NORTHWEST CROPS & SOILS PROGRAM

2023 Summer Annual Variety Trial

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THE UNIVERSITY OF VERMONT EXTENSION

2023 SUMMER ANNUAL VARIETY TRIAL

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Warm season grasses, such as sudangrass, and millet can provide quality forage in the hot summer months, when cool season grasses enter dormancy and decline in productivity. The addition of summer annuals into a rotation can provide a harvest of high-quality forage for stored feed or grazing during this critical time. Generally, summer annuals germinate quickly, grow rapidly, are drought resistant, and have high productivity and flexibility in utilization. The UVM Extension Northwest Crops and Soils Program conducted this variety trial to evaluate the yield and quality of warm season annual grasses.

MATERIALS AND METHODS

A trial was initiated at Borderview Research Farm in Alburgh, VT on 31-May (Table 1). Plots were seeded with a Great Plains cone seeder at a seeding rate of 625,000 seeds ac^{-1} for the sorghum x sudangrass crosses and pearl millets, and 675,000 seeds ac^{-1} for the sudangrasses. A commercially available mixture treatment was also included at two seeding rates based on the label. Twenty varieties of these species were compared, each replicated four times (Table 2). An application of approximately 50 lbs ac^{-1} urea (46-0-0) was made on 14-Jul.

Table 1. General plot management, 2023.

Trial Information	Borderview Research Farm-Alburgh, VT
Soil Type	Benson rocky silt loam
Previous crop	Fiber hemp
Topdress fertilizer	50 lbs ac^{-1} 46-0-0, 14-Jul
Planting date	31-May
First harvest date	12-Jul
Second harvest date	15-Aug
Seeding rates: Sudangrass	675,000 seeds ac^{-1}
Sorghum x sudangrass and pearl millets	625,000 seeds ac^{-1}
YieldMax mixture 1	35 lbs ac^{-1}
YieldMax mixture 2	45 lbs ac^{-1}
Tillage methods	Pottinger TerraDisc

Plots were harvested on 12-Jul and 15-Aug using a Carter small plot flail forage harvester equipped with scales. The material within a 3’ x 20’ swath in each plot was harvested to a height of approximately 4” and weighed. An approximate 1 lb subsample was collected from each plot and dried to determine dry matter content and calculate dry matter yields. The samples were then ground to 2mm using a Wiley mill and to 1mm using a UDY cyclone mill. Samples were analyzed for forage quality at the E. E. Cummings Crop Testing Laboratory at the University of Vermont (Burlington, VT) via near infrared reflectance spectroscopy (NIR) techniques using a FOSS DS2500 Feed and Forage Analyzer.

Mixtures of true proteins, composed of amino acids, and non-protein nitrogen make up the crude protein (CP) content of forages. The bulky characteristics of forage come from fiber. Forage feeding values are

negatively associated with fiber since the less digestible portions of the plant are contained in the fiber fraction. The detergent fiber analysis system separates forages into two parts: cell contents, which include sugars, starches, proteins, non-protein nitrogen, fats and other highly digestible compounds; and the less digestible components found in the fiber fraction. The total fiber content of forage is contained in the neutral detergent fiber (NDF) which includes cellulose, hemicellulose, and lignin. This measure indicates the bulky characteristic of the forage and therefore is negatively correlated with animal dry matter intake. The portion of the NDF fraction that is estimated to be digestible after 30 hours of fermentation in rumen fluid is represented by the 30- hour NDF digestibility. Ethanol soluble carbohydrates (ESC) are simple sugars found in grasses. Water soluble carbohydrates (WSC) include simple sugars as well as fructose polymers called fructans. Several quality metrics are combined to predict net energy needed for lactation (NEL), milk yield per ton of forage, and relative forage quality (RFQ). The acid detergent fraction (ADF) is composed of highly indigestible fiber and therefore, is negatively correlated with digestibility.

Table 2. Summer annual varieties and characteristics, 2023.

Variety	Species	Characteristics
YieldMax 1 and 2	60% Sorghum x Sudangrass 25% Italian ryegrass 5% Medium red clover 5% Berseem clover 5% Hairy vetch	BMR Sorghum x Sudangrass
Exceed	Pearl millet	BMR
Leafy-T	Pearl millet	Non-BMR
Prime 180	Pearl millet	BMR
Prime 360	Pearl millet	BMR
AS6201	Sorghum x Sudangrass	BMR
AS6401	Sorghum x Sudangrass	BMR
AS6501	Sorghum x Sudangrass	BMR
FSG 214	Sorghum x Sudangrass	BMR, dry stalk
FSG 215	Sorghum x Sudangrass	BMR
KF Sugar Pro SS	Sorghum x Sudangrass	BMR
King's 150	Sorghum x Sudangrass	BMR
SSA-251	Sorghum x Sudangrass	BMR, dry stalk
SSA-252	Sorghum x Sudangrass	BMR
SSG 886	Sorghum x Sudangrass	BMR
Viking 0-225	Sorghum x Sudangrass	BMR
AS9301	Sudangrass	BMR
King’s 200	Sudangrass	BMR
Viking 510	Sudangrass	BMR

