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Forage Performance of Cereal Cover Crops in Maryland: 2018-2019 Results

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Dairy farmers are constantly looking for sources of forage to meet their feed needs. One source that many of this region's dairy farmers utilize is the fall planting of cereal grains that are green-chop harvested the following spring. Among the cereal species used for this purpose are rye, triticale, barley, and wheat. Per the Maryland Cover Crop Program guidelines, cereal grains planted as a cover crop prior to November 5 and suppressed via green-chop in the spring are eligible for the grant payment for participation in the Cover Crop Program. In addition, per the Nutrient Management Regulations, a fall application of dairy manure is allowed to a field planted to a cereal cover crop.

Planting a cereal cover crop that will be green chop harvested fits well into the crop rotation used by many dairy farmers. The scenario that many follow is to plant the cereal cover crop following harvest of corn silage. Prior to planting the cover crop, an application of manure is made to the field. The subsequent planting of the cover crop provides incorporation of the manure into the soil. The fall and spring growth of the cover crop is supplied nutrients from the manure. At the same time, the cover crop provides protection to the soil from loss of nutrients via leaching and/or erosion. The objective of this study was to evaluate select varieties of cereal species for cover crop performance and forage production and quality.

Cereal varieties (17) representing two species (rye and triticale) were evaluated at Central Maryland Research and Education Center – Clarksville Facility. Three replications for each entry were planted using a randomized complete block experimental design. Planting date was October 10, 2018. The 3' X 18' plots were planted with a small plot planter with 6-inch spacing between each of the 7 rows. The germination percentage for each entry was used to calculate the seeding rate needed to establish 1.5 million seedlings. Good stands were established by late fall.

In order to compare forage quality among the entries that headed over a period of two weeks, the timing of the spring biomass harvest was when the entries had reached late boot to early heading stage of development. The two rye varieties were harvested on April 23, while the triticale varieties were harvest on either May 1 or May 6, based on heading date (Table 1). Each harvest sample was collected by cutting the plants just above ground-level from three center rows of each plot from an area 2.5 feet in length and from two areas within the plot. The samples were placed into cloth bags and dried using a forced air dryer set at 60°C where they remained until sample water content was zero. Each sample was weighed and is reported as pounds of dry matter production per acre (Table 1). Each of the dried samples was ground through a 20-mesh screen using a large plant grinder. For each location, the ground biomass samples were sent to Cumberland Valley Analytical Laboratory for standard forage quality analysis.

Cover crop performance is measured by amount of biomass produced and the concentration of nitrogen in the biomass. These two factors were used to estimate nitrogen uptake (Table 1). There was no significant difference in nitrogen uptake among the varieties tested. A number of forage quality characteristics for these cereals was measured (Table 1). The descriptions of the various quality characteristics are described here and in the footnotes at the bottom of Table 1. Crude protein (CP) is the nitrogen content of the forage, with higher protein representing better feed quality. This value was used to calculate nitrogen uptake of each variety (nitrogen content = % CP/6.25). Both rye varieties had significantly greater CP than the overall mean, with one triticale variety having significantly less CP content than the overall mean. Both rye varieties also had rumen degradable protein (RDP) content significantly greater than the overall mean.

Neutral and acid detergent fiber (NDF and ADF) are measures of feed value and represent the less digestible components of the plant, with NDF representing total fiber and ADF representing the least digestible plant components. Low NDF and ADF values representing increased digestibility; ideally NDF values should be <50% and ADF values should be <35%. One triticale variety had significantly lower NDF and ADF values than the overall mean, representing a digestible triticale variety. This same variety also had significantly higher total digestible nutrients (TD), net energy for lactation (NEL), relative feed value (RFV), and nonfiber carbohydrates (NFC).

The characteristic that best captures the overall forage quality performance is Relative Feed Value

Table 1. Forage and cover crop performance of cereal species evaluated in Clarksville, MD during 2018-2019 growing season.

Variety	Species	Biomass Yield (lb DM/a)	Head Date	[1]Nitrogen Uptake Lb N/a	[2]Crude Protein %	[3]Soluble Protein % DM	[4]RDP % DM	[5]ADF % DM	[6]NDF % DM	[7]Ash % DM	[8]Total Digestible Nutrients % DM	[9]Net Energy Lactation (Mcal/lb)	[10]RFV	[11]Non Fiber Carbohydrates % DM
TriCal Exp 19R01	Rye	4912#	April 19	106	13.8*	5.2	9.5*	38.2	62.4	6.8	59.0	0.61	88.3	15.3
TriCal Exp 19R02	Rye	5680#	April 19	135	14.8*	5.1	10.0*	38.1	62.1	6.6	60.0	0.62	88.5	14.3
Rye Mean		**5296**	**April 19**	**121**	**14.3**	**5.2**	**9.7***	**38.2**	**62.3**	**6.7**	**59.5**	**0.61**	**88.4**	**14.8**
Mercer MBX 814	Triticale	9556	April 30	169	11.2	4.4	7.8	40.9	66.1	6.8	58.8	0.6	80.5	14.4
Mercer MBXEXP 18-70	Triticale	8942	April 30	161	11.2	4.5	7.8	39.1	64.8	6.1	58.5	0.6	84.0	16.2
Mercer MBXEXP18-68	Triticale	8367	May 1	152	11.3	4.6	8.0	35.4#	57.8#	7.0	61.2*	0.63*	99.0*	22.0*
BCT 15509	Triticale	7752	May 6	140	11.2	4.7	7.95	41.5	67.8	6.5	56.3	0.58	77.5	13.5
BCT 15513	Triticale	9709	May 7	172	11.0	4.3	7.6	42.4	65.6	7.7	56.3	0.57	79.5	14.7
BCT18001	Triticale	10976*	May 6	194	11.1	4.8	7.95	44.8*	69.3*	7.5	54.5#	0.55#	72.5#	11.3#
BCT18002	Triticale	9671	May 4	158	10.5	4.7	7.6	44.7*	68.4*	7.7	54.1#	0.55#	74.3#	12.9
BCT18003	Triticale	8674	May 3	154	11.1	4.7	7.9	38.9	61.1#	6.0#	60.1	0.62	92.5*	20.0*
TriCal Exp 08TF01	Triticale	8955	May 7	156	11.0	4.6	7.8	42.5	63.9	7.9	55.3	0.6	81.7	16.9
TriCal Exp 19T05	Triticale	8635	May 2	148	10.7	3.9	7.3	40.7	65.3	6.9	57.8	0.59	81.3	15.6
TriCal Exp 917	Triticale	9057	May 3	181	12.6	5.1	8.8*	35.8#	61.9	7.3	59.5	0.61	91.7	16.3
TriCal Merlin Mix	Triticale	8136	May 6	131	10.0#	3.5	6.8#	44.5*	70.6*	7.7	53.6#	0.55#	71.8#	10.9#
TriCal Surge	Triticale	9288	May 6	166	11.5	5.1	8.3*	43.2	67.2	7.7	55.6	0.57	77.5	12.7
Trical 813	Triticale	5680#	May 8	111	12.3	5.0	8.6*	40.3	64.7	6.4	58.3	0.60	83.0	15.2
Trical Gainer 154	Triticale	7215	April 30	128	11.2	4.4	7.7	37.9	63.8	6.6	58.8	0.61	86.8	16.9
Triticale Mean		**8616**	**May 4**	**153**	**11.2**	**4.5**	**7.8**	**40.6**	**65.1**	**7.0**	**57.3**	**0.58**	**82.4**	**15.4**
Overall Mean		**8201**	**May 2**	**149**	**11.6**	**4.6**	**8.1**	**40.3**	**64.8**	**7.0**	**57.5**	**0.59**	**83.2**	**15.3**
$LSD_{0.1}$		2398	1 day	-	1.2	-	1.0	3.7	3.6	0.9	2.8	0.03	8.6	3.4

