Selecting Summer Annual Varieties Using Yield and Digestibility

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Although cool-season grasses can provide ample and high quality forage for grazing livestock in the spring and fall, forage growth during the summer months is often restricted by high temperatures (Figure 1). In contrast warm-season annual grasses are most productive during the summer months and do not reach peak growth until temperatures approach 90 degrees Fahrenheit. Summer annual grasses such as forage sorghum (Sorghum bicolor (L.) Moench), sudangrass (Sorghum bicolor (L.) Moench), sorghum-sudangrass hybrids, and pearl millet (Pennisetum americanum (L.) Leeke) can provide high quality summer grazing for ruminant livestock in many regions of the United States.

Choosing a variety

In the past, recommendations for choosing a summer annual variety were to find a reasonably priced, locally available variety, and focus on management. While good management is absolutely critical for optimizing productivity and animal performance, recent data indicate that yield potential and digestibility should also be considered. Trials conducted at Virginia Tech's Southern Piedmont Agricultural Research and Extension Center (AREC) located near Blackstone, VA have shown that the yield and digestibility of summer annual varieties can vary greatly and are in some cases not well correlated. In fact, some of the highest yielding varieties in these trials were also some of the most digestible.

Yield and digestibility

The relationship between yield and digestibility can be seen in Figures 2-7. In three of the six years (2009, 2010, and 2015) there was no relationship between yield and digestibility. In the three remaining years (2011, 2012, and 2014) there was a negative relationship between yield and digestibility. As yield increased, digestibility decreased (Figures 4-6). All of the factors impacting the relationship between yield and digestibility are not understood. Since these were paid variety trails, cultivars entered in the trials were not consistent between years and may have impacted this relationship.

Brown midrib trait

The brown midrib or BMR trait is outward expression of a genetic mutation in corn, sorghum, and pearl millet. The midrib of the leaf appears brown or tannish in color. In most cases, plants possessing the BMR trait contain less or altered lignin, a compound that makes plant fiber less digestible in the rumen. Lower lignin levels make the plant more digestible and increase animal performance. In the sorghum species there are three mutations that have been commercially exploited, BMR-6, BMR-12, and BMR-18.

Work conducted at Virginia Tech's Southern Piedmont AREC found that four out of six years, non-BMR cultivars yielded more than those possessing the BMR trait (Figure 8). However, the range of yield within varieties possessing the BMR trait was great (Table 2). In all six years of these studies, the BMR trait increased average digestibility more than 4.5% (Figure 9). However,

like yield, the range of digestibility within the BMR trait varied greatly (Table 1). This indicates that some BMR varieties are more digestible than others. Therefore, simply selecting a variety containing the BMR trait may or may not result in maximum digestibility.

The impact of the particular BMR mutation (BMR-6, BMR-12, and BMR-18) on digestibility is less clear. Our data indicate that overall the BMR-6 mutation consistently increased digestibility (Figure 10). However, due to low number of BMR-12 and BMR-18 cultivars entered in the trials, it is not possible to draw firm conclusions about differences between BMR mutations. There is likely a strong variety x BMR mutation interaction as indicated by the large range of digestibilites within a given BMR mutation (Table 3).

Variety trial summaries

Summary of the variety trials can be found in Tables 4-9. These tables include total dry matter and in vitro true digestibility-yield (IVTD-YLD) for the season along with a weight average for the following nutritive value parameters: acid detergent fiber (ADF), neutral detergent fiber (NDF), crude protein (CP), total digestible nutrients (TDN), in vitro true digestibility (IVTD), and neutral detergent fiber digestivility-30 hr (NDFD-30). They also include the yield difference from trial average (YLD-DIF), and IVTD difference from trial average (IVTD-DIF). The last column in the tables indicates whether a given variety had an above average yield AND digestibility.

Tables 4-9 provide a tremendous amount of information. However, it can be difficult to visualize what this information means and how to use it for selecting varieties for forage programs. So in Figures 11-16, the difference from average for the yield and digestibility are graphed and the graph is divided into four quadrants. Varieties with above average yield AND digestibility are shown in the upper right hand quadrant (Figures 11-16). These are varieties that you may want to consider including in forage programs. In contrast, varieties that possessed below average yield AND digestibility are shown in the lower left hand quadrant. These are varieties that you may want to avoid.

Table 10 is a summary of varieties that have had above average yield AND digestibility for a given year. Varieties that have performed above average for multiple years tend to be more robust and would be ideal to include in a forage program. It is important to realize that most varieties will not be above average all years and that not all varieties were entered in every year of the trial.

Summary

The relationship between yield and digestibility varied from season to season for the summer annual varieties include in our trials. No relationship was found in three of the six years. In the other three years, a negative relationship occurred, where digestibility decreased as yield increased. Averaged over years, selecting varieties with the BMR trait increased digestibility by 4.5%, but tended to decrease yield. However, there was large range in both yield and digestibility for both BMR and non-BMR varieties, indicating that it is possible to select varieties that have both high yield AND digestibility.

In closing, both yield and digestibility should be considered when selecting summer annual varieties for forage programs. It is also important to select varieties that have consistent

performance across years. This indicates that the variety is robust and will perform well even when growing conditions vary.

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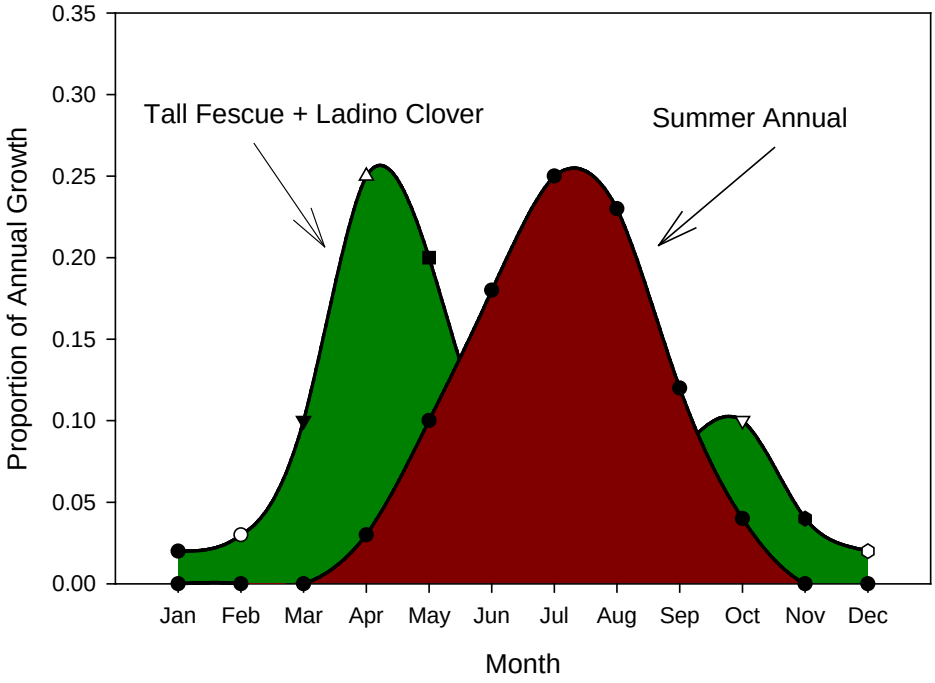

Figure 1. Growth curves for tall fescue and white clover and a summer annual such as pearl millet or sorghum-sudangrass.

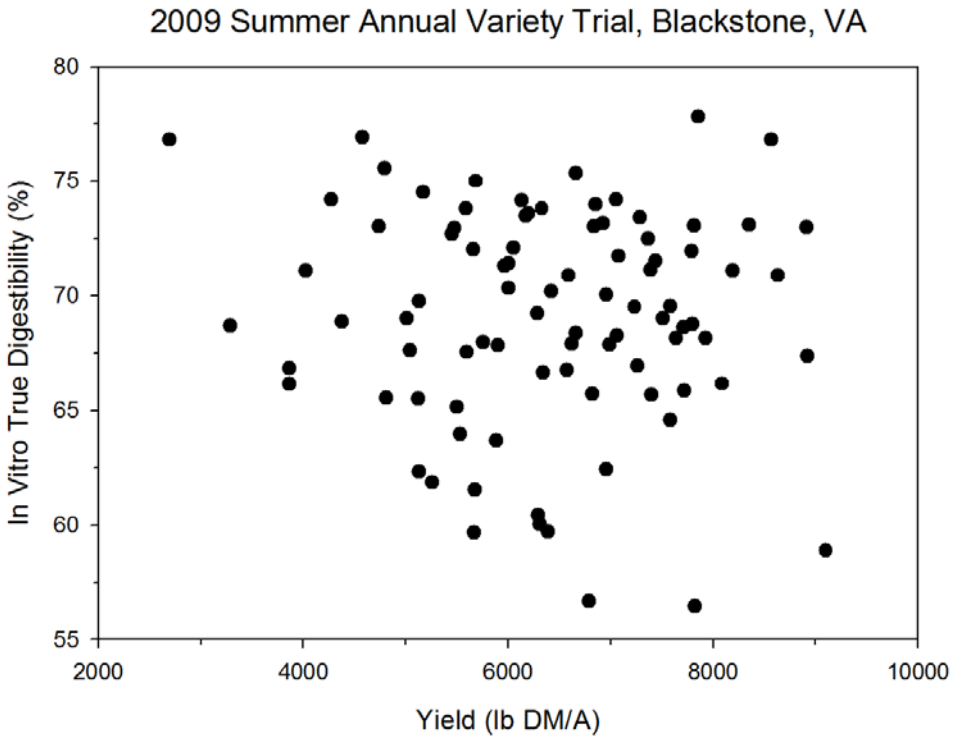

Figure 2. No relationship between yield and in vitro true digestibility existed for the 2009 growing season.