Results were analyzed using a general linear model procedure of SAS (SAS Institute, 2008). Replications were treated as random effects, and treatments were treated as fixed. Mean comparisons were made using the Least Significant Difference (LSD) procedure where the F-test was considered significant, at $p<0.10$. Variations in yield and quality can occur because of variations in genetics, soil, weather and other growing conditions. Statistical analysis makes it possible to determine whether a difference between varieties is likely attributable to the treatment or random variation. At the bottom of each table, an LSD value may be presented. Where the difference between two treatments within a column is equal to or greater than the

LSD value at the bottom of the column, you can be sure in 9 out of 10 chances that there is a real difference between the two treatments. Treatments that were not significantly lower in performance than the highest value in a particular column are indicated with an asterisk. In this example, A is significantly different from C but not from B. The difference between A and B is equal to 1.5, which is less than the LSD value of 2.0. This means that these varieties did not differ in yield. The difference between A and C is equal to 3.0, which is greater than the LSD value of 2.0. This means that the yields of these varieties were significantly different from one another. The asterisk indicates that B was not significantly lower than the top yielding variety.

Variety	Yield
A	6.0
B	7.5*
C	**9.0***
LSD	2.0

RESULTS

Seasonal precipitation and temperatures, recorded with a Davis Instruments Vantage Pro 2 weather station with a WeatherLink data logger in Alburgh, VT, are shown in Table 3. The beginning of the season was cooler with average precipitation. Temperatures continued to be relatively cool through the rest of the season, but rainfall increased substantially in July and August. Over 10 inches of rain fell in July, almost 7 inches above normal. Over 70% of that rain came in >1 inch rain events throughout the month. Several additional large rain events were experienced in August, resulting in over 6 inches of rain and very cool temperatures. These warm season annual species, much like corn, perform best in hot conditions and typically tolerate dry conditions better than the perennial species that grow in this region. The cool temperatures contributed to a total of 1435 Growing Degree Days (GDDs) accumulated over the trial period. This was 328 fewer than last year's trial and 125 below the 30-year normal for these months.

Table 3. Seasonal weather data collected in Alburgh, VT, 2023.

Alburgh, VT	June	July	August
Average temperature (°F)	65.7	72.2	67.0
Departure from normal	-1.76	-0.24	-3.73
Precipitation (inches)	4.40	10.8	6.27
Departure from normal	0.14	6.69	2.73
Growing Degree Days (base 50°F)	483	712	540
Departure from normal	-41	17	-101

Based on weather data from a Davis Instruments Vantage Pro2 with WeatherLink data logger.
Historical averages are for 30 years of NOAA data (1991-2020) from Burlington, VT.

Species Performance Across Cuttings

Since only one mixture was included in the trial, species levels comparisons were made on the three summer annual grasses excluding the mixture treatments. The three species of summer annual grasses performed similarly in dry matter yield but differed in some quality metrics (Table 4). Overall yields were relatively low due to cool, wet conditions. These grasses typically yield 3-4 tons ac^{-1} when temperatures are high through the summer. This year with the cooler temperatures, yields averaged about 1 ton per cutting totaling just over 2 tons ac^{-1} for the season. Two cuttings is typical for these species in our northern climates unless conditions allow for early planting and late harvest.

Table 4. Yield and average quality of three summer annual forage species, 2023.

Species	1st cut	2nd cut	Season total	CP	ESC	30-hr NDFD	RFQ	Milk yield
	DM tons ac^{-1}			% of DM		% of NDF		lbs ton^{-1}
Pearl millet	1.11	**1.13**	2.24	**19.0**	4.52b§	**74.6**	**146a**	3426b
Sorghum x sudangrass	1.10	0.976	2.08	18.6	**5.78a**	73.6	126b	3540ab
Sudangrass	**1.25**	1.02	**2.27**	18.6	5.70a	74.3	134b	**3542a**
Level of significance†	NS‡	NS	NS	NS	**	NS	***	*
Trial mean	1.13	1.02	2.15	18.7	5.48	73.9	132	3515

†* p <0.1, ** p <0.05, *** p <0.0001
‡NS; not statistically significant.
§Treatments that share a letter performed statistically similarly to one another.
The top performing treatment is indicated in **bold.**

The species did not differ in crude protein content, all averaging above 18.5%. The pearl millets had lower ESC content at 4.52% which was 1.18 and 1.26% lower than the sudangrasses and sorghum x sudangrasses respectively. Higher sugar content provides more potential energy when consumed fresh, but also provides more readily fermentable sugars to support proper fermentation if the forage is being ensiled. The species also did not differ in NDF digestibility at 30-hrs (30-hr NDFD) and averaged approximately 74%. Overall, >60% NDFD reflects very digestible forage and therefore all species in the trial produced satisfactory digestible forage. Fiber digestibility tends to decrease when conditions become very hot and moist as the proportion of lignin and the indigestible fiber fraction increases. Although we had excessive moisture this season, below normal temperatures likely contributed to increased digestibility this season. Taking into consideration several quality parameters, we can index these species' relative forage qualities (RFQ). In doing so we see pearl millet scoring 146 which is 20 and 12 points higher than the other species. For comparison, a rating of 150 is typically considered suitable for a lactating dairy cow. When we use these quality metrics to predict milk yield, we see the highest milk yield resulting from sudangrass followed closely by sorghum x sudangrass, and pearl millet producing 116 fewer lbs of milk.