*,# Indicates the entry was either significantly greater (*) or significantly (#)less than the mean

[1]Nitrogen uptake (lb/acre) for each entry was estimated by multiplying the lb DM/ac X % nitrogen contained in the DM. The percent nitrogen for each entry was calculated by dividing crude protein by the conversion factor 6.25 which is the average amount of nitrogen (%) contained in protein.

[2]Crude Protein %: represents total nitrogen content of the forage; higher protein is usually associated with better feed quality.

[3]Soluble Protein %: non-protein N and portion of true proteins that are readily degraded to ammonia in the rumen.

[4]RDP (Rumen Degradable Protein): portion of crude protein that microbes can either digest or degrade to ammonia and amino acids in the rumen.

[5]ADF (Acid Detergent Fiber): represents the least digestible fiber portion of forage; the lower the ADF value the greater the digestibility.

[6]NDF (Neutral Detergent Fiber): insoluble fraction of forage used to estimate the total fiber constituents of a feedstock.

[7]Ash: mineral elements of the forage.

[8]TDN (Total Digestible Nutrients): measure of the energy value of the forage.

[9]Net Energy Lactation: estimate of the energy in a feed used for maintenance plus lactation during milk production.

[10]RFV (Relative Feed Value): indicates how well an animal will eat and digest a forage if it is fed as the only source of energy.

[11]Non Fiber Carbohydrates: represents all forms of digestible carbohydrates (starch, sugar, pectin, and fermentation acids) in the forage.

(RFV). A RFV of 100 is defined as the forage value that full bloom alfalfa would have. Two triticale varieties had significantly higher RFV than the overall average but both rye varieties also had high RFV values, though not significantly different than the overall mean. Though, none of these green-chop cereal forages are considered to be adequate as a stand-alone feed for a dairy operation, they can supply a source of forage used in a total mixed ration at the time of year when feed supply may be running short. When this forage benefit is added to the environmental benefit that is gained, planting winter cereal cover crops on a dairy farm can be a win-win decision.

EPA Takes Action to Provide Accurate Risk Information to Consumers, Stop False Labeling on Products

EPA Press Release

EPA is issuing guidance to registrants of glyphosate to ensure clarity on labeling of the chemical on their products. EPA will no longer approve product labels claiming glyphosate is known to cause cancer – a false claim that does not meet the labeling requirements of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The State of California's much criticized Proposition 65 has led to misleading labeling requirements for products, like glyphosate, because it misinforms the public about the risks they are facing. This action will ensure consumers have correct information, and is based on EPA's comprehensive evaluation of glyphosate.

"It is irresponsible to require labels on products that are inaccurate when EPA knows the product does not pose a cancer risk. We will not allow California's flawed program to dictate federal policy," said EPA Administrator Andrew Wheeler. "It is critical that federal regulatory agencies like EPA relay to consumers accurate, scientific based information about risks that pesticides may pose to them. EPA's notification to glyphosate registrants is an important step to ensuring the information shared with the public on a federal pesticide label is correct and not misleading."

In April, EPA took the next step in the review process for glyphosate. EPA found – as it has before – that glyphosate is not a carcinogen, and there are no risks to public health when glyphosate is used in accordance with its current label. These scientific findings are consistent with the conclusions of science reviews by many other countries and other federal agencies.

On Feb. 26, 2018, the United States District Court for the Eastern District of California issued a preliminary injunction stopping California from enforcing the state warning requirements involving glyphosate's carcinogenicity, in part on the basis that the required warning statement is false or misleading. The preliminary injunction has not been appealed and remains in place.

California's listing of glyphosate as a substance under Proposition 65 is based on the International Agency on the Research for Cancer (IARC) classifying it as "probably carcinogenic to humans." EPA's independent evaluation of available scientific data included a more extensive and relevant dataset than IARC considered during its evaluation of glyphosate, from which the agency concluded that glyphosate is "not likely to be carcinogenic to humans." EPA's cancer classification is consistent with many other international expert panels and regulatory authorities.

Registrants with glyphosate products currently bearing Proposition 65 warning language should submit draft amended labeling that removes this language within 90 days of the date of the letter.

For more information about EPA's comprehensive evaluation of glyphosate, visit https://www.regulations.gov/document?D=EPA-HQ-OPP-2009-0361-0073.

To read the notice to registrants, click here.

Palmer Amaranth and Waterhemp Management At Harvest

Kelly Nichols, Agriculture Agent Associate
University of Maryland Extension, Frederick County

This summer, we have gotten a few calls about Palmer amaranth and waterhemp, two pigweed species that are unfortunately becoming more common. These two pigweeds are difficult to control, mostly due to their herbicide resistance and fast growth (especially in hot weather). Often, these pigweeds are not noticed until they are seen growing up over the crop canopy, especially in soybeans. By then, it is too late to control them.

Figure 2. *Waterhemp.*

As we head into harvest, if you have Palmer or waterhemp – or want to make sure you don't have them – scout your fields to be certain. Know how to identify Palmer (Figure 1) and waterhemp (Figure 2). The main characteristic is that these two troublesome pigweeds are completely hairless. Redroot and smooth pigweed, our most common pigweed species, have hairs on the stems and leaves. Another characteristic of Palmer is that the petiole (the little stem that attaches the leaf blade to the main stem) is longer than the leaf blade itself. (Note: Spiny amaranth, or spiny pigweed, is another pigweed that is common in pastures. It also does not have hairs; however, it will have spines on the stem. Palmer and waterhemp do not have these spines).

Figure 1. *Palmer amaranth.*

While you are scouting, pull out the Palmer or waterhemp plants (as many as you can). Palmer and waterhemp can produce hundreds of thousands of seeds per plant. At this point in the season, this is the best way to reduce the number of seeds that could germinate next year. Consider taking a paper bag with you to put the plants in, as smaller plants can re-root. Take the plants out of the field and bury or burn them.

