WISCONSIN ALFALFA YIELD AND PERSISTENCE (WAYP) PROGRAM
2019 SUMMARY REPORT

Program Objectives:

1. To verify the yield and quality of alfalfa harvested from production fields over the life of the stand beginning with the first production year (year after seeding).
2. To quantify decreases in stand productivity of alfalfa fields as they age.

2019 Overview:

This summary has now reached thirteen years of project data. UW-Extension agents were asked to identify forage producers willing to weigh and sample forage from a 2018-seeded field and continue to do so for the life of the stand. A total of 4 new fields from 2 different farms were enrolled in the program in 2019 and 18 fields continued from previous years. The new fields were from farms and counties that have previously participated in the program. The current summary includes data for the first, second, and third production years from fields entered into the program in 2017 through 2019 (2016-2018 seedings). No fourth-year stands remained in the project, which is unfortunate because they are valuable for obtaining long-term data. As is always the case in these types of studies, there is some attrition of fields over time. This is either because the farmer decided to terminate the field because of winterkill, declining productivity or critical yield or forage quality data for a cutting or multiple cuttings could not be obtained. This year there were nine fields dropped from the project that participated in 2018. A couple were planned, but the rest experienced extreme winterkill the previous winter. Production data was collected from 22 fields in 2019 with a total of 3,358 dry matter tons of forage harvested, weighed, and sampled from 818 acres. Over 13 years, data was collected from 109 fields with a total of 61,610 dry matter tons of forage harvested, weighed, and sampled from 6,752 acres. A summary of all project fields (current and past) is presented in Table 1.

2019 Weather

The growing season was challenging for producers. A polar vortex caused record low temperatures in late January. Above average snowfall and spring rain caused flooding. Cold April and May temperatures combined with late snowstorms delayed spring greenup and new seeding. Winter injury was observed across the state, but was most severe in eastern and north central areas. Wet conditions persisted through much of the year, resulting in narrow windows to harvest without the threat of rained on hay or muddy fields. Precipitation records fell as alfalfa cutting was delayed. Temperatures were below normal to normal in June and August and above normal in July, September, and early October. Alfalfa went dormant for winter under early snow, record cold, and saturated soils in November.

2018 Weather

The growing season overall was again marked by many extreme weather events. Very cold December temperatures with little snow cover followed by January rainfall and ice did not seem to hurt alfalfa. An April blizzard and below normal temperatures delayed spring greenup. Precipitation in southern Wisconsin was above normal and near record through most of the season. The central and eastern parts of the state were dry through much of summer and most of the state was above normal in late-August and September. Much of the state had normal or above normal temperatures through the growing season. This included several hot stretches in late May, June, and July. Fall weather was mostly cold and wet as alfalfa prepared for dormancy.

2017 Weather

The growing season overall was characterized by many extremes that ended up averaging out to a “normal” year. After a warm winter, the early season was generally cool and wet in most areas of the state. This led to delayed seeding as soils remained wet. Extreme winterkill was observed in NE Wisconsin counties where all 2nd production year fields and four of six 3rd year fields for this study were lost. This was regardless of a late fall cut being taken or not. First harvest timing was normal because spring growth was not as rapid as some previous years. Temperatures in June were generally near to above normal, while July and August were below normal.

September and October were much above normal. Precipitation was variable, but generally wet until July and dry after. Some areas received very little rain in September. A very late killing frost allowed established stands and summer seeding time to recover and strengthen for the winter.