Table 5. Dry matter and quality component yields by species, 2023.

Species	Season total	CP	ESC	30-hr NDFD	Milk yield
	DM tons ac^{-1}	lbs ac^{-1}		tons ac^{-1}	cwt ac^{-1}
Pearl millet	2.24	**850**	206	0.840	76.7
Sorghum x sudangrass	2.08	779	237	0.801	73.6
Sudangrass	**2.27**	846	**256**	**0.869**	**80.3**
Level of significance	NS†	NS	NS	NS	NS
Trial mean	2.15	806	234	0.821	75.4

†NS; not statistically significant.
The top performing treatment is indicated in **bold.**

Considering both dry matter yield and quality of that dry matter can help us better understand the value of the forage produced by these species (Table 5). Since there were few differences in dry matter yield and average quality, there were no statistical differences between the species in the yield of protein, sugars, digestible fiber, or predicted milk yield on a per acre basis.

Variety Performance by Species-Pearl Millet

The four varieties of pearl millet included in this trial performed similarly in dry matter yield and average quality across the two harvests (Table 6). While there was some numerical difference in yields in each cutting, variability within the treatments likely contributed to the lack of statistical difference.

Table 6. Yield and average quality of four varieties of pearl millet, 2023.

Variety	1st cut	2nd cut	Season total	CP	ESC	30-hr NDFD	RFQ	Milk yield
	DM tons ac^{-1}			% of DM		% of NDF		lbs ton^{-1}
Exceed	1.27	1.01	2.28	18.6	4.70	74.3	139	3422
Leafy-T	0.882	1.20	2.08	**19.8**	4.14	74.2	150	3383
Prime 180	**1.34**	1.05	**2.40**	19.7	**4.74**	74.8	**151**	**3494**
Prime 360	0.953	**1.25**	2.20	18.0	4.49	**75.0**	146	3407
LSD (p = 0.10) †	NS‡	NS	NS	NS	NS	NS	NS	NS
Species mean	1.11	1.13	2.24	19.0	4.52	74.6	146	3426

†Least significant difference at the $p = 0.10$ level.
‡NS; not statistically significant.
The top performing treatment is indicated in **bold.**

While all the varieties produced over 2 tons ac^{-1}, there were some differences in the distribution of the dry matter production across the season (Figure 1). Exceed and Prime 180 produced more of their total biomass in the 1st cutting whereas Leafy-T and Prime 360 produced more of their total biomass in the 2nd cutting.

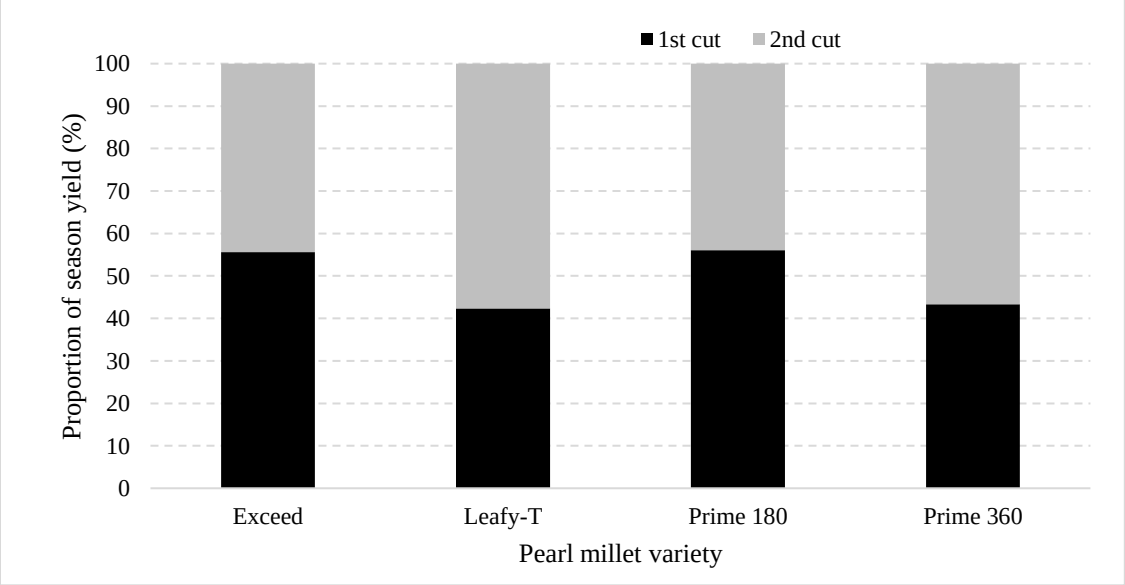

Figure 1. Distribution of dry matter production across season for four varieties of pearl millet, 2023.