Harvest infested fields last. The biggest concern with harvesting infested fields is the spread of the seeds – not only throughout the currently infested field, but also to other fields and possibly other farms. If there is only a small section of the field that is infested, consider not harvesting that section to avoid spreading the seeds. If you are not running the combine, be in communication with the person who is to ensure that Palmer or waterhemp seeds are not brought onto your farm and/or spread around your fields. If the infested harvested crop is to be fed to livestock, the processes of grinding, roasting, and ensiling can destroy weed seeds and prevent the seeds from being spread in the manure.

After harvest (or in between fields if necessary), clean out the combine. Pigweed seeds are tiny (about the size of a pencil point), and it is difficult to perfectly clean out a combine. However, cleaning can still reduce the number of weed seeds in the combine. Use compressed air and start at the front of the combine, working up to the grain tank and auger, and then to the back. Running straw through the combine can also help to clean it out. Research from the University of Delaware has shown that using compressed air in combination with running straw through the combine can potentially reduce the number of weed seeds in the combine by thousands.

For next year, consider using these strategies to control Palmer and waterhemp: plant a cover crop to provide weed suppression in the spring; rotate to corn for more effective herbicide options (compared to soybeans) or a perennial forage; use the full recommended labeled rate; use residual herbicides in both the pre- and post-emergence applications, as Palmer and waterhemp seeds can germinate throughout the growing season; use multiple effective modes of action; and rotate modes of action. More information on Palmer and waterhemp, as well as herbicide resistance weed management, can be found at www.integratedweedmanagement.org, a website run by Extension Weed Specialists from across the U.S.

Register Now For 2019 Mid-Atlantic Crop Management School
November 19-21, Princess Royal Hotel, Ocean City, MD

The Mid-Atlantic Crop Management School offers a 2 1/2 day format with a variety of breakout sessions. Individuals needing training in soil and water, nutrient management, crop management and pest management can create their own schedule by choosing from 5 program options offered each hour. Emphasis is placed on new and advanced information with group discussion and interaction encouraged.

You are encouraged to register as soon as possible in order to enroll for the sessions of your choice. Maximum capacity is 300 attendees.

Register Online Here

2019 Fusarium Head Blight Screening Nursery Factsheet

Dr. Nidhi Rawat, Small Grain Pathologist & Dr. Jason Wight, Field Trials Coordinator
Department of Plant Science and Landscape Architecture, University of Maryland

Fusarium Head Blight (FHB) has been a major challenge to wheat and barley yields and quality in the Mid-Atlantic region. To assist wheat growers in their planting decisions for Fusarium Head Blight management, popular local varieties of wheat and barley were evaluated for FHB reaction under heavy disease pressure in the misted nursery conducted at the Beltsville research farm of University of Maryland. Table 1 and Table 2 summarize the FHB indices and DON content values of the tested barley and wheat varieties, respectively. To provide growers with consolidated information, data on statewide wheat yield trials has also been combined in Table 2. All the entries have been sorted according to the DON content values as it is one of the most important parameters of quality of harvested grain. Please note that these results are coming from a high disease pressure set-up without any fungicide treatment, and the DON contents, as well as FHB indices, are much higher than normal fields. However, these should be considered excellent projections of high or low DON values in the fields. In Table 2, green cells indicate moderate resistance/tolerance to FHB, orange cells may be considered moderately susceptible, whereas those highlighted in blue depict highly susceptible wheat varieties.

***Table 1.** DON content and FHB indices of local barley varieties tested*

Variety	Two/ Six row	FHB indices	DON content (ppm)
Claypso	Two	23	9.2
Casanova	Six	39	16.6
VA11B-141 LA	Six	32	17.7
Thoroughbred	Six	34	19.3
Amaze 10	Six	38	20.3
Nerea	Six	31	22.0
Nomini	Six	29	22.3
Secretariat	Six	38	27.6
Hirondella	Six	30	28.1
Flavia	Six	40	29.9
Violetta	Two	38	39.4

In case of any questions, please contact: Nidhi Rawat (nidhirwt@umd.edu) or Jason Wight (jpwight@umd.edu).

This work was supported by US Wheat and Barley Scab Initiative, Maryland Crop Improvement Association, and MD Grain Utilization Producers Board.

**Table 2 is on the following pages*

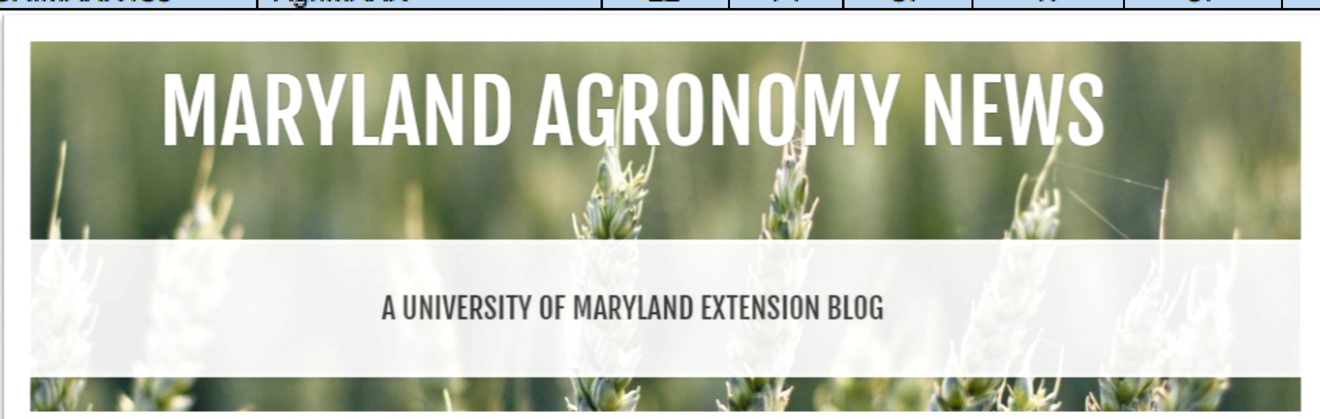
Table 2. *DON content and FHB indices of wheat varieties.*