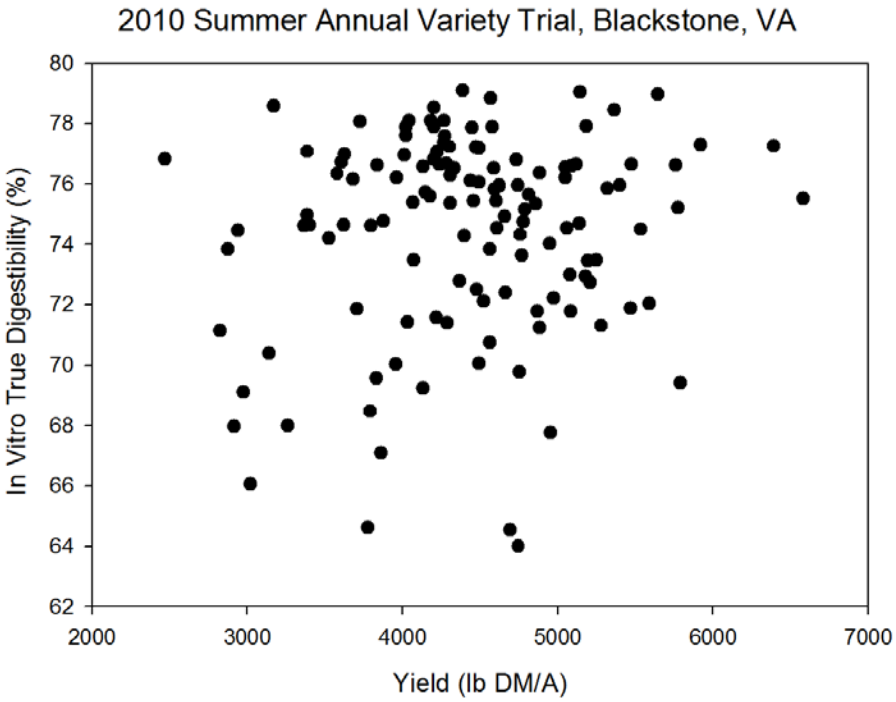

Figure 3. No relationship between yield and in vitro true digestibility existed for the 2010 growing season.

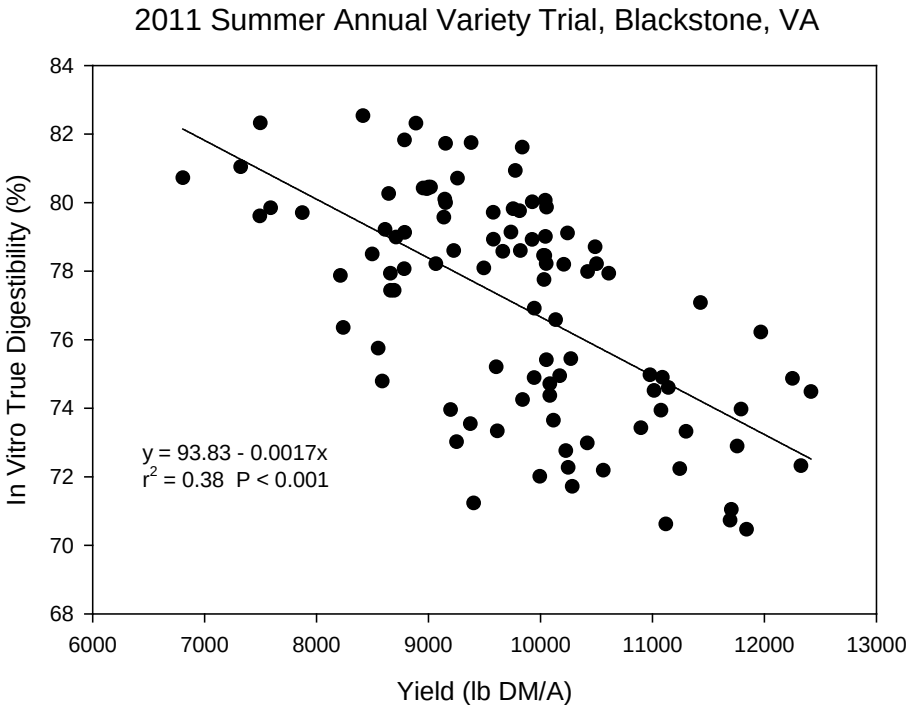

Figure 4. A negative relationship between yield and in vitro true digestibility existed for the 2011 growing season.

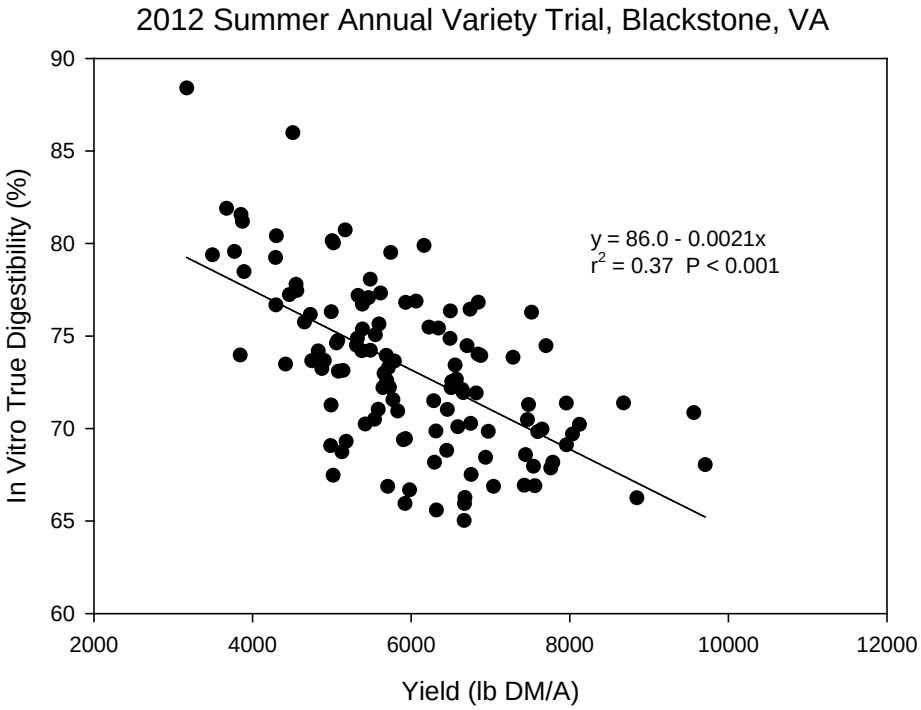

Figure 5. A negative relationship between yield and in vitro true digestibility existed for the 2012 growing season.

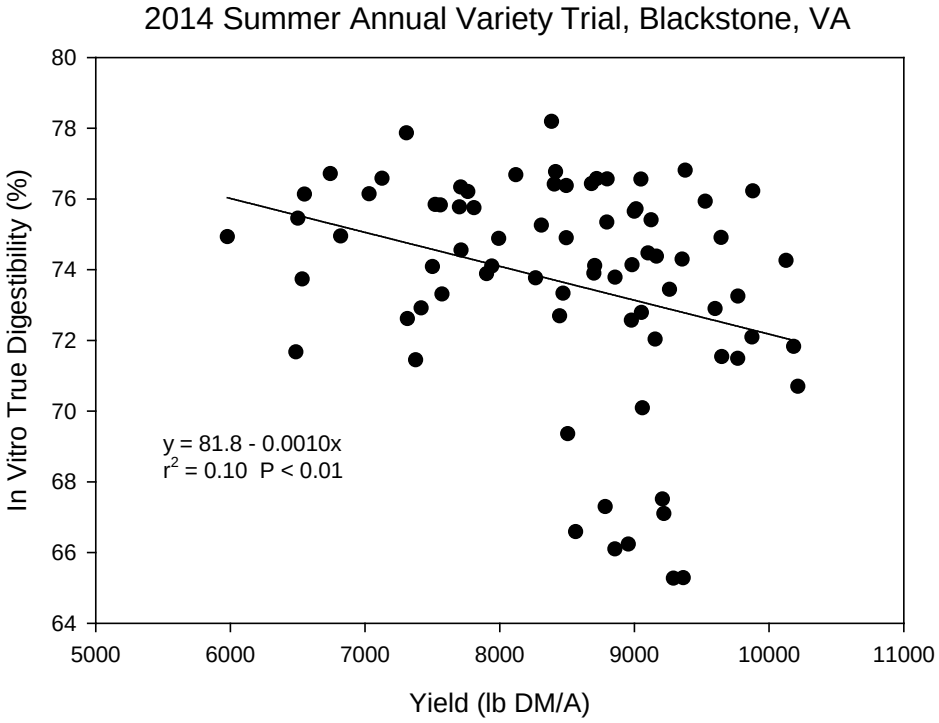

Figure 6. A negative relationship between yield and in vitro true digestibility existed for the 2014 growing season.