With no statistical differences in yield or quality, the varieties also performed similarly when we consider the yield of the quality components on a per acre basis (Table 7). Again, some numerical differences can be seen but, due to variability within treatments, these differences are considered to be due to random chance, not a varietal difference.

Table 7. Dry matter and quality component yield of four varieties of pearl millet, 2023.

Variety	Season total	CP	ESC	30-hr NDFD	Milk yield
	DM tons ac^{-1}	lbs ac^{-1}		tons ac^{-1}	cwt ac^{-1}
Exceed	2.28	859	212	0.855	77.7
Leafy-T	2.08	818	182	0.793	70.9
Prime 180	**2.40**	**947**	**222**	0.842	**83.1**
Prime 360	2.20	777	208	**0.868**	74.9
LSD (p = 0.10)†	NS‡	NS	NS	NS	NS
Species mean	2.24	850	206	0.840	76.7

†Least significant difference at the *p* = 0.10 level.
‡NS; not statistically significant.
The top performing treatment is indicated in **bold.**

Sorghum x Sudangrass

The eleven sorghum x sudangrasses included in the trial did not differ statistically in yield but did differ in some quality metrics (Table 8). Similar to the millets, the sorghum x sudangrasses yielded about 1 ton ac^{-1} in each cutting. While there were some differences numerically in each cutting and in total yield, these were not statistically different.

Table 8. Yield and average quality of eleven varieties of sorghum x sudangrass, 2023.

Variety	1st cut	2nd cut	Season total	CP	ESC	30-hr NDFD	RFQ	Milk yield
	DM tons ac^{-1}			% of DM		% of NDF		lbs ton^{-1}
AS6201	1.05	0.871	1.92	18.9bc†	5.64	73.9abcd	128	3533
AS6401	1.11	1.05	2.16	18.8bc	5.24	72.7cd	119	3456
AS6501	1.01	0.810	1.82	**21.2a**	5.05	73.5abcd	110	3459
FSG214	1.14	0.894	2.03	18.7bc	4.95	73.2bcd	128	3535
FSG215	1.18	1.08	2.26	19.4abc	6.14	75.2abc	130	3620
KF Sugar Pro SS	1.11	1.13	2.24	16.3d	5.84	69.5e	131	3470
King's 150	1.06	0.936	1.99	20.0ab	6.08	74.5abcd	121	3482
SSA-251	**1.32**	0.904	2.23	18.2bcd	5.58	71.8cde	124	3509
SSA-252	1.17	**1.27**	**2.44**	18.2bcd	5.71	75.6ab	130	3568
SSG 886	1.18	1.06	2.24	17.4cd	**6.71**	**76.2a**	**135**	**3667**
Viking 0-225	0.805	0.730	1.53	17.8bcd	6.63	73.8abcd	130	3640
LSD (p = 0.10) ‡	NS§	NS	NS	2.30	NS	2.79	NS	NS
Species mean	1.10	0.98	2.08	18.6	5.78	73.6	126	3540

†Treatments that share a letter performed statistically similarly to one another. The top performing treatment is indicated in **bold.**
‡Least significant difference at the *p* = 0.10 level.
§NS; not statistically significant.

Similar to the pearl millets, there was little difference between the distribution of dry matter production across the two harvests (Figure 2). While overall the varieties produced about equal yields in 1st and 2nd cuttings, the variety SSA-251 produced almost 60% of its total yield in the first cutting.