Entry	Brand	Statewide Yield Results: Yield Rank	Statewide Yield Results: Yield	Statewide Yield Results: Test Wt	FHB Index	DON content (ppm)	R/S
MAS116	Mid-Atlantic Seeds	30	73	58	12	3	Moderately Resistant
MAS105	Mid-Atlantic Seeds	41	72	58	4	4	
Catawba	Virginia Tech	78	64	58	12	5	
LW2867	Local Seed	45	72	57	3	6	
DG9750	Dyna-Gro	9	76	57	7	6	
15MDX20	UMD	51	71	58	9	6	
MBX932	Mercer Brand	27	73	58	6	7	
USG3228	UniSouth Genetics	75	65	56	8	7	
15MDX5	UMD	76	65	60	15	7	
MAS67	Mid-Atlantic Seeds	15	75	56	10	7	
USG3329	UniSouth Genetics	6	76	57	13	7	
ARW1813	Armor Seed	18	75	56	14	8	
AGRIMAXX463	AgriMAXX	28	73	57	6	8	
DG9862	Dyna-Gro	11	75	58	11	8	
AGRIMAXX485	AgriMAXX	19	74	58	6	8	
FS878	FS	40	72	56	21	8	
LW2848	Local Seed	12	75	58	8	9	
Viper	Syngenta	65	69	58	20	9	
MAS86	Mid-Atlantic Seeds	1	80	57	10	9	
MAS35	Mid-Atlantic Seeds	54	71	57	10	9	
MBX17-P-275	Mercer Brand	67	69	56	10	10	
FS875	FS	5	77	57	23	10	
VA09MAS1-12-5-1-1	VCIA/ VA Tech	44	72	59	26	11	
15MW131	UMD	70	67	59	14	11	
Liberty5658	VCIA/ VA Tech	23	73	59	15	11	
MAS61	Mid-Atlantic Seeds	60	71	57	18	12	
CP8550	Croplan	46	72	57	8	12	
AGRIMAXX415	AgriMAXX	16	75	59	15	12	
SH7200	Southern Harvest	52	71	58	34	12	
MAS106	Mid-Atlantic Seeds	74	65	58	9	12	
VA-MD16W-299	Virginia Tech	63	70	59	16	13	
DG9941	Dyna-Gro	10	75	56	15	13	
VA14HRW-25	VCIA	56	71	59	33	13	
SY007	Syngenta	29	73	57	17	14	Moderately Susceptible
MAS316	Mid-Atlantic Seeds	47	71	57	9	14	
SH4400	Southern Harvest	21	74	57	30	14	
Luisa	Cover Crop 100	48	71	59	17	14	
AGRIMAXX480	AgriMAXX	59	71	60	45	14	
25R74	Pioneer	4	77	57	9	14	
MBX17-M-245	Mercer Brand	39	72	56	40	14	
Voodoo	Armor Seed	34	73	58	14	15	
15MDX19	UMD	71	67	58	12	15	
CP8800	Croplan	13	75	58	16	15	
EXP 1986	AgriMAXX	38	72	57	39	15	
Hilliard	VCIA/ VA Tech	49	71	58	21	16	
VA14HRW-41	VCIA	69	68	59	20	16	
Spirit	Armor Seed	64	70	58	26	16	

Continue on next page

Table 2 (continued). *DON content and FHB indices of wheat varieties.*

Entry	Brand	Statewide Yield Results			FHB Index	DON content (ppm)	R/S
		Yield Rank	Yield	Test Wt			
MAS6	Mid-Atlantic Seeds	37	72	57	22	16	Highly Susceptible
USG3118	UniSouth Genetics	72	67	59	32	17	
WX19712	Dyna-Gro	24	73	57	16	18	
USG3536	UniSouth Genetics	43	72	57	8	18	
WX19714	Dyna-Gro	25	73	57	9	18	
AGRIMAXX495	AgriMAXX	66	69	58	13	19	
AGRIMAXX473	AgriMAXX	35	73	58	9	19	
LW2958	Local Seed	31	73	58	12	19	
DG9932	Dyna-Gro	33	73	58	12	20	
CP9606	Croplan	57	71	56	18	21	
SY100	Syngenta	7	76	56	18	21	
Mayhem	Armor Seed	58	71	57	10	22	
MBX969	Mercer Brand	17	75	57	16	22	
L11719	Limagrain Cereal Seed	8	76	58	27	22	
ARW1883	Armor Seed	62	70	58	19	22	
EXP 1902	AgriMAXX	36	73	57	20	22	
VA13W-38	VCIA/ VA Tech	53	71	59	17	22	
5210HR	Virginia Tech	77	65	56	22	23	
25R25	Pioneer	2	79	57	14	24	
SH7510	Southern Harvest	50	71	59	29	24	
MAS108	Mid-Atlantic Seeds	26	73	58	26	24	
USG3316	UniSouth Genetics	14	75	58	16	24	
USG3790	UniSouth Genetics	3	78	57	29	25	
MAS7	Mid-Atlantic Seeds	55	71	58	52	26	
LWX19D	Local Seed	32	73	58	31	26	
LW2937	Local Seed	20	74	56	20	27	
Vision 45	VCIA	73	67	55	41	27	
SY547	Syngenta	61	70	57	11	28	
AGRIMAXX454	AgriMAXX	42	72	58	18	30	
15MDX18	UMD	68	69	59	19	31	
AGRIMAXX486	AgriMAXX	22	74	57	17	37	



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http://blog.umd.edu/agronomynews/

Wheat Variety Selections—An Important Factor For Managing Head Blight

Andrew Kness, Agriculture Agent
University of Maryland Extension, Harford County

Compared to the 2018 wheat crop, 2019 was a much better year for Fusarium head blight (FHB, also known as head scab). Growing quality wheat in Maryland starts with proper variety selection. As you look ahead to the 2020 wheat crop, select wheat varieties that have good FHB ratings. There are no varieties with complete resistance to head scab; only varying degrees of susceptibility. Nevertheless, planting a somewhat resistant variety will go a long way in managing FHB and keeping vomitoxin levels (DON) lower in your grain compared to a susceptible variety.

To aid in your selection of wheat varieties, the University of Maryland screens several wheat varieties for their resistance to *Fusarium graminearim*, the causal agent of FHB. The results from the 2019 trials can be found here, and on pages 5-7 of this newsletter.

Additional considerations for FHB management include:

- Planting behind soybeans rather than corn or other small grains. The FHB pathogen survives on residue of corn, wheat, barley, oats, and other grasses; however, it does not persist on soybean residue.
- If planting into corn residue, consider tillage if it is an option for your farm. Sizing and burying corn residue will accelerate its decomposition and reduce the FHB pathogen survival.
- Fungicides in spring 2020. Please note that fall fungicide applications ***do not*** have any effect on managing FHB. More information will be covered concerning fungicide recommendations in the spring, or read this article from earlier this year.

Scouting For Stalk Rot In Corn

Alyssa Koehler, Extension Field Crops Pathologist
University of Delaware

We are entering that time of year to begin scouting for stalk rots in corn. Stalk rot signs and symptoms do not appear until later in the season. After pollination, the ear becomes the major sink of sugars produced by the plant. If a stress event occurs, plants will divert or remobilize sugars from the stalk and roots to meet the needs of the developing ear. Often the pathogens that cause stalk rots are opportunistic and take advantage of plants that have been weakened by potential stress events (drought, flooding, hail, insect damage, foliar disease damage). It is also possible to have multiple stalk rot organisms in the same plant.

