Forage Performance of Cereal Cover Crops in Maryland

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2020-2021 Results
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Dairy farmers are constantly looking for sources of forage to meet their feed needs. One source that many of our 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 (26) representing three species (rye, triticale, wheat) 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 November 5, 2020. Planting was delayed in 2020 due to multiple large rain events that kept equipment out of the field. 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 in most plots by late fall.

Our goal each year is to time spring biomass harvest with when entries reach late boot to early heading stage of development. We reached this growth stage from late April to mid May in 2021, with three harvest dates to capture the variation in maturity (April 20, May 4, May 14). 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^{o} 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 and 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 (N) in the biomass. These two factors were used to estimate N uptake (Table 1). Despite late planting 2020, all varieties amassed good biomass during the growing season. Nitrogen uptake in 2021 was lower than in 2020, but still good, with only two varieties significantly different from the overall mean (one greater, one less). Several forage quality characteristics for these cereals were 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 N 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). Three rye varieties (Aroostook, TriCal Exp 19R01, and the check variety) had significantly greater CP than overall mean, with two triticale varieties (BCT 19004 and Hi Octane) having significantly less CP than the overall mean. Both Aroostook and TriCal Exp 19R01 also had soluble protein and rumen degradable protein (RDP) significantly greater than the overall mean.

Neutral and acid detergent fiber (NDF, 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%. Our plots were slightly more mature than ideal this year, with overall mean NDF of 60.2% and ADF of 36%. Despite this, one rye variety (KWS Propower) had ADF significantly less than the mean and both Aroostook and TriCal Exp 19R01 had ADF numerically less than 35%, although they likely would have ADF similar to the overall mean of 36%. Aroostook and TriCal Exp 19R01 also had total digestible nutrients (TDN), net energy for lactation (NEL) significantly greater than the overall mean, indicating good performing varieties. Some good performing

wheat varieties included LW2068 and LW2958, which had lower ADF values, low NDF values, high TDN and NEL.

The characteristic that best captures the overall forage quality performance is Relative Feed Value (RFV). An RFV of 100 is defined as the forage value that full bloom alfalfa would have. Two triticale varieties (KWS Propower and Aroostook) had RFV significantly greater than the overall mean (95.0) and over 100. TriCal Exp 19R01 had RFV similar to the overall mean, but combined with the other forage quality factors indicate a good performing triticale variety. Three wheat varieties (LW2068, LW2958, Pioneer 25R25) had RFV significantly greater than the overall mean, and combined with other forage quality factors, indicate good performing wheat varieties.

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.

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Table 1. Forage and cover crop performance of cereal species evaluated in Clarksville, MD during 2020-2021 growing season.