Table 1. Field background information

Field #	1st Production Year	County	Seeding Mo/Yr.	Seeding Rate (lb/ac)	Field Size (ac)	Last Production Year
107	2007	Outagamie	05/06	15	103.7	2009
207	2007	Outagamie	04/06	16	79.3	2009
307	2007	Outagamie	04/06	16	37.0	2010
407	2007	Outagamie	04/06	16	156.7	2009
507	2007	St. Croix	08/06	NA	51.0	2009
607	2007	Waupaca	04/06	15	24.1	2007
707	2007	Fond du Lac	04/06	17	15.7	2007
807	2007	Fond du Lac	04/06	17	39.7	2010
108	2008	Chippewa	04/07	15	18.8	2009
208	2008	Marathon	04/07	15	5.2	2011
308	2008	Winnebago	05/07	15	115	2011
408	2008	Winnebago	08/07	15	36.0	2011
508	2008	Winnebago	05/07	15	22.0	2011
608	2008	Outagamie	05/07	20	83.7	2011
708	2008	Outagamie	04/07	16	147.8	2011
808	2008	Outagamie	04/07	16	53.0	2011
908	2008	Outagamie	05/07	15	50.3	2011
1008	2008	Outagamie	08/07	15	194.8	2008
109	2009	St. Croix	08/08	NA	41	2011
209	2009	Winnebago	04/08	15	67	2012
309	2009	Winnebago	08/08	15	78	2011
409	2009	Brown	08/08	18	75	2011
509	2009	Chippewa	04/08	15	16.2	2009
609	2009	Calumet	04/08	12	15	2011
709	2009	Outagamie	05/08	20	74.8	2010
809	2009	Outagamie	05/08	20	63	2010
110	2010	Outagamie	05/09	16	48	2010
210	2010	Outagamie	05/09	16	110.2	2012
310	2010	Outagamie	05/09	16	61.7	2012
410	2010	Outagamie	05/09	16	111	2012
510	2010	Fond du Lac	04/09	17	50.3	2012
610	2010	Fond du Lac	04/09	17	19.3	2012
111	2011	Fond du Lac	04/10	17	10	2013
211	2011	Brown	04/10	17	35.7	2012
311	2011	Outagamie	05/10	20/+4 TF	75.8	2011
411	2011	Outagamie	05/10	20/+4 TF	72	2011
112	2012	St. Croix	08/11	16	73.9	2012
212	2012	Kewaunee	05/11	17	73.5	2014
312	2012	Outagamie	05/11	16	143.6	2014
412	2012	Outagamie	05/11	16	75	2014
512	2012	Outagamie	05/11	16	189	2014
612	2012	Outagamie	05/11	16	45.9	2014
712	2012	Outagamie	05/11	16	38.7	2013
812	2012	Dodge	05/11	16	59.6	2013

Table 1. Field background information (**continued**)

Field #	1st Production Year	County	Seeding Mo/Yr.	Seeding Rate (lb/ac)	Field Size (ac)	Last Production Year
113	2013	Columbia	08/12	15	44.6	2015
213	2013	Outagamie	04/12	16	150.7	2014
313	2013	Outagamie	04/12	16	54	2014
413	2013	Outagamie	04/12	16	79.3	2014
513	2013	Brown	08/12	28	156	2013
114	2014	Fond du Lac	04/13	19	32.8	2016
214	2014	Fond du Lac	07/13	17	35.7	2016
314	2014	Fond du Lac	05/13	15	9.4	2016
414	2014	Fond du Lac	05/13	18	20.3	2017
514	2014	Kewaunee	05/13	21	32	2016
614	2014	Door	05/13	18	60.8	2016
714	2014	Columbia	04/13	14	9.4	2017
814	2014	Pierce	09/13	15	16.3	2015
914	2014	Marathon	07/13	12	14.2	2015
1014	2014	Marathon	06/13	15	32.5	2016
1114	2014	Outagamie	05/13	16	104.3	2014
1214	2014	Outagamie	05/13	16	156.8	2014
1314	2014	Outagamie	06/13	16	69	2014
1414	2014	Outagamie	05/13	20/+3.5 TF	38.9	2016
1514	2014	Outagamie	06/13	20/+3.5 TF	76.7	2015
115	2015	Manitowoc	06/14	16	19.3	2017
215	2015	Door	07/14	18	52.0	2016
315	2015	Outagamie	05/14	16	55.7	2016
415	2015	Outagamie	05/14	16	110.2	2016
515	2015	Outagamie	05/14	16	86.5	2018
615	2015	Outagamie	05/14	16	45.8	2016
715	2015	Outagamie	05/14	16	225.0	2016
815	2015	Marathon	06/14	18	11.4	2017
915	2015	Marathon	06/14	15	5.61	2016
1015	2015	Columbia	04/14	15	15.9	2018
116	2016	Marathon	04/15	12	20.0	2017
216	2016	Outagamie	05/15	16	215.7	2016
316	2016	Outagamie	05/15	16	108.6	2016
416	2016	Outagamie	05/15	16	65.0	2016
516	2016	Outagamie	05/15	16	78.2	2016
616	2016	Outagamie	05/15	16	90.0	2016
716	2016	Columbia	05/15	16	11.9	2018
117	2017	Door	05/16	18	48.6	active
217	2017	Kewaunee	07/16	20	33.7	active
317	2017	Outagamie	05/16	16	89.6	active
417	2017	Outagamie	05/16	16	103.4	2018
517	2017	Outagamie	05/16	16	285.3	active
617	2017	Columbia	05/16	16	16.5	active
717	2017	Marathon	05/16	12	6.2	2018
817	2017	Marathon	08/16	12	42.4	2018
917	2017	Columbia	05/16	15	16.5	active
1017	2017	Columbia	05/16	15	16.2	active
118	2018	Kewaunee	05/17	18	40.0	active