Yield losses occur when stalks become brittle and lodge close to harvest. Stalk rots can also result in premature plant senescence and reduced grain fill. When plants are a few weeks from physiological maturity (kernel black layer), stalk rots can be scouted by walking the field in a W pattern and randomly checking stalks with either the pinch or push test (aim to check 10-20 plants for every 10-20 acres). For the pinch test, pinch the stalk between the lowest two internodes to see if it can withstand the pressure, if the stalk collapses, it fails. To complete a push test, push the stalk 30 degrees from vertical (around 8 inches) and see how many spring back to upright or lodge. In cases where more than 10% of plants fail the test, you may want to consider harvesting at higher moisture and drying grain after harvest to avoid yield loss due to lodging.

Since stalk rots are linked to stress, the best management strategies are to reduce stress by planting optimal stand populations, irrigating when possible, managing insect pests and foliar diseases, and using a balanced nutritional program. Planting hybrids with some level of foliar disease resistance can also help to reduce plant stress and encourage strong stalk development.

Can Aboveground Pest Pressure Disrupt Nitrogen Fixation in Alfalfa?

Morgan N. Thompson & William O. Lamp
University of Maryland, Department of Entomology

Nitrogen is a critical nutrient for forage crop growth and quality. Typically, farmers need to apply additional nitrogen fertilizers to meet the nitrogen demand of crops. Nitrogen-fixing crops, however, do not require nitrogen fertilizer inputs, providing their own nitrogen supply through symbiotic interactions with soil microbes (rhizobia). Rhizobia induce the formation of root nodules in nitrogen-fixing crops, predominantly legumes, and extract inert nitrogen gas from the atmosphere to produce ammonium. In exchange for ammonium, legumes provide the rhizobia carbohydrates to fuel the microbe's metabolism. Alfalfa is a leguminous forage crop that relies on symbiotic interactions with rhizobia to obtain nitrogen. As a perennial crop, alfalfa stands can last from 3-7 years and typically require no nitrogen fertilizer inputs, making alfalfa a sustainable and high-quality option for forage growers.

Pest pressure can decrease the economic viability of an alfalfa harvest. One particularly devastating pest of alfalfa in Maryland is the potato leafhopper (*Empoasca fabae*). Potato leafhoppers migrate northward from the southern United States every spring, making the timing of management in the northeast very difficult. Additionally, potato leafhoppers can utilize many alternative host plants, some of which are also of agroeconomic value, such as soybeans and several other fruit and vegetable crops, and leafhoppers can reproduce multiple times during the growing season. To protect alfalfa from potato leafhopper damage (termed 'hopperburn'), insecticides are often the only option for growers. As a perennial crop, serious pest pressure in one growing season could impact nitrogen fixation in subsequent growing seasons, further accelerating economic losses for growers.

Therefore, in recent field and greenhouse experiments, we sought to determine the effect of potato leafhopper pest pressure on nitrogen fixation in alfalfa. We predicted pest pressure would negatively impact plant growth and carbohydrate production, resulting in reduced nitrogen fixation by rhizobia and uptake of fixed nitrogen by alfalfa. We also predicted losses in nitrogen content of alfalfa due to pest pressure could be offset by nitrogen fertilizer applications. To test our predictions in a field setting, we planted four combinations of small plots: 1) Fixing Cultivar + Nitrogen Fertilizer, 2) Non-Fixing Cultivar + Nitrogen Fertilizer, 3) Fixing Cultivar No Nitrogen Fertilizer, and 4) Non-Fixing Cultivar No Nitrogen Fertilizer. Fixing and non-fixing alfalfa cultivars were utilized to compare plants reliant on both nitrogen fixation and soil nitrogen with plants completely reliant on soil nitrogen. We split each plot in half, applying cages with leafhoppers to one side and cages without leafhoppers to the other. We analyzed the amount of fixed nitrogen in aboveground plant tissue. Results from the field experiment contradicted our predictions, showing nitrogen fertilizer did not increase aboveground nitrogen content of alfalfa under pest pressure. Nitrogen fertilizer (Moderate Nitrate) also decreased aboveground fixed nitrogen content in plants with and without pest pressure (Fig. 1). Unfertilized plants (No Nitrate), in contrast, showed significantly increased amounts of fixed nitrogen content when under pest pressure (Fig. 1). These results contradicted our predictions and suggest alfalfa interactions with rhizobia play a role in helping plants withstand pest damage.

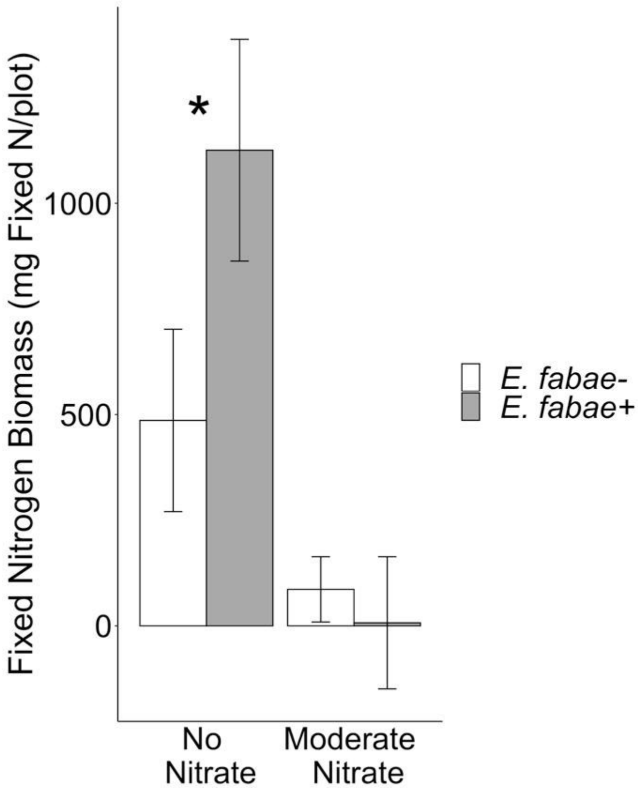

Figure 1. *Amount of fixed nitrogen in alfalfa stems and leaves. * represents significant differences between treatments. No Nitrate = No Nitrogen Fertilizer, Moderate Nitrate = Nitrogen Fertilizer Applied; E. fabae- = No Leafhopper Pressure, E. fabae+ = Leafhopper Pressure.*

We also examined leafhopper-alfalfa interactions in a greenhouse setting. Here, we analyzed the response of two different cultivars of alfalfa: leafhopper-susceptible (Pioneer 55V50) and leafhopper-resistant (Pioneer 55H94). Nitrogen fertilizer treatments were applied to both cultivars, as well as cages with or without leafhoppers. Results indicate that additional nitrogen fertilizer did not increase the percent nitrogen of plants under pest pressure, regardless of the cultivar (Table 1).