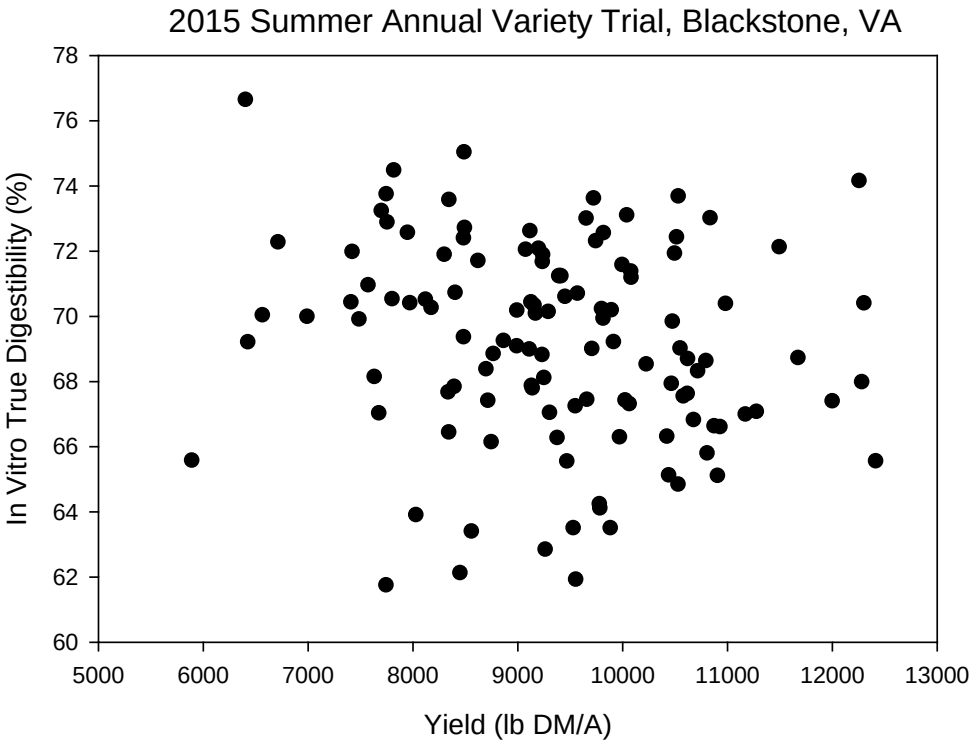

Figure 7. No relationship between yield and in vitro true digestibility existed for the 2015 growing season.

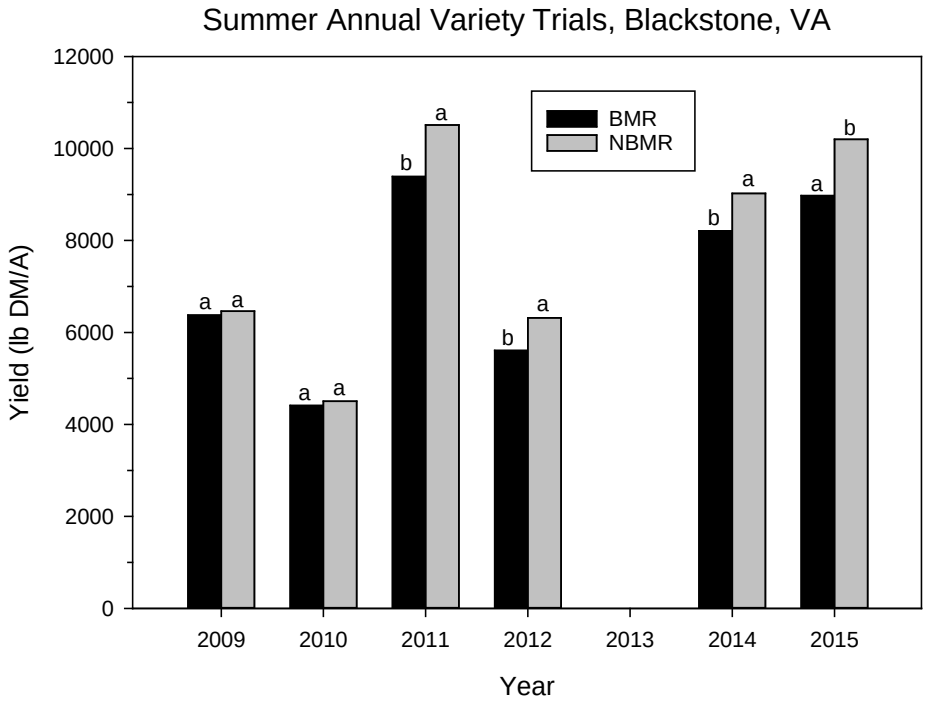

Figure 8. Four out six years, cultivars with the non-BMR trait yielded more than varieties with the BMR trait.

Table 1. Dry matter yield varied greatly within BMR trait for a given year. This indicates that it may be possible to select BMR cultivars that are higher yielding.

BMR	2009		2010		2011		2012		2014		2015	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	lb DM/A											
BMR	5199	8289	3826	5896	7303	11944	5093	6481	7071	8449	7038	10309
NBMR	4911	7631	3670	5297	9094	11772	5308	7464	8896	9542	9110	11120

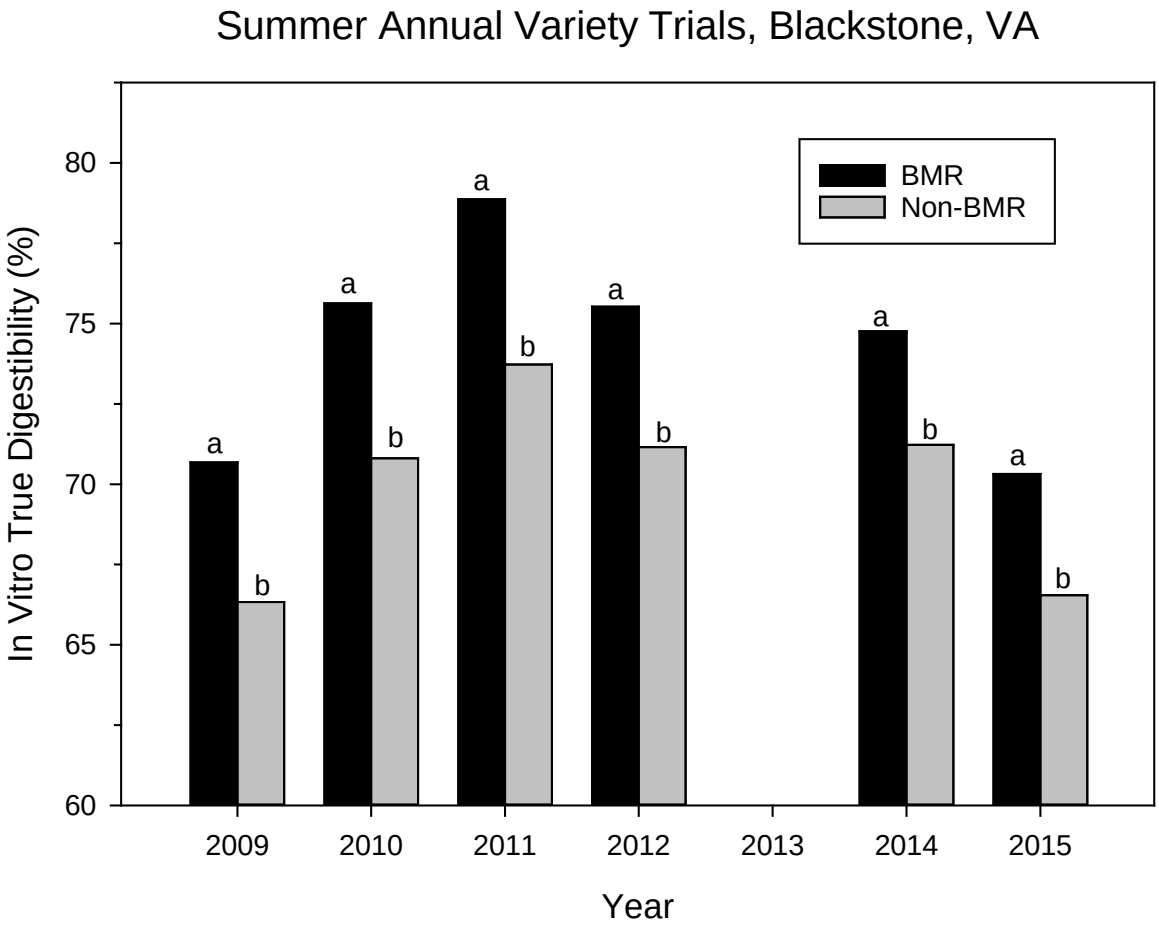

Figure 9. Cultivars with the BMR trait had a higher in vitro true digestibility.

Table 2. In vitro true digestibility varied greatly within BMR trait for a given year.