Variety	Species	Brand	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
Wheeler	Rye	TriCal	13241	May 9	266*	12.5	6.0	9.3	38.5	60.7	6.2	60.1	0.61	90.0
Hazlet	Rye	TriCal	10736	May 6	202	11.5	4.9	8.2	36.4	61.3	6.8	60.1	0.61	92.2
KWS Propower	Rye	TriCal	9412	May 9	182	12.5	6.9*	9.7*	32.2	57.5	6.5	62.8*	0.64*	104.2*
Aroostook	Rye	TriCal	8117#	April 25	211	16.7*	7.0*	11.9*	34.7	55.4	8.6*	62.1	0.63	104.5*
TriCal Exp 19R01	Rye	TriCal	8251	April 25	197	14.8*	6.8*	10.8*	34.2	57.4	7.3	62.0	0.63	101.0
Rye VNS	Rye	check	10065	May 4	240	15.1*	5.5	10.3*	35.4	55.8	7.9*	61.8	0.63	102.5
Rye Mean			**9970**	**May 3**	**216**	**13.9**	**6.2**	**10.0**	**35.2**	**58.0**	**7.2**	**61.5**	**0.63**	**99.1**
TriCal Gunner	Triticale	TriCal	11936	May 14	176	9.2	4.2	6.7	39.1*	63.6*	7.2	58.2	0.59	85.7
TriCal Exp 20T02	Triticale	TriCal	12531	May 14	186	9.3	3.1	6.2	37.2	62.1	6.1	59.4	0.60	90.0
TriCal Flex 719	Triticale	TriCal	12329	May 14	205	10.4	5.4	7.9	41.7*	65.8*	7.0	56.2	0.57	80.0
TriCal Merlin Max	Triticale	TriCal	14641*	May 14	233	9.9	5.7	7.8	41.4*	65.5*	6.4	56.0	0.57	81.0
TriCal Surge	Triticale	TriCal	10535	May 14	188	11.1	5.1	8.1	37.0	61.0	6.9	57.9	0.59	92.0
TriCal Gainer 154	Triticale	TriCal	10458	May 6	176	10.4	4.2	7.3	32.7	58.0	6.9	61.8	0.63	101.7
TriCal Thor	Triticale	TriCal	12646	May 14	196	9.7	4.8	7.2	39.9*	64.6*	6.8	57.8	0.59	84.0
BCT18001	Triticale	SeedLink	8817	May 6	172	12.4	4.6	8.5	33.0	55.6	7.3	63.6*	0.65*	106.0*
BCT18002	Triticale	SeedLink	11878	May 14	186	9.9	5.3	7.6	38.3	64.5*	7.1	56.6	0.57	85.5
BCT19003	Triticale	SeedLink	13001	May 14	204	9.8	3.5	6.6	36.3	61.5	5.5	60.1	0.61	92.0
BCT19004	Triticale	SeedLink	15064*	May 14	208	8.6	3.7	6.1	42.6*	67.6*	5.5	55.9	0.57	77.0
BCT19005	Triticale	SeedLink	12406	May 14	209	10.7	5.5	8.1	35.5	61.9	5.9	60.2	0.61	92.2
BCT19007	Triticale	SeedLink	13500	May 14	199	9.2	3.3	6.2	37.4	62.7	6.9	58.3	0.59	88.7
MBX Tri-Cow Arcia	Triticale	Eddie Mercer	11849	May 6	242	12.8	5.6	9.2	35.7	60.8	7.4	60.5	0.62	93.5
Hi Octane	Triticale	check	10957	May 14	139	8.1	4.1	6.1	40.2*	63.5	6.5	57.0	0.58	85.2
Triticale Mean			**12170**	**May 12**	**195**	**10.1**	**4.5**	**7.3**	**37.9**	**62.6**	**6.6**	**58.6**	**0.60**	**89.0**
LW2169	Wheat	Local Seed	10554	May 14	172	10.2	4.7	7.5	33.9	58.6	5.2	61.9	0.63	99.3
LW2148	Wheat	Local Seed	10410	May 14	180	10.8	5.1	8.0	32.0	56.7	6.0	61.3	0.63	105.5*
LW2068	Wheat	Local Seed	12300	May 14	205	10.4	5.8	8.1	30.7	54.4	5.7	63.2*	0.65*	111.5*
LW2958	Wheat	Local Seed	10679	May 14	172	10.2	4.7	7.4	30.1	45.6	5.8	63.8*	0.66*	111.2*
P25R25	Wheat	check	11274	May 14	177	9.8	4.8	7.3	30.0	53.3	5.8	64.1	0.66*	115.0*
Wheat Mean			**11069**	**May 14**	**182**	**10.3**	**5.0**	**7.7**	**31.2**	**55.4**	**5.7**	**62.9**	**0.64**	**109.0**
Overall Mean			**11454**	**May 10**	**197**	**11.0**	**5.0**	**8.0**	**36.0**	**60.2**	**6.6**	**60.1**	**0.61**	**95.0**
$LSD_{0.1}$			2257	<1 day	47	1.9	1.8	1.6	3.1	3.4	1.1	2.4	0.03	8.8

*,# Indicates the entry was either significantly greater (*) or significantly (#) less than the overall mean for that feed characteristic.

[1]Nitrogen uptake (lb N/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.

Table 2. Brands and companies in the 2020-2021 Maryland cereal forage trials.

Brand	Address
Eddie Mercer Agri-Services, Inc.	6900 Linganore Road Frederick, Maryland 21701 www.eddiemerceragri-services.com
Local Seed Co.	802 Rozelle Street Memphis, Tennessee 38104 www.localseed.com
Seed-Link Inc.	208 St. David Street Lindsay, Ontario (Canada) K9V-4Z4 www.seed-link.ca
TriCal Superior Forage	12167 Highway 70S Vernon, Texas 76384 tricalforage.com