Overall, we conclude leafhopper pest pressure decreases total nitrogen content of alfalfa across all four cultivars tested in both field and greenhouse settings. Amending soils with additional nitrogen fertilizer did not offset losses to leafhopper pressure and we do not recommend this as a management strategy to growers. In our field experiment, however, we found evidence that leafhopper pressure enhances aboveground fixed nitrogen content of alfalfa grown in soils without additional nitrogen. Rhizobia may play an unexamined role in the response of alfalfa to leafhopper pressure. Broader implications of our results highlight how pest damage may increase nitrogen fixation, which may benefit farmers interested in utilizing nitrogen-fixing cover crops.

Acknowledgements: Many thanks to the Western Maryland Research and Education Center staff and greenhouse staff at the University of Maryland aiding in the execution of these experiments, as well as members of the Lamp Lab. This study was funded by Northeastern Sustainable Agriculture Research and Education (Award Number GNE18-187-32231) and the Hatch Project MD-ENTM-1802.

Table 1. *Systemic (shoots, crowns, roots) percent nitrogen content of susceptible and resistant alfalfa cultivars in the greenhouse. No Nitrogen Added = No Nitrogen Fertilizer, Nitrogen Added = Nitrogen Fertilizer Applied; Healthy = No Leafhopper Pressure, Injured = Leafhopper Pressure.*

	Susceptible Cultivar				**Resistant Cultivar**			
	No Nitrogen Added		*Nitrogen Added*		*No Nitrogen Added*		*Nitrogen Added*	
Nitrogen (%)	Healthy	Injured	Healthy	Injured	Healthy	Injured	Healthy	Injured
Shoots	3.7 ± 0.3	3.5 ± 0.4	4.0 ± 0.2	3.4 ± 0.2	3.9 ± 0.3	3.6 ± 0.3	3.7 ± 0.4	3.6 ± 0.4
Crowns	2.34 ± 0.31	2.09 ± 0.67	2.31 ± 0.15	1.95 ± 0.84	2.01 ± 0.83	2.30 ± 0.31	2.13 ± 0.39	2.26 ± 0.20
Roots	2.39 ± 0.24	2.35 ± 0.43	2.19 ± 0.32	2.19 ± 0.40	2.30 ± 0.58	2.60 ± 0.26	2.26 ± 0.49	2.43 ± 0.36

Interseeding Cover Crops into Double-Crop Soybeans - Initial Findings

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The mid-Atlantic region has the highest percentage of arable acreage in cover crops in the United States, with some reports placing Maryland and Delaware as the two states with the highest percentage of total cropland planted with cover crops (Wade et al., 2015; Hamilton et al., 2017). However, the majority of producers in the region are only using grass cover crops, since legumes require earlier planting dates in order to over-winter (Mirsky et al., 2011; Clark, 2012). Farmers in this region have success with legume cover crops when planting them after wheat harvest or frost-seeding in the spring. However, most mid-Atlantic crop rotations include double-crop soybeans planted after wheat, which limits opportunities for establishing a legume cover crop. Low legume adoption is particularly problematic as farmers could use this cover crop before corn to maximize the opportunity for nitrogen fixation benefits.

Some farmers interseed cover crops into growing cash crops to overcome this timing challenge. Current options for planting cover crops into standing corn and soybean include both aerial broadcasting via airplane and adapted high-boy sprayers. However, these two techniques often result in poor establishment due to low seed-to-soil contact and seed predation by rodents and birds (Hively et al., 2001; Baker and Griffis, 2009; Wilson et al., 2013).

To address the issue of planting cover crops into standing cash crops, our mid-Atlantic team ran numerous trials of an InterSeeder grain drill (InterSeeder Technologies, LLC; Fig. 2). Engineered by the Pennsylvania State University, this drill plants three rows of cover crops between 30-inch rows of standing cash crops. Field trials of this InterSeeder have been conducted in corn, as well as full-season soybeans, at various sites in the region with mixed results (Curran et al., 2018; Wallace et al. 2017). In Maryland, interseeding into full-season corn was moderately successful, whereas cover crops did not perform well in full season beans. However, exploratory research in Maryland identified wide-row double crop soybeans as a viable option for interseeding. The success of seeding grass-legume mixtures into 30-inch double-crop soybeans has led to an expanded on-station research program.

New Field Trials. Field trials with five different interseeded cover crop treatments were conducted to determine the optimal legume cover crop species to interseed in mixture with cereal rye and if interseeding a cover crop mixture affected wide-row double crop soybean yields. The five different cover crop treatments included: cereal rye alone, cereal rye independently mixed with four different legumes (hairy vetch, crimson clover, red clover, and winter pea), and a no cover crop control (Table 1).

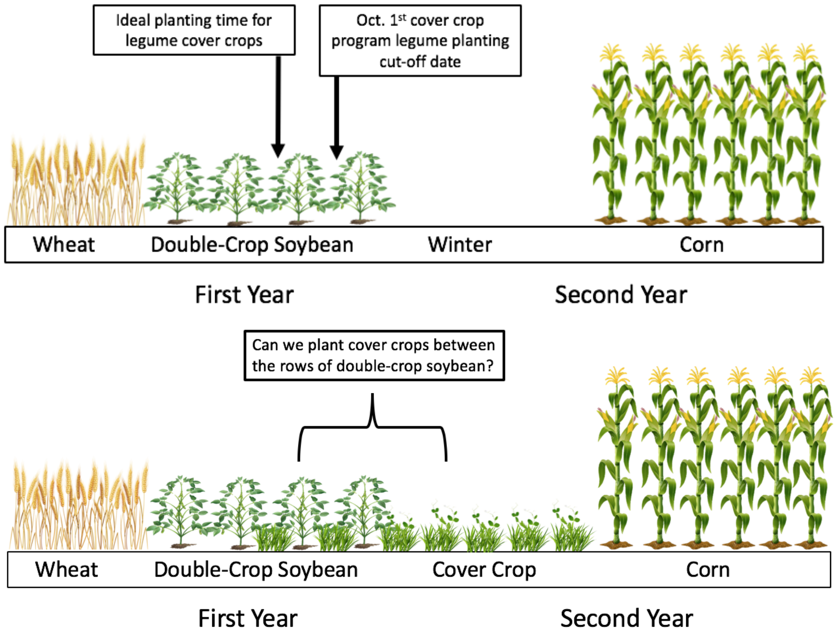

Figure 1. *(Top) A typical mid-Atlantic crop rotation, with double-crop soybeans in the field at the pivotal points for establishing a successful legume cover crop. (Bottom) Proposed crop rotation scheme for interseeding a cover crop between 30-inch soybeans. The cover crop over-winters and is terminated before corn planting in the spring.*

Table 1. *Interseeding Trial Cover Crop Seeding Rates*

Cover Crop Treatment	Seeding Rate (lbs/acre)
control - no cover crop	n/a
cereal rye	cereal rye (112)
cereal rye + hairy vetch	cereal Rye (30); hairy vetch (20)
cereal rye + crimson clover	cereal rye (30); crimson clover (20)
cereal rye + red clover	cereal rye (30); red clover (10)
cereal rye + winter pea	cereal rye (30); winter pea (70)

Figure 2. *Interseeding cover crops with three planting units between 30-inch soybean rows.*

Double-crop soybeans planted in June were then interseeded with the cover crop treatments in early September 2017 and late August 2018. The double-crop soybeans were harvested in November for 2017 and later in 2018 (December) due to wet field conditions. The interseeded cover crop treatments grew throughout the winter and were terminated with herbicides in April 2017 and 2018 before planting corn.