BMR	2009		2010		2011		2012		2014		2015	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	% In Vitro True Digestibility											
BMR	61	76	69	78	73	82	69	80	72	77	64	75
NBMR	59	70	66	73	72	81	67	75	66	73	65	68

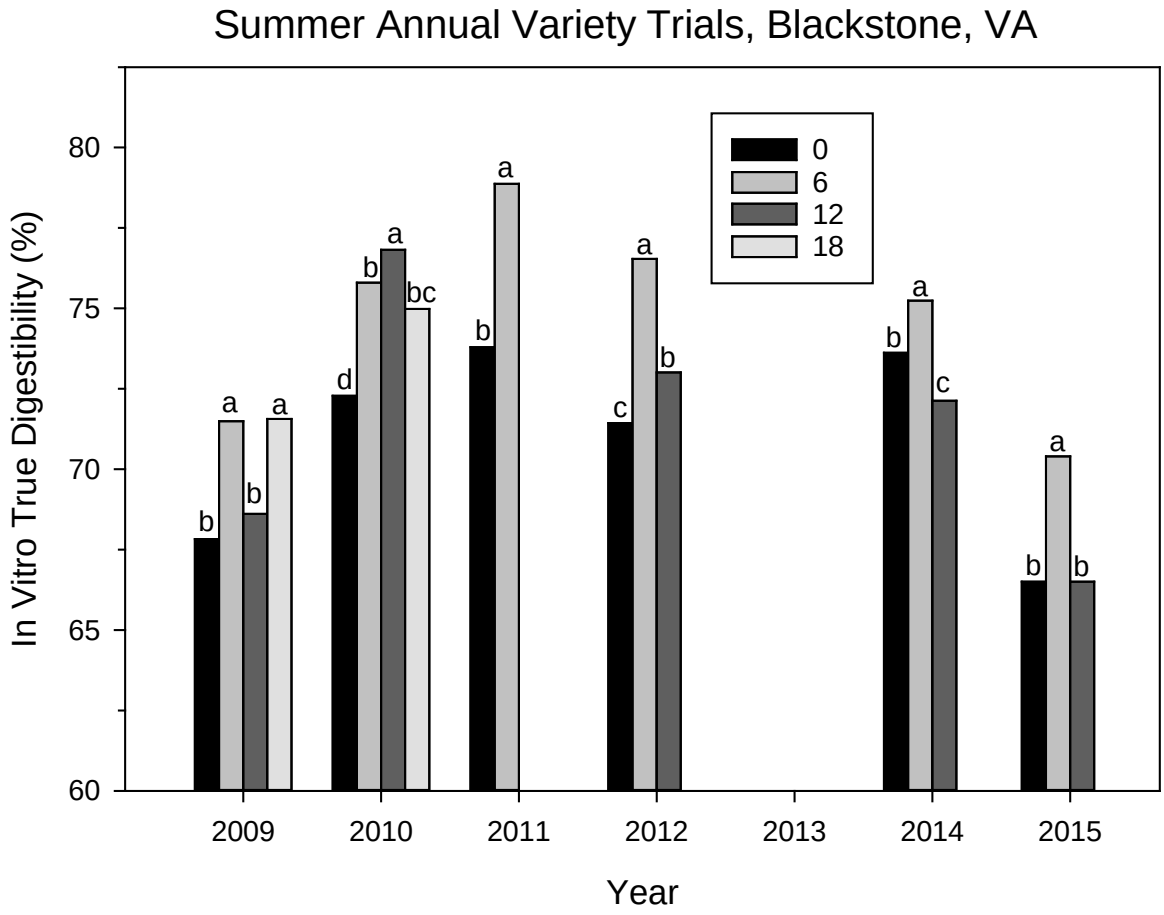

Figure 10. Averaged across varieties, BMR-6 gene consistently had increased digestibility. This data must be used with caution since the number of varieties with the BMR-12 and BMR-18 genes entered in these trials were small.

Table 3. In vitro true digestibility varied greatly within BMR mutation (gene) trait for a given year.

Gene	2009		2010		2011		2012		2014		2015	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	% In Vitro True Digestibility											
0	59	70	66	73	72	81	68	75	66	73	65	68
6	67	73	69	78	73	82	72	80	73	77	64	75
12	61	75	76	77	.	.	69	77	72	72	67	67
18	48	58	73	76	.	.	.	.	.	.	.	.

Summer Annual Variety Trial Summaries-2009 to 2015

Summaries are for *Total Yield*, *Total In Vitro True Digestibility-Yield* (IVTD-YLD), *Acid Detergent Fiber* (ADF), *Neutral Detergent Fiber* (NDF), *Crude Protein* (CP), *Total Digestible Nutrients* (TDN), *In Vitro True Digestibility* (IVTD), *Neutral Detergent Fiber Digestivility-30 hr* (NDFD-30), *Yield Difference from Trial Average* (YLD-DIF), and IVTD Difference from Trial Average (IVTD-DIF).

All nutritive value data are averages that have been weighted for yield for that given trial.

“Above Average” in last column refers for cultivars that have above average yield and digestibility.

Varieties highlighted in yellow are not different in yield than the highest yielding variety in the trial.

Table 4. Summer Annual Variety Trial-2009

Variety	BMR	Gene	Yield	IVTD-YLD	ADF	NDF	CP	TDN	IVTD	NDFD-30	YLD-DIF	IVTD-DIF	Above Average
			lb DM/A	lb DM/A	%	%	%	%	%	%	lb DM/A	%	
CanexBMR402	BMR	18	8289	6228	34.1	59.6	9.2	62.2	75.2	58.4	1882	6.1	X
XtraGraze	BMR	6	7695	5410	34.8	60.4	10.4	61.4	70.3	51.1	1288	1.2	X
HayMaster	NBMR	0	7361	4963	35.3	60.1	10.4	60.9	67.4	45.8	954	-1.7	
SS501	NBMR	0	7145	4208	36.9	64.3	11.6	59.0	58.9	36.6	738	-10.2	
SS1	BMR	6	7071	5114	33.0	58.3	11.2	63.4	72.4	52.6	664	3.3	X
Mix-PM+SS	BMR	12	7054	5075	33.3	59.8	12.4	63.1	71.9	53.0	647	2.8	X
GrazexBMR802	BMR	18	7022	4775	35.7	61.4	10.0	60.4	68.0	48.0	615	-1.1	
SS1515A	NBMR	0	6888	4816	34.6	60.9	11.2	61.7	70.4	51.7	481	1.3	X
Leafy2000	NBMR	0	6638	4403	35.1	62.1	13.2	61.1	66.1	45.6	231	-3.0	
SS635	NBMR	0	6506	4306	34.2	61.2	14.3	62.0	66.5	45.5	99	-2.6	
HayMaster2	NBMR	0	6447	4335	35.3	60.7	11.0	60.9	67.4	46.8	40	-1.7	
Surpass	BMR	6	6435	4706	32.8	60.1	11.8	63.7	73.2	55.6	28	4.1	X
22050	BMR	6	6425	4651	34.7	59.9	10.9	61.6	72.4	54.0	18	3.3	X
22053	BMR	6	6415	4592	34.8	60.0	10.7	61.5	71.8	53.0	8	2.7	X
Hayking	BMR	12	5813	3502	36.8	62.2	10.7	59.2	61.1	37.9	-595	-8.0	
SS211A	NBMR	0	5800	4000	33.9	60.1	10.9	62.4	69.2	48.9	-607	0.1	
SS220BMR	BMR	6	5751	4185	31.3	56.7	11.4	65.3	72.9	52.4	-657	3.8	
23431	BMR	6	5548	4012	34.3	61.4	12.1	62.0	72.6	55.5	-859	3.5	
HayMasterBMR	BMR	12	5296	3975	33.6	59.7	10.6	62.8	75.5	59.0	-1111	6.4	
SS130	BMR	6	5246	3495	34.9	60.2	11.0	61.3	66.5	44.4	-1161	-2.6	
ProMaxBMR	BMR	12	5199	3427	35.0	60.5	11.3	61.2	65.9	43.9	-1208	-3.2	
SS120	NBMR	0	4911	3148	36.1	61.6	10.3	60.0	64.7	43.0	-1497	-4.4	
Average			**6407**	**4424**	**34.6**	**60.5**	**11.2**	**61.7**	**69.1**	**49.2**	**0.0**	**0.0**	
Median			**6441**	**4369**	**34.7**	**60.3**	**11.0**	**61.5**	**69.8**	**50.0**	**34.0**	**0.7**	
Min			**4911**	**3148**	**31.3**	**56.7**	**9.2**	**59.0**	**58.9**	**36.6**	**-1496.5**	**-10.2**	
Max			**8289**	**6228**	**36.9**	**64.3**	**14.3**	**65.3**	**75.5**	**59.0**	**1881.8**	**6.4**	
CV (%)			**18**	**17**	**4**	**2**	**10**	**3**	**3**	**6**			
LSD(0.10)			**1327**	**882**	**1.8**	**1.5**	**1.3**	**2.0**	**2.7**	**3.4**			

