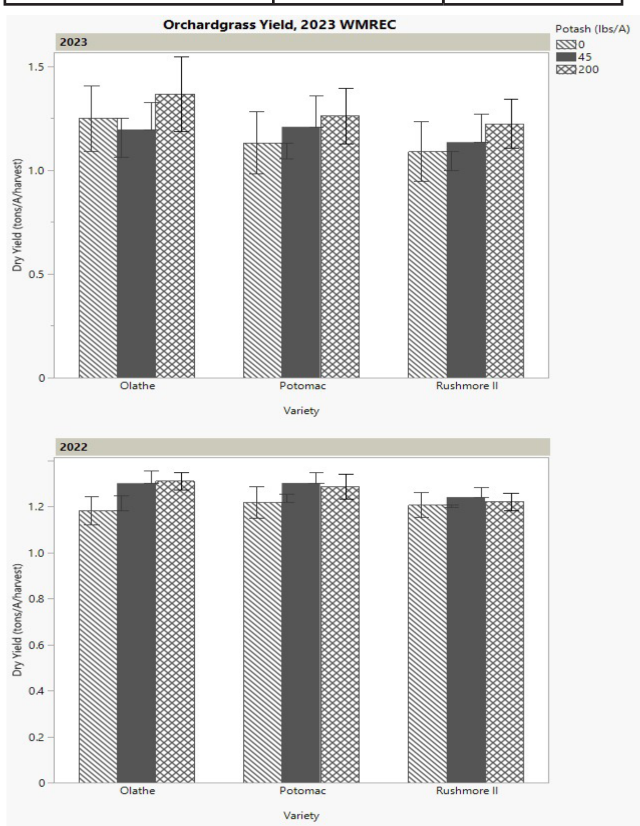


Figure 1. Average orchardgrass yield per cutting, 2022 and 2023.

Interestingly in 2023, Potomac, an old variety, yielded significantly more (3.96 tons/A) than Olathe (3.65 tons/A) and Rushmore II (3.67 tons/A). In terms of fertility, plots that received 200 lbs/A potash yielded significantly more than those that received 0 and 45 lbs/A (Table 1).

Drier weather prevailed in 2023, preventing us from getting a third cutting. Methods remained the same as in 2022 with the exception of the fourth fertilizer application which was skipped due to the drought. As a result, all plots received 150 lbs/A total nitrogen and plots received between 45 and 120 lbs of potash/A depending on the treatment.

Overall, yields we lower in 2023 compared to 2022 as expected due to the reduction in fertility and rainfall. The top-yielding treatment was again the 200 lbs/A potash program with 2.57 tons/A, significantly greater than 0 and 45 lbs/A potash programs (p=0.003). While the 200 lbs/A potash plots only received 120 total pounds in 2023, this data demonstrates the importance of maintaining high potash fertility because these higher-fertility plots were able to cope with the drought stress better than those in the 45 and 0 lbs/A plots.

We will continue to collect yield data in 2024 and additionally collect new soil fertility data from the plots, as well as monitor disease presence and prevalence, as well as orchardgrass persistence.

We would like to acknowledge the Maryland Agriculture Experiment Station and the farm crew at the Western Maryland Research and Education Center for making this research project possible, as well as monetary support from the Maryland Horse Industry Board and USDA.

Adapting to Climate Change

Excerpt from Momentum Magazine, Winter 2024 Edition

Kimbra Cutlip, Assistant Program Director, University of Maryland

AGNR researcher Chris Walsh in an orchard of his new climate resilient apple trees

Already feeling the impacts of climate change, many farmers need help adapting to unpredictable conditions now, as well as in the future, because climate change not only brings new temperature and moisture levels, but it allows pests and diseases to spread into new territories. Researcher Chris Walsh began thinking about that decades ago. Now, through years of careful crossbreeding, he has developed two new breeds of apples that address a growing suite of problems for apple growers.

His apples are heat-tolerant, blight resistant, low-maintenance, and delicious-tasting.

While orchard fruits play a significant role in the world's economy and diet, wheat and corn fill the nation's granaries and provide a significant portion of the world's calories. Both are facing environmental threats around the world.

After thousands of years of breeding for large grains and high yields, modern wheat lacks the genetic diversity essential to adapt to those emerging threats. Fortunately, an international team led by Professor Vijay Tiwari has sequenced the complete genome of an ancient variety of wheat known as einkorn. This breakthrough allows researchers to identify genetic traits like disease- and drought-tolerance, and potentially reintroduce those resilience genes into modern bread wheat.

AGNR Assistant Professor Vijay Tiwari

Western Maryland Research and Education Center

Keedysville Facility

COLLEGE OF AGRICULTURE & NATURAL RESOURCES
MAES | MARYLAND AGRICULTURAL EXPERIMENT STATION

18330 Keedysville Road, Keedysville, MD 21756   301-432-2767

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

Facility Personnel & Support

Brian Spielman, Assistant Director
bspielma@umd.edu

Douglas Price, Agricultural Technician Supervisor
dprice@umd.edu

David Wyand, Agricultural Technician Supervisor
dwyand@umd.edu

Leonard Greek, Agricultural Technician Lead
lgreek@umd.edu

Lexie Simmons, Agricultural Technician
lsimmon3@umd.edu

James Frey, Agricultural Worker I
jfrey124@umd.edu

Michael Hershey, Agricultural Worker I
hershey2@umd.edu

Nina Price, Agricultural Worker I
nprice15@umd.edu

Susan Barnes, Program Management Specialist
sbarnes6@umd.edu

Pamela Thomas, Business Service Specialist
pthomas@umd.edu

Dee Dee Allen, Coordinator, Faculty & Staff Support
dallen3@umd.edu

Steven M Rogowsky, Regional IT Coordinator
rogy@umd.edu

Resident Faculty

Joseph Fiola, Principal Agent
Agriculture & Food Systems
jfiola@umd.edu

Amanda Grev, Agent
Agriculture & Food Systems
agrev@umd.edu

Dale Johnson, Principal Agent
Agriculture & Food Systems
Agricultural & Resource Economics
dmj@umd.edu

Jonathan Kays, Principal Agent
Environment, Natural Resources, and Sea Grant (ENR)
jkays@umd.edu

Andrew A. Kling, Faculty Extension Assistant
akling1@umd.edu

Drew Schiavone, Agent
Environment, Natural Resources, and Sea Grant (ENR)
dschiavo@umd.edu