In an ideal interseeding scenario, the cover crop is planted as the double-crop soybeans are beginning to reach full canopy in early September. That way, the cover crops only have to survive a few weeks under the low light conditions of a soybean canopy until leaf drop. Once the soybean canopy is gone, the cover crops continue to grow but do not interfere with soybean harvest.

Insights from Interseeding Trials

- **Cereal rye + crimson clover produced the highest average cover crop biomass.** The cereal rye + crimson clover fall 2017 seeding produced an average of 4,980 lbs per acre of biomass while the 2018 seeding produced 3,950 lbs per acre by the spring of 2019. Cereal rye + hairy vetch and cereal rye + winter pea reached similar levels of biomass in two out of the three field sites where the cover crops survived under the soybean canopy.
- **Interseeding did not decrease yield.** There was no pattern of soybean yield differences between the 30 -inch wide row double-crop soybeans that had or hadn't been interseeded. Likewise, there were very minimal differences in soybean yields between the cover crop treatments.
- **Interseeding did not affect soybean grain quality.** Green cover crop plant material was not found in any soybean grain subsampling. Moisture levels remained consistent, with very slight variance across the field as expected in a normal cropping system.
- **Row orientation matters.** Out of the five trial sites, two of the cover crop plantings did not survive under the soybean canopy. Interestingly, the three

field sites with strong cover crop survival rates had rows oriented in roughly the same direction: East-West or Southeast-Northwest. The two field sites where the cover crops sprouted but did not survive under the soybean canopy in the fall were on a perpendicular row orientation of Northeast-Southwest.

Row Spacing Considerations. The InterSeeder requires a 30-inch row spacing, while most double-crop soybean fields are planted in narrower rows of 15 inches or less. To account for the differing production practices, these field trials also included simple yield comparisons of 30- and 15-inch row double-crop soybeans. In the row spacing (15- vs 30-inches) trial, results were mixed. There was a yield penalty for wide row spacing in 2017, but not in 2018.

While the benefits of narrow row spacing have been well documented in full season beans, less is known about the potential advantages in double crop soybeans. We speculate that optimal production years enhance the effect of row spacing. For example, 2017 was a better soybean year compared to 2018 across the mid-Atlantic region. Higher levels of precipitation in 2018 than 2017 could have damaged yields. Previous research indicates that in lower yield years or for late-planted soybeans, the benefit of planting in 15 inch rows over 30 inch rows is lost (Alessi and Power, 1982; Hodges et al., 1983; Boquet, 1990; Weaver et al., 1990, Oplinger et al., 1992; Pederson and Lauer, 2003, Whaley et al., 2015).

Future Research. Nitrogen content analysis of the interseeded cover crop biomass is currently underway. Next, the research team will analyze how the following year's corn crop responded to the interseeded cover crop mixtures.

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Cereal Rye + Winter Pea


Cereal Rye + Hairy Vetch


Cereal Rye + Crimson Clover

17 days after interseeding cover crops (Sept. 22, 2017)


Cereal Rye + Winter Pea


Cereal Rye + Hairy Vetch

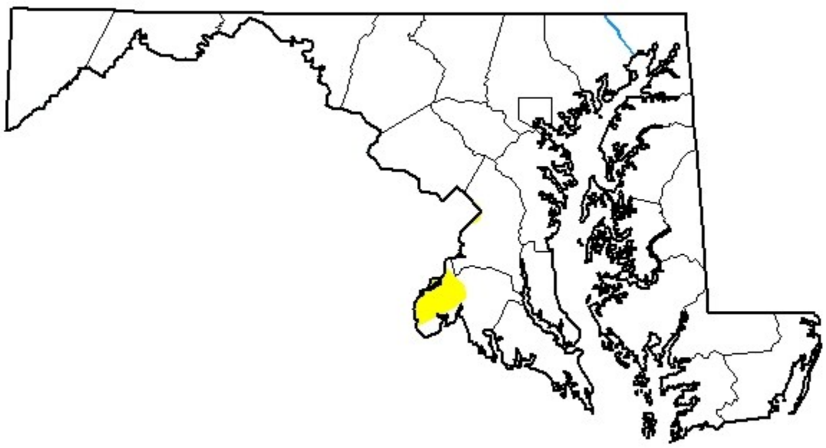

Cereal Rye + Crimson Clover

Interseeded cover crops prior to harvest (Nov. 13, 2017)

Currently, 1.48% of the State is abnormally dry. There is a 33-40% probability of above-average temperatures in the month of September for the southern half of the State. Points east and south of Frederick County have between a 33-60% probability of above-average rainfall for September.