Table 5. Summer Annual Variety Trial-2010

Variety	BMR	Gene	Yield	IVTD-YLD	ADF	NDF	CP	TDN	IVTD	NDFD-30	YLD-DIF	IVTD-DIF	Above Average
			lb DM/A	lb DM/A	%	%	%	%	%	%	lb DM/A	%	
Haymaster	NBMR	0	5297	3852	30.5	56.0	13.7	66.2	72.7	55.5	863	-1.7	
Xtraraze	BMR	6	5096	3880	30.3	56.1	13.2	66.4	76.1	55.7	662	1.7	X
Summergrazer	NBMR	0	5087	3616	31.1	56.9	12.4	65.5	71.2	56.4	653	-3.2	
6810	BMR	6	4958	3886	29.1	54.5	12.6	67.8	78.4	54.1	524	4.0	X
GW8528FB	BMR	12	4903	3786	30.1	55.5	11.9	66.7	77.2	55.1	469	2.8	X
SS220	BMR	6	4879	3678	29.6	54.8	13.4	67.2	75.3	54.3	445	0.9	X
SS2	BMR	6	4757	3605	29.9	55.6	13.1	66.8	75.8	55.2	323	1.4	X
22053	BMR	6	4719	3544	31.2	57.3	13.6	65.4	75.1	56.8	285	0.7	X
AS6402	BMR	6	4556	3458	30.1	56.5	14.7	66.6	75.9	56.0	122	1.5	X
SS1515A	NBMR	0	4531	3305	30.9	57.3	13.2	65.7	72.9	56.8	97	-1.5	
SS211A	NBMR	0	4522	3275	30.7	56.8	12.5	66.0	72.3	56.3	88	-2.1	
Super_Sugar	NBMR	0	4515	3261	31.3	56.8	12.5	65.3	72.1	56.3	81	-2.3	
GW9417G	NBMR	0	4504	3266	31.5	57.3	13.4	65.2	72.5	56.9	70	-1.9	
AS6501	BMR	6	4490	3425	31.0	56.6	12.9	65.7	76.4	56.2	56	2.0	X
26837	BMR	6	4481	3492	30.6	57.6	13.5	66.1	77.8	57.2	47	3.4	X
AS6401	BMR	6	4471	3378	30.9	57.2	13.8	65.8	75.7	56.8	37	1.3	X
Haymaster_BMR	BMR	12	4428	3426	30.9	56.6	13.2	65.7	77.2	56.2	-6	2.8	
Canex_801	BMR	18	4405	3219	32.0	58.7	12.7	64.5	73.1	58.2	-29	-1.3	
Surpass	BMR	6	4399	3259	30.7	57.6	13.2	66.0	74.1	57.2	-35	-0.3	
SS130	BMR	6	4374	3028	31.5	56.7	13.2	65.1	69.3	56.1	-60	-5.1	
EXPSSH82	BMR	12	4323	3321	30.0	55.8	12.9	66.7	76.8	55.4	-111	2.4	
Canex_301	BMR	18	4278	3249	30.8	56.6	13.8	65.9	76.0	56.2	-157	1.6	
22050	BMR	6	4270	3277	30.3	56.7	14.4	66.4	76.8	56.3	-164	2.4	
23402	BMR	6	4212	3236	30.5	57.0	14.1	66.2	76.9	56.6	-222	2.5	
Canex_403	BMR	18	4105	3112	30.2	56.8	12.3	66.6	75.8	56.3	-329	1.4	
GW9917GB	BMR	12	4095	3134	30.9	56.9	13.5	65.7	76.4	56.5	-339	2.0	
SS2010BD	BMR	6	3995	3096	30.8	58.1	14.3	65.9	77.4	57.7	-439	3.0	
23431	BMR	6	3942	2998	30.6	57.2	14.4	66.1	76.0	56.8	-493	1.6	
EXPSSH38	BMR	12	3910	2994	30.3	56.4	13.7	66.5	76.5	56.0	-524	2.1	
Leafy_2000	NBMR	0	3900	2616	31.1	56.1	16.2	65.6	67.2	55.5	-534	-7.2	
EXPPMBMR	BMR	3	3826	2658	30.3	56.1	16.8	66.4	69.2	55.6	-608	-5.2	
SS635	NBMR	0	3670	2420	31.6	57.0	15.6	65.0	66.3	56.4	-764	-8.1	
Average			**4434**	**3305**	**30.7**	**56.7**	**13.6**	**66.0**	**74.4**	**56.2**	**0.0**	**0.0**	
Median			**4449**	**3276**	**30.7**	**56.7**	**13.4**	**66.0**	**75.8**	**56.3**	**15.4**	**1.4**	
Min			**3670**	**2420**	**29.1**	**54.5**	**11.9**	**64.5**	**66.3**	**54.1**	**-764.3**	**-8.1**	
Max			**4719**	**3544**	**32.0**	**58.7**	**16.8**	**66.7**	**77.8**	**58.2**	**285.3**	**3.4**	
CV (%)			**12**	**13**	**2**	**2**	**7**	**1**	**2**	**2**			
LSD(0.10)			**643**	**489**	**0.7**	**1.1**	**1.1**	**0.8**	**1.6**	**1.7**			

Table 6. Summer Annual Variety Trial-2011

Variety	BMR	Gene	Yield	IVTD-YLD	ADF	NDF	CP	TDN	IVTD	NDFD-30	YLD-DIF	IVTD-DIF	Above Average
			lb DM/A	lb DM/A	%	%	%	%	%	%	lb DM/A	%	
SS210BDF	BMR	6	11944	8964	34.5	57.6	12.5	61.8	75.0	57.2	2151	-2.0	
Haymaster	NBMR	0	11772	8521	36.0	58.3	12.4	60.1	72.4	52.9	1979	-4.6	
Summergrazer_III	NBMR	0	11454	8355	34.8	57.9	13.4	61.4	73.0	53.7	1661	-4.0	
Sordan_Headless	NBMR	0	10763	7750	34.9	58.1	12.6	61.3	72.1	52.2	970	-4.9	
Super_Sugar	NBMR	0	10470	7759	34.6	57.5	13.6	61.6	74.1	55.7	677	-2.9	
SS635	NBMR	0	10430	7665	35.0	59.1	13.1	61.1	73.5	55.4	637	-3.5	
AS6501	BMR	6	10412	8073	34.0	57.4	14.6	62.3	77.6	62.2	619	0.6	X
AS9301	BMR	6	10153	7958	32.6	56.8	13.2	63.8	78.4	63.0	360	1.4	X
SS211A	NBMR	0	10073	7962	31.4	55.6	13.7	65.2	79.1	63.4	280	2.1	X
Trudan_Headless	NBMR	0	9913	7327	34.7	58.2	14.9	61.5	73.9	56.2	120	-3.1	
SS140	BMR	6	9863	7363	34.2	59.6	13.3	62.0	74.6	57.1	70	-2.4	
SS130	BMR	6	9682	7581	32.0	56.8	13.6	64.5	78.3	62.6	-112	1.3	
6810	BMR	6	9663	7661	31.6	56.9	14.2	65.0	79.3	64.1	-130	2.3	
Xtragraze	BMR	6	9645	7496	33.6	58.0	14.2	62.8	77.8	62.9	-148	0.8	
SS240	BMR	6	9636	6985	34.8	61.0	14.0	61.4	72.6	56.7	-157	-4.4	
Surpass	BMR	6	9364	7333	33.3	59.0	14.8	63.0	78.3	63.8	-429	1.3	
AS6402B2	BMR	6	9323	7484	33.6	58.5	15.1	62.7	80.3	67.2	-471	3.3	
Surpass_XL	BMR	6	9281	7360	34.3	58.7	14.8	62.0	79.3	65.7	-512	2.3	
AF7401B2	BMR	6	9236	7461	33.1	58.2	14.2	63.4	80.8	67.3	-557	3.8	
Leafy_2000	NBMR	0	9114	6781	34.2	60.5	13.8	62.1	74.5	59.5	-679	-2.5	
SS1515A	NBMR	0	9094	7367	32.2	58.3	14.6	64.3	81.0	67.7	-700	4.0	
SS220	BMR	6	9042	7180	33.1	58.9	16.1	63.3	79.4	66.2	-751	2.4	
MG_PS	BMR	6	8609	6715	34.4	58.8	15.4	61.9	78.0	63.6	-1185	1.0	
XS6503	BMR	6	8581	7039	32.7	58.6	15.0	63.8	82.0	69.7	-1213	5.0	
AF7301	BMR	6	7303	5864	32.9	57.9	15.9	63.6	80.3	67.0	-2490	3.3	
Average			**9793**	**7520**	**33.7**	**58.2**	**14.1**	**62.6**	**77.0**	**61.3**	**0.0**	**0.0**	
Median			**9663**	**7484**	**34.0**	**58.2**	**14.2**	**62.3**	**78.0**	**62.9**	**-129.8**	**1.0**	
Min			**7303**	**5864**	**31.4**	**55.6**	**12.4**	**60.1**	**72.1**	**52.2**	**-2490.0**	**-4.9**	
Max			**11944**	**8964**	**36.0**	**61.0**	**16.1**	**65.2**	**82.0**	**69.7**	**2151.0**	**5.0**	
CV (%)			**6**	**6**	**2**	**1**	**6**	**1**	**1**	**3**			
LSD(0.10)			**728**	**535**	**0.9**	**0.8**	**1.0**	**1.0**	**1.3**	**1.8**			