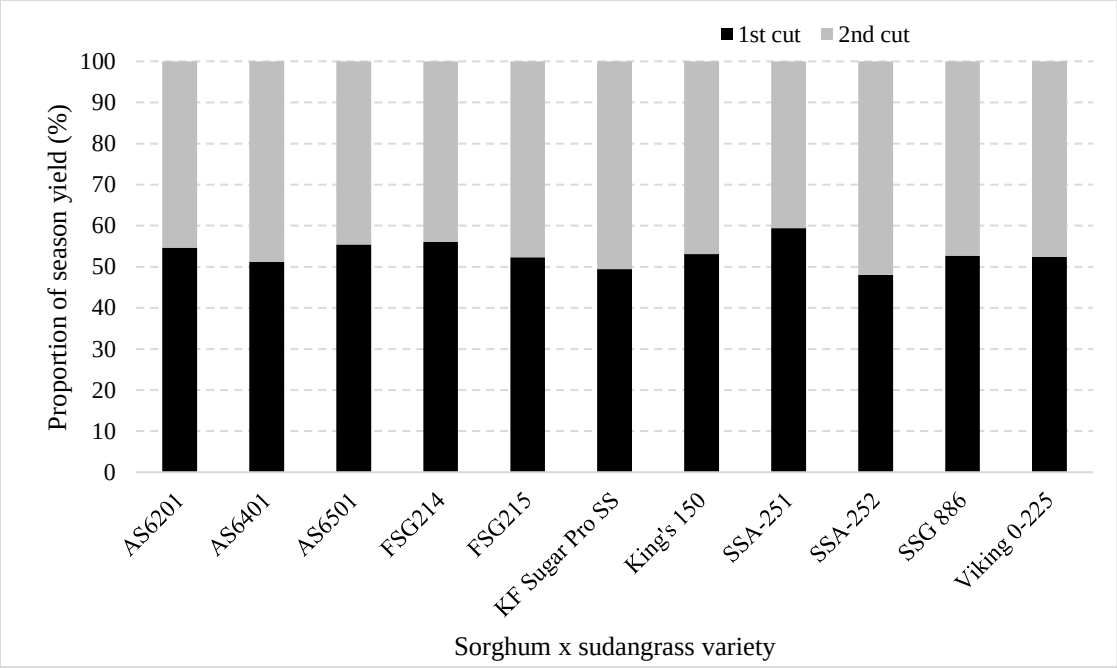

Figure 2. Distribution of dry matter production for eleven varieties of sorghum x sudangrass, 2023.

Despite no significant differences in dry matter yields, we did see a significant difference in protein content. The varieties ranged from 16.3% up to 21.2% with two varieties producing forage >20% protein, which is substantial for a non-legume forage. Sugar content ranged from just over 5.00% to 6.71% but did not differ statistically between varieties. Fiber digestibility ranged from 69.5% to 76.2% and did differ statistically. All but one variety produced forage with >70% fiber digestibility. As discussed previously, the cool wet weather conditions experienced this season were conducive to producing highly digestible forage. Relative forage quality and predicted milk yields also did not differ statistically. With the sorghum x sudangrasses on average producing forage of lower RFQ than the pearl millets you can see these varieties ranged from 110 to 135, much lower than the 126 to 151 in the pearl millets. Predicted milk yield ranged from 3456 to 3667 lbs ton^{-1}.

Despite the differences in protein and fiber digestibility, the varieties did not differ statistically in the total yield of these quality components on a per acre basis (Table 9). Numerically the highest protein, digestible fiber, and milk yields were observed with variety SSA-252 and the highest sugar yield with SSG 886.

Table 9. Dry matter and quality component yield of eleven varieties of sorghum x sudangrass, 2023.

Variety	Season total	CP	ESC	30-hr NDFD	Milk yield
	DM tons ac^{-1}	lbs ac^{-1}		tons ac^{-1}	cwt ac^{-1}
AS6201	1.92	755	214	0.732	68.4
AS6401	2.16	810	226	0.840	74.9
AS6501	1.82	767	185	0.685	62.4
FSG214	2.03	761	196	0.798	71.8
FSG215	2.26	862	279	0.873	81.6
KF Sugar Pro SS	2.24	733	252	0.841	77.1
King's 150	1.99	807	239	0.744	69.4
SSA-251	2.23	809	244	0.851	78.6
SSA-252	**2.44**	**915**	273	**0.980**	**87.1**
SSG 886	2.24	786	**298**	0.897	82.5
Viking 0-225	1.53	566	203	0.569	55.7
LSD (p = 0.10) †	NS‡	NS	NS	NS	NS
Species mean	2.08	779	237	0.801	73.6

†Least significant difference at the *p* = 0.10 level.
‡NS; not statistically significant.
The top performing treatment is indicated in **bold.**

Sudangrass

The three sudangrass varieties included in this trial did not differ statistically in yield or quality (Table 10). Yields averaged 1.25- and 1.02-tons ac^{-1} in the first and second harvests respectively. There were slight differences in regrowth following the first cut and therefore, the distribution of total dry matter produced across the season (Figure 3). The variety AS9301 produced approximately equal harvests while the other two varieties produced approximately 60% of their total dry matter in the first harvest. Protein content was highest in the King's 200 variety at 19.5% although not statistically different from either other variety. The King's 200 variety had the lowest ESC content of 4.41% which was 1.60 to 2.27% lower than the other varieties although not statistically different. Fiber digestibility was above 72% for all varieties. Due to no differences in individual quality metrics, the overall relative forage quality and predicted milk yields also did not differ between varieties.

Table 10. Yield and average quality of three varieties of sudangrass, 2023.