U.S. Drought Monitor
Maryland

August 27, 2019
(Released Thursday, Aug. 29, 2019)
Valid 8 a.m. EDT

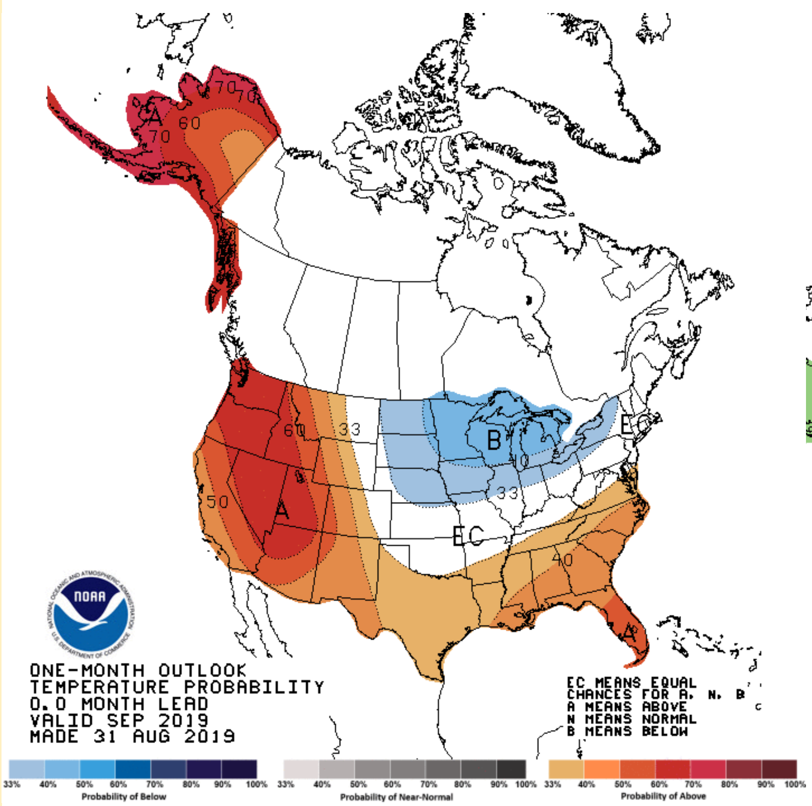


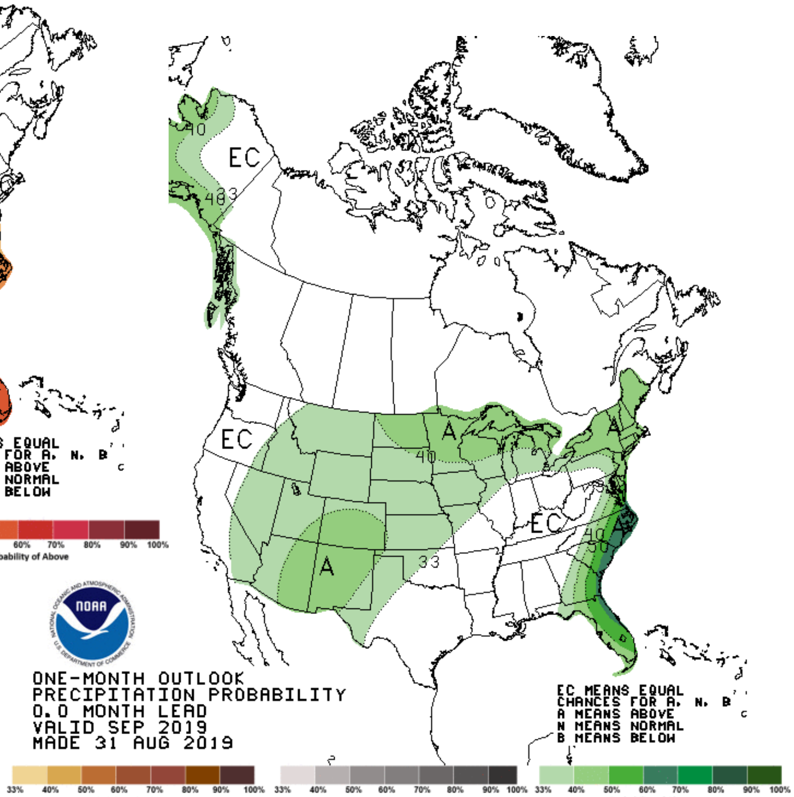
Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	98.52	1.48	0.00	0.00	0.00	0.00
Last Week 08-20-2019	98.52	1.48	0.00	0.00	0.00	0.00
3 Months Ago 05-28-2019	100.00	0.00	0.00	0.00	0.00	0.00
Start of Calendar Year 01-01-2019	100.00	0.00	0.00	0.00	0.00	0.00
Start of Water Year 09-25-2018	100.00	0.00	0.00	0.00	0.00	0.00
One Year Ago 08-28-2018	100.00	0.00	0.00	0.00	0.00	0.00

Intensity:
- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions.





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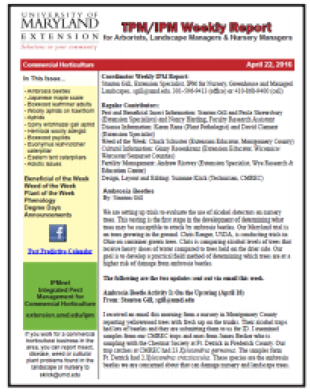

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Crop Reports

Western Maryland

Corn silage harvest has begun. Corn is drying down; be sure to keep an eye on the moisture. Soybeans have not yet begun to dry down; most are still filling pods. Total rainfall over the past month has been approximately 2-4 inches across the county, with most of that coming in a few thunderstorms. Temperatures have dropped into the upper 70s and lower 80s; this will continue into the next couple of weeks. —*Kelly Nichols*

Northern Maryland

August has been hot and dry for most of Northern MD; although several isolated storms did bring some rain to many parts of the region; however, very spotty. The weather has been nice for making hay and silage. The lack of moisture in some areas has likely taken some of our top-end yields—but still, crops look good and a big corn harvest is anticipated for much of the region; which should be in full swing in about two weeks. Full season soybeans look good and are starting to turn; some of the latest planted double-crop beans have struggled to put on much growth during this hot, dry spell. —*Andy Kness*

Upper & Mid Eastern Shore

Corn harvest is in full swing. Yields are not at record levels, but very good overall and well above 10 year average - the lines at the granaries are forming. Early full season beans will be ready soon and look good. The later full season beans suffered from drought in some areas. Double crop beans greatly needed the recent rains. I am optimistic that bean yields will be very good this year. I am not sure the aerial applicators have slept much in the past month. They went from spraying podworms to spreading cover crop seed from day break to dark. Hay quality has been excellent and recent rains are helping fall growth. Palmer Amaranth has really showed up above beans in the past couple weeks. Many fields that were assumed clean, still have a plant here and there. The dicamba beans are really helping to control Palmer and has proven to be a good tool. However, precautions need to be taken to prevent off site movement. —*Jim Lewis*

Lower Eastern Shore

Most corn is approaching maturity at dent to black layer stages. In the fields that are mature, many farmers have stopped shelling due to high moisture content, and very little corn has been harvested to-date. Yield reports range from good to poor to bad, depending on location and the amount of rain received. Soybean crops are on average R6 stage. Some short season soybean fields are starting to dry down. There have been several reports of nematode damage in soybean fields. The hot, humid weather has led to reports of increased disease pressure in vegetable crops. Herbicide resistant ragweed, marestail, and Palmer Amaranth are problematic in the region, and care should be taken to thoroughly clean equipment during harvest to avoid contamination of other fields. Cover crops have been aerial seeded on many fields. —*Sarah Hirsh*

Southern Maryland

Dry conditions have continued for most of the region. Corn harvest began two weeks ago and is well underway with an early maturing crop. Yields are variable, with most farms reporting a decent crop overall. Soybeans have suffered over the last month due to limited rainfall. We are finding podworms in many fields throughout the area well above threshold levels. If you haven't already scouted fields for worm activity, I encourage you to do so soon. As was the case last year, Sudden Death Syndrome (SDS) is now evident, with patches showing up mainly in full season beans. With the drier weather, Palmer Amaranth and common ragweed are readily evident. Cool season grasses are dormant now with very limited regrowth. —*Ben Beale*

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