Table 7. Summer Annual Variety Trial-2012

Variety	BMR	Gene	Yield	IVTD-YLD	ADF	NDF	CP	TDN	IVTD	NDFD-30	YLD-DIF	IVTD-DIF	Above Average
			lb DM/A	lb DM/A	%	%	%	%	%	%	lb DM/A	%	
Summergrazer_III	NBMR	0	7464	5210	38.4	63.2	11.4	57.4	69.9	52.4	1478	-3.3	
DynaGraze_ST	NBMR	0	7230	5188	37.6	62.2	11.4	58.3	72.2	55.3	1244	-1.0	
SS211A	NBMR	0	7198	5181	36.6	62.0	10.3	59.4	72.1	55.1	1212	-1.1	
CHR-SS2	NBMR	0	7149	4818	39.2	63.9	11.3	56.5	67.5	49.1	1163	-5.7	
Sugar_Graze_II	NBMR	0	6716	4673	38.6	63.1	10.4	57.1	69.5	51.7	730	-3.7	
Super_Sugar-CPS	NBMR	0	6659	4657	38.2	62.7	11.5	57.6	70.3	52.7	673	-2.9	
CW6-43-50	BMR	12	6481	4482	37.9	62.8	11.4	57.9	69.2	50.9	495	-4.0	
Super_Sugar-GW	NBMR	0	6249	4588	37.3	62.0	11.3	58.6	74.2	58.7	263	1.0	X
Haymaster	NBMR	0	6244	4383	37.8	62.7	11.7	58.1	70.5	53.0	258	-2.7	
Xtragraze_BMR	BMR	6	6198	4527	36.9	62.1	11.4	59.0	73.3	57.0	212	0.1	X
Leafy_2000	NBMR	0	6038	4202	37.0	62.9	12.9	59.0	69.7	51.8	52	-3.5	
Sweet_Forever	NBMR	0	5954	4267	37.5	62.4	11.6	58.3	72.1	55.4	-32	-1.1	
SS635	NBMR	0	5941	4129	37.4	63.8	11.9	58.5	69.6	52.3	-45	-3.6	
CHR-FS9	NBMR	0	5928	4195	38.3	64.6	12.6	57.6	71.2	55.5	-58	-2.0	
CHR-SG1	NBMR	0	5925	4226	37.2	62.0	12.3	58.7	71.9	54.8	-61	-1.3	
SS130	BMR	6	5894	4162	37.1	62.3	12.1	58.9	72.0	55.2	-92	-1.2	
AF7201	BMR	6	5870	4509	35.7	60.6	11.7	60.4	76.8	61.8	-116	3.6	
SS220	BMR	6	5869	4385	35.7	60.2	11.2	60.4	74.6	57.7	-117	1.4	
EXP10010	BMR	12	5713	4382	36.8	62.5	10.0	59.2	77.3	63.8	-273	4.1	
SS1515A	NBMR	0	5539	4014	36.7	62.7	12.3	59.3	72.7	56.6	-447	-0.5	
CHR-FS4	NBMR	0	5523	4096	36.7	62.4	11.6	59.3	74.5	59.1	-463	1.3	
AF7301	BMR	6	5497	4249	35.9	61.5	12.6	60.1	78.0	64.4	-489	4.8	
AS9301	BMR	6	5496	4214	35.1	59.9	10.9	61.1	76.8	61.3	-490	3.6	
CW5-43-29	BMR	12	5470	3821	37.4	61.8	11.8	58.5	69.9	51.4	-516	-3.3	
UNL	NBMR	0	5308	3756	38.1	63.7	12.2	57.7	70.7	53.9	-678	-2.5	
AS6401	BMR	6	5297	4126	37.0	61.4	13.1	58.9	79.1	66.3	-689	5.9	
Sweet Forever-BMR	BMR	12	5279	3969	36.9	63.1	10.6	59.1	75.6	61.5	-707	2.4	
AS6501	BMR	6	5229	4143	36.8	61.2	12.8	59.1	79.8	67.1	-757	6.6	
AF7401	BMR	6	5142	4028	34.9	61.0	11.8	61.3	78.5	64.8	-844	5.3	
AS6402	BMR	6	5093	3864	36.3	62.8	12.7	59.7	76.5	62.7	-893	3.3	
Average			**5986**	**4348**	**37.1**	**62.3**	**11.7**	**58.8**	**73.2**	**57.1**	**0.0**	**0.0**	
Median			**5909**	**4237**	**37.0**	**62.4**	**11.7**	**58.9**	**72.2**	**55.5**	**-76.5**	**-1.1**	
Min			**5093**	**3756**	**34.9**	**59.9**	**10.0**	**56.5**	**67.5**	**49.1**	**-892.6**	**-5.7**	
Max			**7464**	**5210**	**39.2**	**64.6**	**13.1**	**61.3**	**79.8**	**67.1**	**1478.1**	**6.6**	
CV (%)			**13**	**12**	**3**	**2**	**9**	**2**	**4**	**7**			
LSD(0.10)			**884**	**593**	**1.4**	**1.4**	**1.2**	**1.5**	**3.3**	**4.9**			

Table 8. Summer Variety Trial-2014

Variety	BMR	Gene	Yield	IVTD-YLD	ADF	NDF	CP	TDN	IVTD	NDFD-30	YLD-DIF	IVTD-DIF	Above Average
			lb DM/A	lb DM/A	%	%	%	%	%	%	lb DM/A	%	
SuperSugar	NBMR	0	9542	6869	33.74	59.67	11.95	62.59	71.99	53.16	1073	-1.66	
SS220	BMR	6	9497	7090	31.63	58.05	11.86	64.96	74.66	56.39	1028	1.01	X
SS211	NBMR	0	9199	6644	33.50	60.18	11.73	62.87	72.31	54.09	730	-1.34	
Grazex_801	BMR	12	9145	6592	33.46	60.93	12.25	62.91	72.12	54.34	676	-1.53	
Tifleaf_III	NBMR	0	9106	6024	34.11	62.18	13.79	62.18	66.17	45.80	637	-7.49	
SS635	NBMR	0	8953	5970	33.63	61.71	13.95	62.72	66.69	46.13	484	-6.97	
SuperSugar_DM	NBMR	0	8896	6517	33.09	59.41	12.29	63.33	73.26	55.02	427	-0.39	
SSG886	BMR	6	8841	6597	32.20	58.77	12.40	64.33	74.63	56.91	372	0.98	X
AS6501	NBMR	0	8449	6501	33.00	59.16	12.70	63.42	76.95	61.09	-20	3.30	
AS9302	BMR	6	8445	6372	32.26	59.92	13.67	64.25	75.47	59.07	-24	1.82	
GW300BMR	BMR	6	8369	6379	33.22	60.27	11.84	63.17	76.19	60.56	-100	2.54	
SweetSixBMR	BMR	6	8334	6307	32.63	59.04	12.75	63.84	75.63	58.77	-135	1.98	
AS6401	BMR	6	8294	6228	33.61	59.61	12.76	62.75	75.10	58.24	-175	1.45	
AS9301	BMR	6	8257	6210	32.21	58.78	11.74	64.31	75.25	57.93	-212	1.60	
SweetForeverBMR	BMR	6	8222	6243	33.18	60.44	12.81	63.23	75.96	60.33	-247	2.31	
Grazex_725	BMR	6	7782	5868	32.65	59.27	12.33	63.82	75.45	58.59	-687	1.80	
AS6402	BMR	6	7275	5550	31.99	60.17	13.78	64.55	76.26	60.58	-1194	2.60	
SS130	BMR	6	7206	5263	32.78	58.97	11.74	63.68	73.05	54.39	-1263	-0.60	
Pro-Max_BMR	BMR	12	7071	5085	32.97	59.84	13.28	63.47	72.15	53.61	-1398	-1.51	
Average			**8468**	**6227**	**32.94**	**59.81**	**12.61**	**63.49**	**73.65**	**56.05**	**0**	**0.00**	
Median			**8445**	**6307**	**33.00**	**59.67**	**12.40**	**63.42**	**74.66**	**56.91**	**-24**	**1.01**	
Min			**7071**	**5085**	**31.63**	**58.05**	**11.73**	**62.18**	**66.17**	**45.80**	**-1398**	**-7.49**	
Max			**9542**	**7090**	**34.11**	**62.18**	**13.95**	**64.96**	**76.95**	**61.09**	**1073**	**3.30**	
CV (%)			**9**	**9**	**2**	**1**	**6**	**1**	**1**	**3**			
LSD(0.10)			**870**	**644**	**0.7**	**0.8**	**0.8**	**0.8**	**1.2**	**1.8**			