Variety	1st cut	2nd cut	Season total	CP	ESC	30-hr NDFD	RFQ	Milk yield
	DM tons ac^{-1}			% of DM		% of NDF		lbs ton^{-1}
AS9301	1.26	**1.23**	**2.49**	18.4	6.01	74.5	133	3452
King's 200	1.15	0.861	2.01	**19.5**	4.41	72.5	133	3565
Viking 510	**1.34**	0.959	2.30	17.7	**6.68**	**75.7**	**137**	**3609**
LSD (p = 0.10) †	NS‡	NS	NS	NS	1.29	NS	NS	NS
Species mean	1.25	1.02	2.27	18.6	5.70	74.3	134	3542

†Least significant difference at the *p* = 0.10 level.
‡NS; not statistically significant.
The top performing treatment is indicated in **bold.**

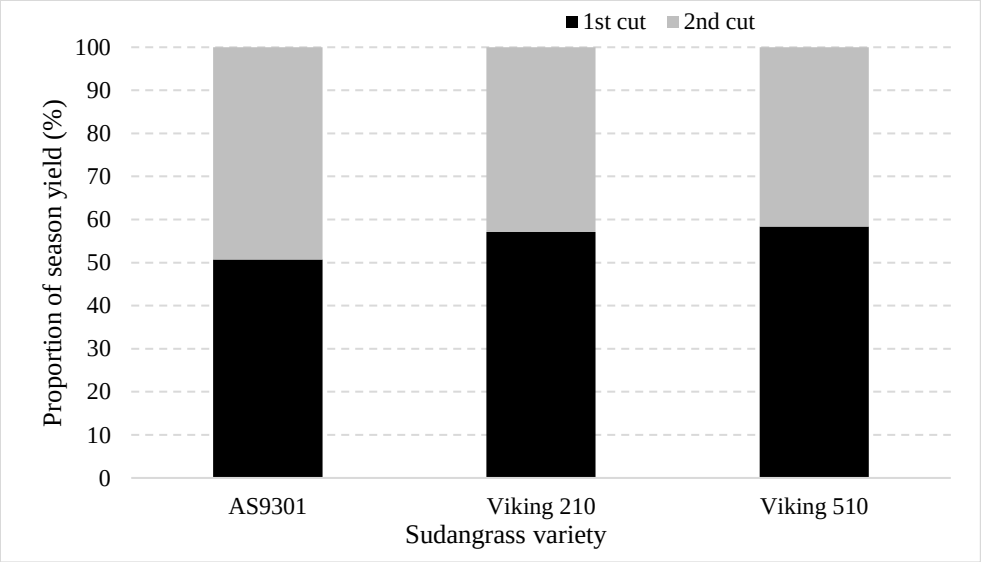

Figure 3. Distribution of dry matter production for three varieties of sudangrass, 2023.

With no significant differences in yield or quality, we also did not see statistical differences in yield of quality components between the varieties (Table 11). The numerical differences indicate there may have been more variability in performance within varieties this year, likely due to the unfavorable weather conditions for these species.

Table 11. Dry matter and quality component yield of three varieties of sudangrass, 2023.

Variety	Season total	CP	ESC	30-hr NDFD	Milk yield
	DM tons ac^{-1}	lbs ac^{-1}		tons ac^{-1}	cwt ac^{-1}
AS9301	**2.49**	**932**	289	**0.942**	**85.3**
King's 200	2.01	785	172	0.753	71.8
Viking 510	2.30	822	**309**	0.913	83.8
LSD (p = 0.10) †	NS‡	NS	NS	NS	NS
Species mean	2.27	846	256	0.869	80.3

†Least significant difference at the $p = 0.10$ level.
‡NS; not statistically significant
The top performing treatment is indicated in **bold.**

Variety Performance by Cutting

When comparing all summer annual varieties/species, they did not differ statistically in dry matter yield at each harvest and in comparing total season yields (Table 12, Figure 4). Yields in the first cutting ranged from 0.805 to 1.34 tons ac^{-1} while yields in the second cutting ranged from 0.845 to 1.37 tons ac^{-1}. Total yields across the season therefore ranged from 1.82 to 2.52 tons ac^{-1}. While statistical differences were not observed this year, likely due to poor weather conditions increasing variability within treatments, the numerical differences suggest performance could differ among species and varieties. Hence, additional years and environments should be evaluated to better understand species and varietal performance.

Table 12. Yield of 20 summer annual treatments, 2023.

Variety	Species	1st cut	2nd cut	Season total
			DM tons ac^{-1}	
YieldMax 1	Mixture	1.14	**1.37**	**2.52**
YieldMax 2	Mixture	1.10	0.845	1.95
Exceed	Pearl millet	1.27	1.01	2.28
Leafy-T	Pearl millet	0.882	1.20	2.08
Prime 180	Pearl millet	**1.34**	1.05	2.40
Prime 360	Pearl millet	0.953	1.25	2.20
AS6201	Sorghum x Sudangrass	1.05	0.871	1.92
AS6401	Sorghum x Sudangrass	1.11	1.05	2.16
AS6501	Sorghum x Sudangrass	1.01	0.810	1.82
FSG 214	Sorghum x Sudangrass	1.14	0.894	2.03
FSG 215	Sorghum x Sudangrass	1.18	1.08	2.26
KF Sugar Pro SS	Sorghum x Sudangrass	1.11	1.13	2.24
King's 150	Sorghum x Sudangrass	1.06	0.936	1.99
SSA-251	Sorghum x Sudangrass	1.32	0.904	2.23
SSA-252	Sorghum x Sudangrass	1.17	1.27	2.44
SSG 886	Sorghum x Sudangrass	1.18	1.06	2.24
Viking 0-225	Sorghum x Sudangrass	0.805	0.730	1.53
AS9301	Sudangrass	1.26	1.23	2.49
King’s 200	Sudangrass	1.15	0.861	2.01
Viking 510	Sudangrass	1.34	0.959	2.30
LSD (p = 0.10) †		NS‡	NS	NS
Trial mean		1.13	1.03	2.15

†LSD; least significant difference at the p=0.10 level
‡NS; not statistically significant.
Top performer in each column indicated in **bold**.