Table 9. Summer Annual Variety Trial-2015

Variety	BMR	Gene	ADF	NDF	CP	TDN	IVTD	NDFD-30	Yield	Yld-Diff	IVTD-Diff	ABOVE Average
			%	%	%	%	%	%	lb DM/A	lb DM/A	%	
Super Sugar	NBMR	0	36.4	60.4	13.1	59.6	68.3	47.8	11120	1767	-0.9	
Super Sugar (DM)	NBMR	0	36.5	60.7	13.0	59.5	68.0	47.4	11032	1679	-1.2	
SS211	NBMR	0	36.6	61.9	12.8	59.4	67.1	47.1	10698	1345	-2.1	
AS9301+SS635	BMR+NBMR	6+0	37.2	61.5	12.8	58.7	67.7	47.4	10530	1177	-1.5	
AS5201	NBMR	0	36.7	60.9	11.9	59.3	66.8	45.6	10472	1119	-2.4	
Tifleaf III	NBMR	0	37.8	63.6	13.7	58.1	65.8	46.2	10319	966	-3.4	
AS9301+AS6402	BMR	6	34.0	58.6	13.2	62.3	72.6	53.2	10309	956	3.4	X
AF7401+AS9301	BMR	6	33.9	58.2	13.0	62.4	72.5	52.6	10148	795	3.3	X
FSG215BMR6	BMR	6	35.6	59.6	12.1	60.5	72.4	53.6	9988	635	3.2	X
Exp 10033	BMR	6	37.3	60.8	12.3	58.7	68.4	48.0	9947	594	-0.8	
Sweet Forever BMR	BMR	6	36.7	60.8	12.0	59.3	69.1	49.4	9716	363	-0.1	
AS6402	BMR	6	35.3	60.8	14.0	60.8	70.9	52.2	9690	337	1.7	X
Nutra-King BMR-6	BMR	6	35.5	59.4	12.7	60.6	70.0	49.6	9574	221	0.8	X
FSG214BMR6	BMR	6	36.7	61.4	12.9	59.3	69.0	49.4	9530	177	-0.2	
SS635	NBMR	0	38.2	63.7	14.9	57.6	65.8	46.2	9507	154	-3.4	
Sweet Six BMR-6	BMR	6	37.0	61.5	12.6	58.9	68.0	48.0	9344	-9	-1.2	
FSG Leafy 300	NBMR	0	38.2	64.3	15.2	57.7	65.1	45.7	9327	-26	-4.1	
AS6401	BMR	6	36.6	61.0	13.9	59.4	71.7	53.5	9309	-44	2.5	
Greengrazer V	NBMR	0	37.4	61.5	12.1	58.5	65.4	43.9	9110	-243	-3.8	
FSG315 Dwarf BMR	BMR	?	34.2	62.1	15.5	62.1	71.0	53.2	8773	-581	1.8	
AS9302	BMR	6	35.2	60.4	13.4	61.0	72.7	54.8	8770	-583	3.5	
AS9301	BMR	6	36.3	60.5	11.8	59.7	69.8	50.2	8737	-617	0.6	
Danny Boy BMR	BMR	6	37.6	61.9	14.0	58.3	70.1	51.8	8445	-909	0.9	
SS1562	BMR	R	35.7	62.7	16.2	60.4	70.7	53.2	8437	-916	1.5	
Fullgraze BMR	BMR	6	35.3	60.1	13.4	60.9	72.3	54.0	8432	-921	3.1	
SS1652	BMR	6	37.6	61.9	12.8	58.3	68.5	49.1	8313	-1040	-0.7	
AS6201	BMR	6	36.0	60.8	12.7	60.0	72.1	54.0	8285	-1068	2.8	
SS130	BMR	6	38.3	61.8	12.4	57.5	63.7	41.5	8270	-1084	-5.5	
AF7401	BMR	6	33.7	59.2	14.3	62.6	74.5	57.1	7414	-1939	5.3	
FSG1000BMR	BMR	12	36.4	60.9	13.6	59.6	66.6	45.2	7038	-2315	-2.6	
Average			**36.3**	**61.1**	**13.3**	**59.7**	**69.2**	**49.7**	**9353**	**0**	**0.0**	
Median			**36.5**	**60.9**	**13.0**	**59.5**	**69.1**	**49.4**	**9425**	**72**	**-0.1**	
Min			**33.7**	**58.2**	**11.8**	**57.5**	**63.7**	**41.5**	**7038**	**-2315**	**-5.5**	
Max			**38.3**	**64.3**	**16.2**	**62.6**	**74.5**	**57.1**	**11120**	**1767**	**5.3**	
CV (%)			**3**	**2**	**7**	**2**	**2**	**5**	**10**			
LSD (0.10)			**1.3**	**1.3**	**1.1**	**1.5**	**2.0**	**1.7**	**1145**			

Figures 11-16. In these figures yield and in vitro digestibility are expressed as a difference from the average value for a given trial. The value of zero represents the average value for the trial. Negative values represent a value that is below average, while positive values represent a value that is above average. Producers should try to select varieties that are above average for both yield and digestibility.

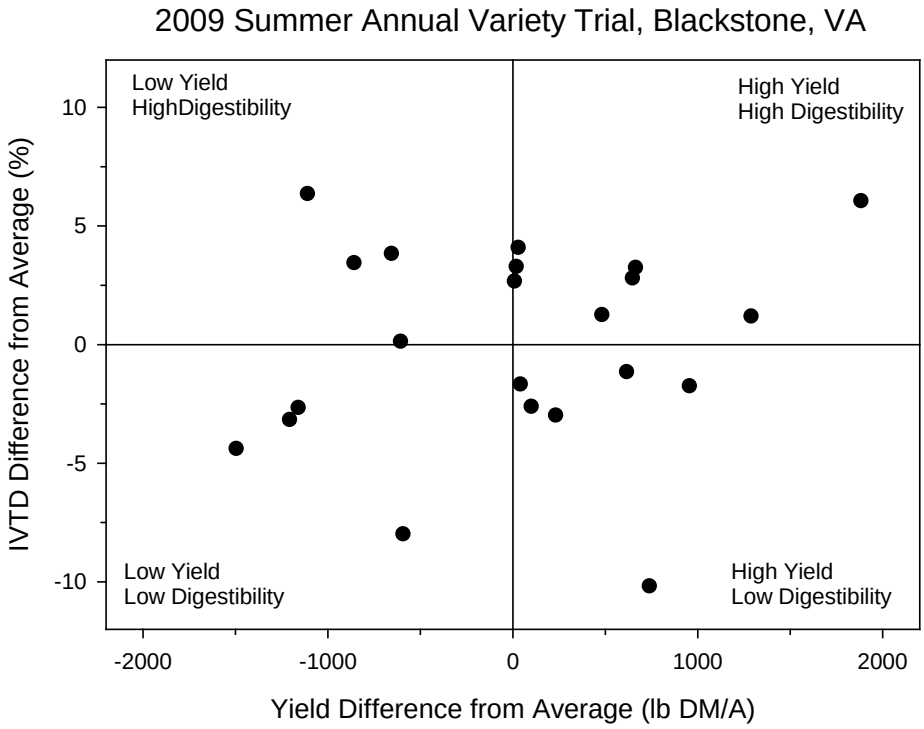

Figure 11. In 2009, eight varieties were above average in both yield and digestibility for the summer annual variety trial held at Virginia Tech's Southern Piedmont AREC, Blackstone, VA.

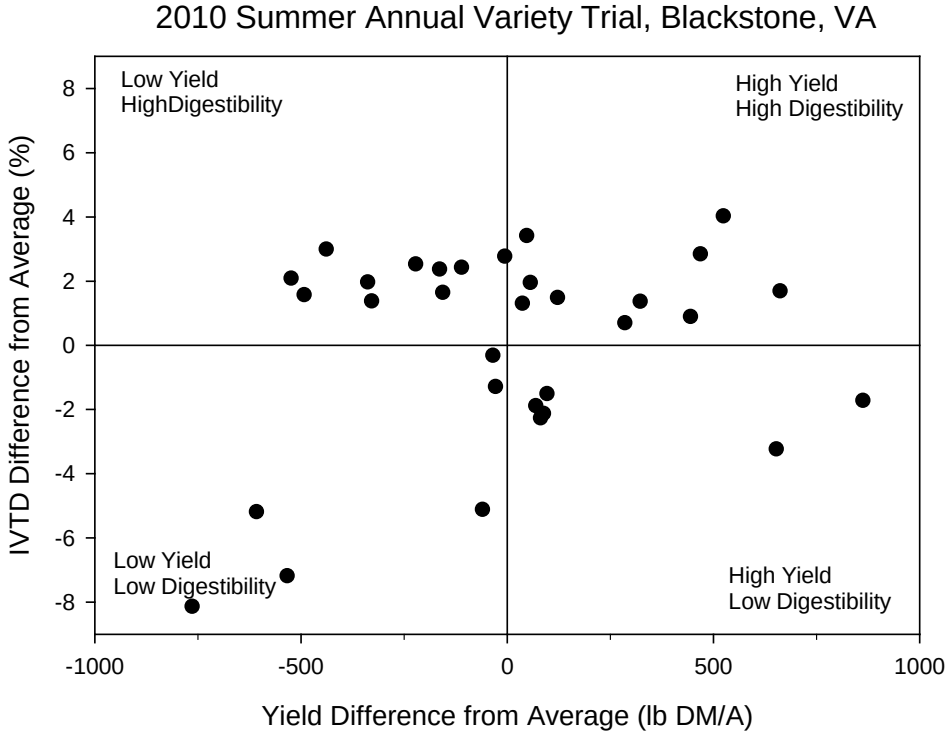

Figure 12. In 2010, ten varieties were above average in both yield and digestibility for the summer annual variety trial held at Virginia Tech's Southern Piedmont AREC, Blackstone, VA.

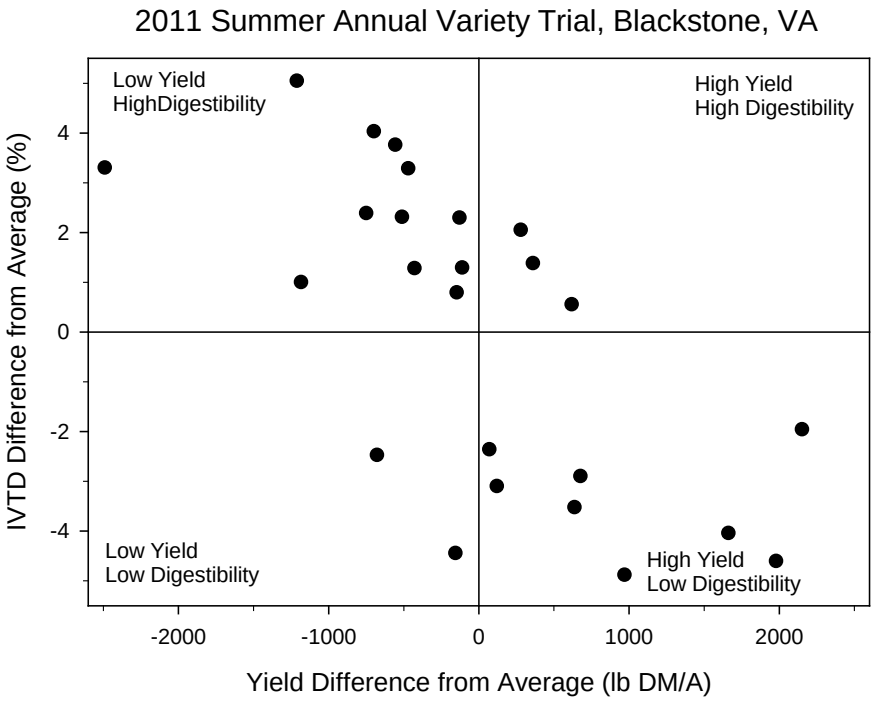

Figure 13. In 2011, thee varieties were above average in both yield and digestibility for the summer annual variety trial held at Virginia Tech's Southern Piedmont AREC, Blackstone, VA.

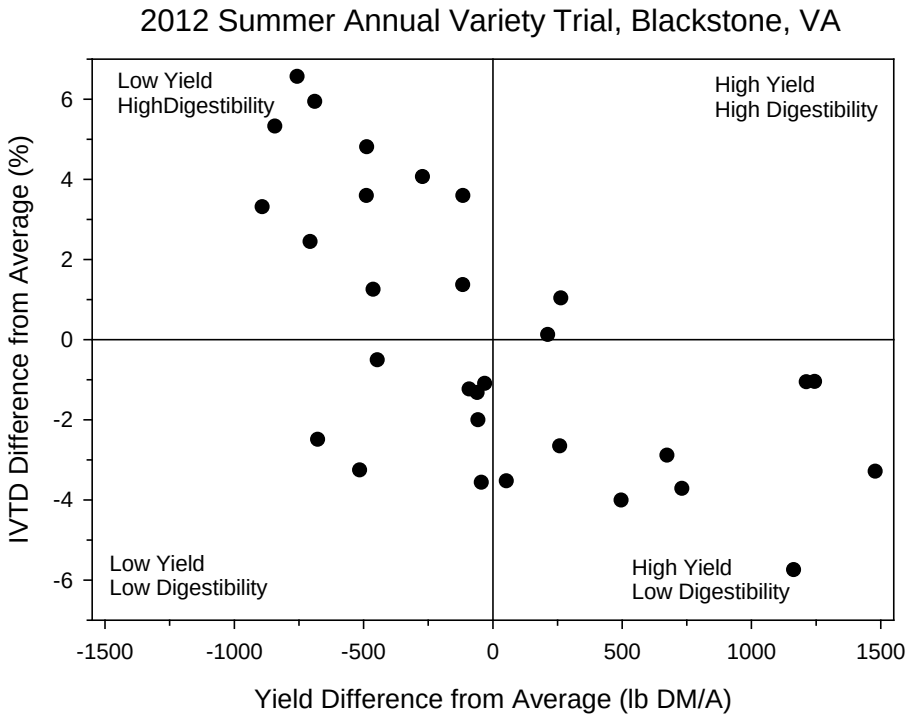

Figure 14. In 2012, thee varieties were above average in both yield and digestibility for the summer annual variety trial held at Virginia Tech's Southern Piedmont AREC, Blackstone, VA.

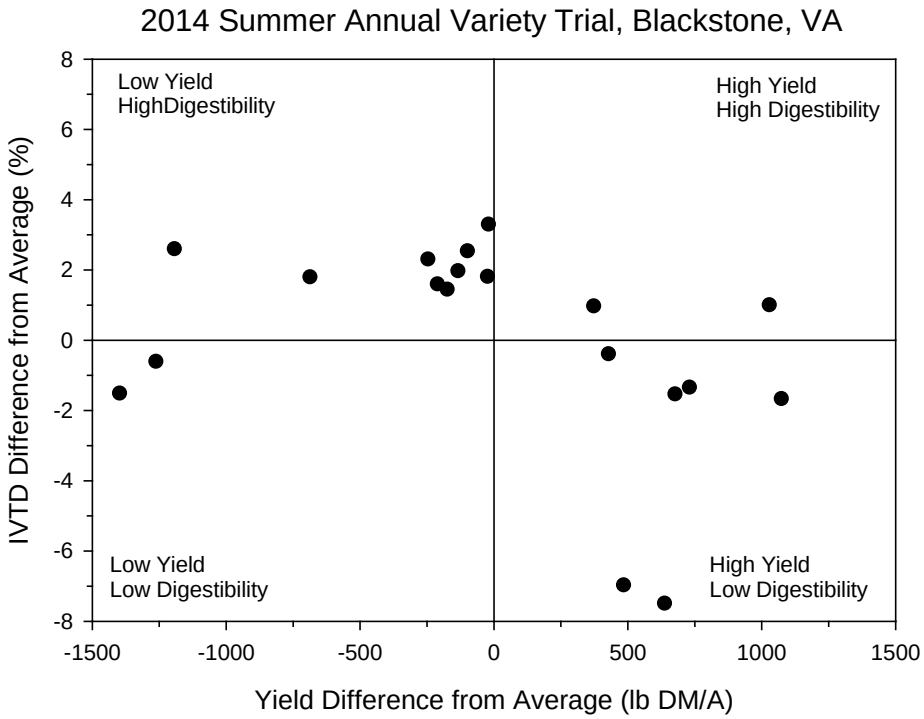

Figure 15. In 2014, only two varieties were above average in both yield and digestibility for the summer annual variety trial held at Virginia Tech's Southern Piedmont AREC, Blackstone, VA.

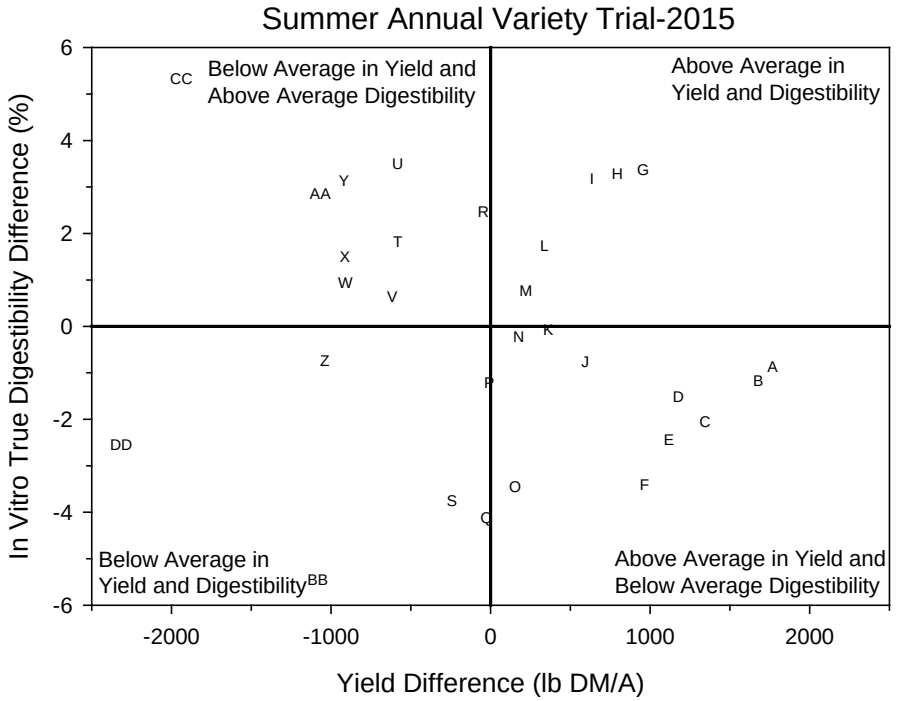

Figure 16. In 2015, five varieties were above average in both yield and digestibility for the summer annual variety trial held at Virginia Tech's Southern Piedmont AREC, Blackstone, VA.

Table 10. Summary of varieties with above average yield and digestibility.

Variety	Seed Company	2009	2010	2011	2012	2014	2015
22050	Advanta US	X					
26837	Advanta US		X				
6810 BMR	Coffey Forage Seeds		X				
AF7401-AS6402	Alta Seeds						X
AS6401	Alta Seeds		X				
AS6402	Alta Seeds		X				X
AS6501	Alta Seeds	X	X	X			
AS9301	Alta Seeds	X	X	X			
AS9301-AS6402	Alta Seeds						X
Canex 402 BMR	Sharp Brothers Seed	X					
FSG215 BMR-6	Farm Science Genetics						X
Grazex 802 BMR	Sharp Brothers Seed	X					
GW8528FB	Gayland Ward Seed Company		X				
Nutra-King BMR-6	Gayland Ward Seed Company						X
SS1515A	Southern States Cooperative	X					
SS211	Southern States Cooperative		X				
SS220	Southern States Cooperative		X			X	
SSG886	Advanta US					X	
Super Sugar	Gayland Ward Seed Company				X		
Surpass BMR	Coffey Forage Seeds	X					
Xtragraze BMR	Coffey Forage Seeds	X	X		X		

Please note that not all varieties were entered every year.