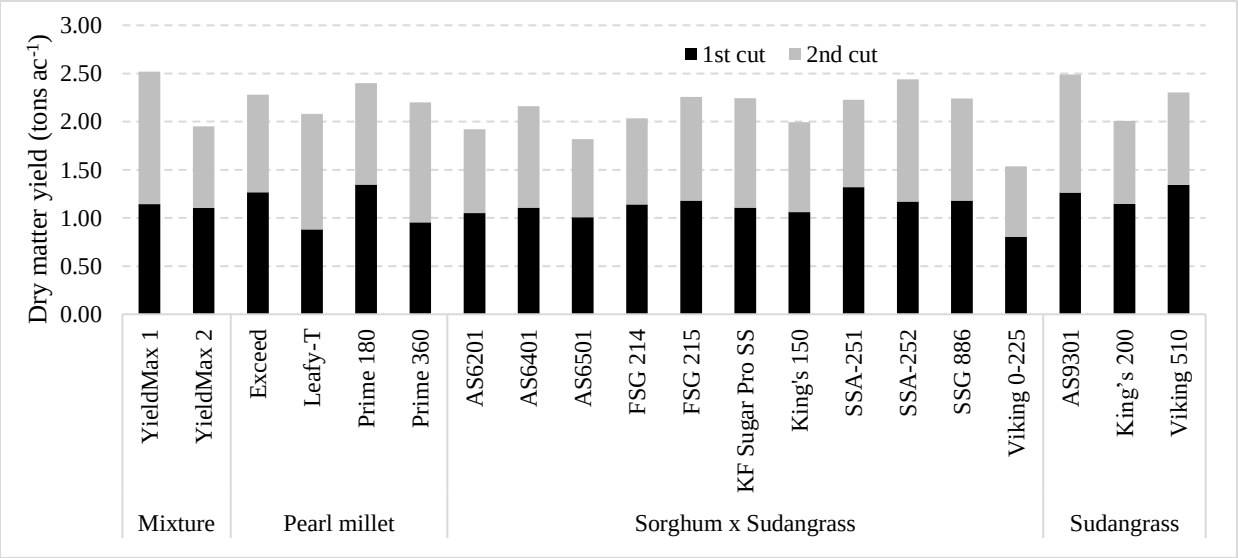

Figure 4. Total yield of 20 summer annual treatments by harvest, 2023.

Forage Quality Across Cuttings

The varieties did differ significantly in several forage quality metrics (Table 13). Crude protein levels ranged from 16.3 to 21.2% and averaged 18.9% across the trial. ESC ranged from 4.14 to 6.68% and averaged 5.56% across the trial. NDF digestibility was high with all varieties except one averaging >70% and the top variety being 76.6%. Relative forage quality ranged from 110 to 151 and milk yield per ton of forage fed ranged from 3383 to 3749 lbs ton^{-1}. Despite these differences in quality, there were no significant differences in the yield of these quality components on a per acre basis.

Table 13. Average quality of 20 summer annual treatments, 2023.

Variety	Species	CP	ESC	30-hr NDFD	RFQ	Milk yield
		% of DM		% of NDF		lbs ton^{-1}
YieldMax 1	Mixture	20.4*†	6.19*	**76.6**	128	**3749**
YieldMax 2	Mixture	20.0*	6.21*	77.2*	137*	3741
Exceed	Pearl millet	18.6	4.70	74.3*	139*	3422
Leafy-T	Pearl millet	19.8*	4.14	74.2*	150*	3383
Prime 180	Pearl millet	19.7*	4.74	74.8*	**151**	3494
Prime 360	Pearl millet	18.0	4.49	75.0*	146*	3407
AS6201	Sorghum x Sudangrass	18.9	5.64*	73.9	128	3533
AS6401	Sorghum x Sudangrass	18.8	5.24	72.7	119	3456
AS6501	Sorghum x Sudangrass	**21.2**	5.05	73.5	110	3459
FSG 214	Sorghum x Sudangrass	18.7	4.95	73.2	128	3535
FSG 215	Sorghum x Sudangrass	19.4*	6.14*	75.2*	130	3620
KF Sugar Pro SS	Sorghum x Sudangrass	16.3	5.84*	69.5	131	3470
King's 150	Sorghum x Sudangrass	20.0*	6.08*	74.5*	121	3482
SSA-251	Sorghum x Sudangrass	18.2	5.58	71.8	124	3509
SSA-252	Sorghum x Sudangrass	18.2	5.71*	75.6*	130	3568
SSG 886	Sorghum x Sudangrass	17.4	6.71*	76.2*	135*	3667
Viking 0-225	Sorghum x Sudangrass	17.8	6.63*	73.8	130	3640
AS9301	Sudangrass	18.4	6.01*	74.5*	133*	3452
King's 200	Sudangrass	19.5*	4.41	72.5	133*	3565
Viking 510	Sudangrass	17.7	**6.68**	75.7*	137*	3609
LSD (p = 0.10) ‡		2.19	1.13	3.17	18.1	NS§
Trial mean		18.9	5.56	74.2	132	3538

†Treatments with an asterisk performed statistically similarly to the top performer in **bold.**
‡LSD; least significant difference at the p=0.10 level.
§NS; not statistically significant.

It can be helpful to visualize both yield and quality simultaneously to understand which varieties and species are capable of optimizing both. Figure 5 shows total season dry matter yield versus RFQ. Varieties that land in the upper right corner represent the highest yielding varieties with the highest relative forage quality. The figure shows six of the 20 varieties falling in the highest yield and quality category and five falling in the lowest with all others somewhere in between.

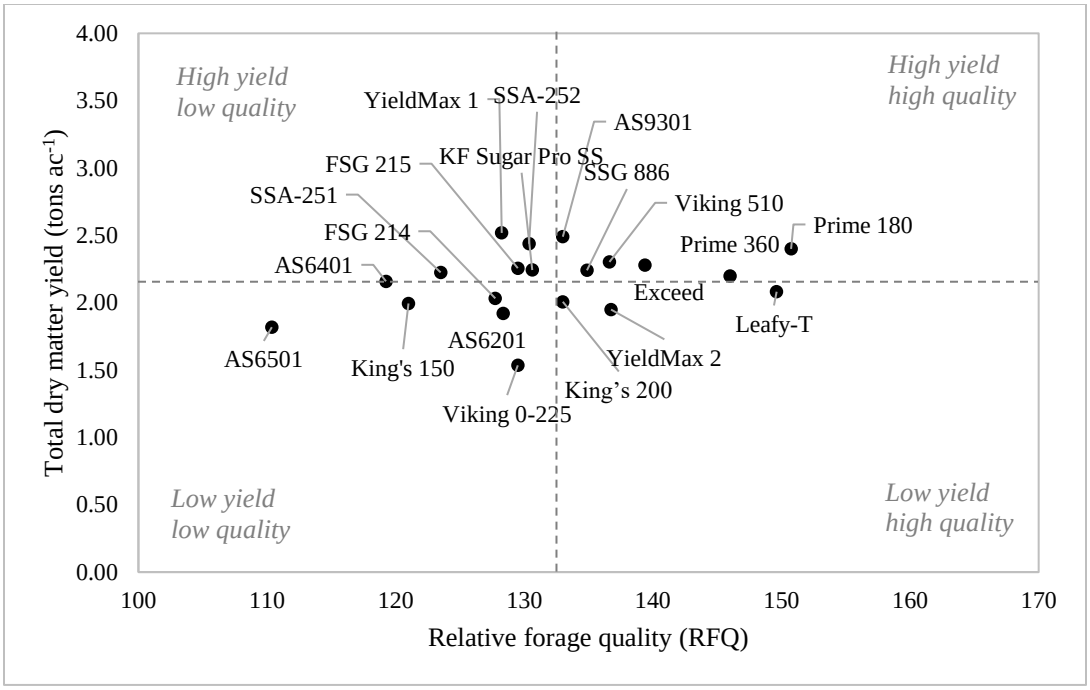

Figure 5. Total yield and RFQ of summer annual varieties across harvests, 2023.

DISCUSSION

This data demonstrates one of the challenges with utilizing summer annual forage in production systems in the Northeast. In a year where weather conditions favored cool season species, these warm season annual grasses yielded only about 2 tons ac^{-1} compared to their 4.5 tons ac^{-1} average in 2022. Despite lower yields the forage was exceptionally high in digestible fiber with all but one treatment producing >70% NDF digestibility. This research exhibits the importance of varietal selection as varieties differ in performance in terms of yield and quality. Several years of data should be considered before making management decisions.

With growing summer annuals, it is important to also be aware of the risk of nitrate accumulation and the presence of prussic acid. Nitrates are considered relatively safe for feed up to 5000 ppm, however, there is a risk of excessive nitrate accumulation under excessive fertility, and immediately after a drought stressed crop receives rainfall. Additionally, sorghums, sudangrasses, and hybrids may contain prussic acid, which can be toxic. To avoid prussic acid poisoning from summer annuals:

Graze when the grasses are at least 18 inches tall.
Do not graze plants during and shortly after drought periods when growth is severely reduced.
Do not graze wilted plants or plants with young tillers.
Do not graze after a non-killing frost; regrowth can be toxic.
Do not graze after a killing frost until plant material is dry (the toxin usually dissipates within 48 hours).
Do not graze at night when frost is likely. High levels of toxins are produced within hours after frost occurs.
Delay feeding silage six to eight weeks following ensiling.

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