Table 1. Field background information (**continued**)						
Field #	**1st Production Year**	**County**	**Seeding Mo/Yr.**	**Seeding Rate (lb/ac)**	**Field Size (ac)**	**Last Production Year**
218	2018	Dane	08/17	18	102.5	2018
318	2018	Dane	08/17	20	52.6	active
418	2018	Manitowoc	05/17	18	53.9	2018
518	2018	Fond du Lac	05/17	18	38.0	active
618	2018	Fond du Lac	08/17	20	14.3	active
718	2018	Fond du Lac	05/17	17	8.0	active
818	2018	Fond du Lac	05/17	17	58.0	active
918	2018	Fond du Lac	05/17	17	57.0	active
1018	2018	Columbia	08/17	15	19.5	active
1118	2018	Outagamie	05/17	16	57.7	active
1218	2018	Outagamie	05/17	16	46.7	2018
1318	2018	Outagamie	05/17	16	60.3	active
1418	2018	Marathon	08/17	15	9.7	active
119	2019	Columbia	05/18	16	22.3	active
219	2019	Marathon	05/18	15	10.3	active
319	2019	Marathon	05/18	15	31.6	active
419	2019	Marathon	05/18	15	32.5	active

Data Collection:
Project fields were identified and an accurate measure of field size was determined (if not previously known). Forage yield from an entire project field was weighed (usually this was done with an on-farm drive-over scale). Both empty and full weights for all trucks/wagons used were recorded. Beginning in 2008, two forage samples from each harvest were taken and submitted to the Marshfield Soil and Forage Analysis Laboratory (only one sample was submitted per harvest in 2007) for NIR analysis. Data from the two forage samples was averaged and recorded into a spreadsheet by the local coordinator. The data was then shared with the producer following each harvest. At the end of the season, all data was collected and summarized for this report.

Harvest Schedules:
Mean cutting dates by year are presented in Table 2 and cutting dates for all project fields harvested in 2019 are presented in Table 3. The 2019 season was marked by later than normal harvest dates for all cuts (Table 2). The average date of each cut was 7-10 days later than the thirteen-year average. First cut was the second latest recorded. It was delayed 7 days by slow greenup and wet conditions, which pushed back the remainder of the cuts through the season. Average first-cut date has ranged from May 16 in 2012 to June 10 in 2013. Regardless of first-cut date, the average fourth-cut date is generally within a week of September 1, with the exception of a few extreme weather years. The majority of fields in this study and in 2019 were cut four times. Across years and sites, 29 fields were cut three times, 201 fields were cut four times (generally prior to or soon after September 1), and 23 fields were cut five times (generally four times before September 1 with a final cut in October).

First cut occurred over a 26 day range (May 30 to June 25) which is longer than normal (Table 3). Typically, first cut occurred over 19 days because of varying location and weather, but ranged from 13 in 2007 to 45 in 2015. Only one field was cut in May and the majority were cut the first week in June. Throughout the season, cutting date was affected by weather and individual producer's decisions, contributing to wider ranges in subsequent cuttings. Six fields were cut 3 times (not including fall) this year and none were cut 5 times. The average days between cutting for 4-cut fields was 1st to 2nd- 33, 2nd to 3rd- 29, and 3rd to 4th- 33. The average days between cutting for 3-cut fields was 1st to 2nd- 35 and 2nd to 3rd- 33. These fields generally were in northern counties or had a late first cut. Several fields were slated to be harvested in fall because producers needed forage, but ultimately were not because they were too wet for traffic and then under snow.

Table 2. Mean cutting dates by year

Year	1st Cut Date	2nd Cut Date	3rd Cut Date	4th Cut* Date	5th Cut Date
2007	22-May	24-June	25-July	30-Aug	21-Oct
2008	3-Jun	3-Jul	3-Aug	29-Aug	29-Oct
2009	31-May	1-Jul	4-Aug	5-Sep	
2010	22-May	28-Jun	2-Aug	29-Aug	12-Oct
2011	31-May	1-Jul	31-Jul	31-Aug	
2012	16-May	14-Jun	14-Jul	10-Aug	21-Sep**
2013	10-Jun	11-Jul	6-Aug	7-Sep	
2014	4-Jun	9-Jul	7-Aug	13-Sep	
2015	3-Jun	2-Jul	3-Aug	27-Aug	12-Sep
2016	29-May	26-Jun	26-Jul	19-Aug	1-Sep
2017	29-May	2-Jul	1-Aug	29-Aug	
2018	30-May	28-Jun	28-Jul	3-Sep	14-Sep
2019	7-Jun	10-Jul	9-Aug	6-Sep	
MEAN	**30-May**	**30-Jun**	**31-Jul**	**30-Aug***	**1-Oct**

*average excludes data where a 4th-cut was taken in October

** average includes 8 fields with 5th-cuts taken in early-October and 5 fields in late-August/early-September

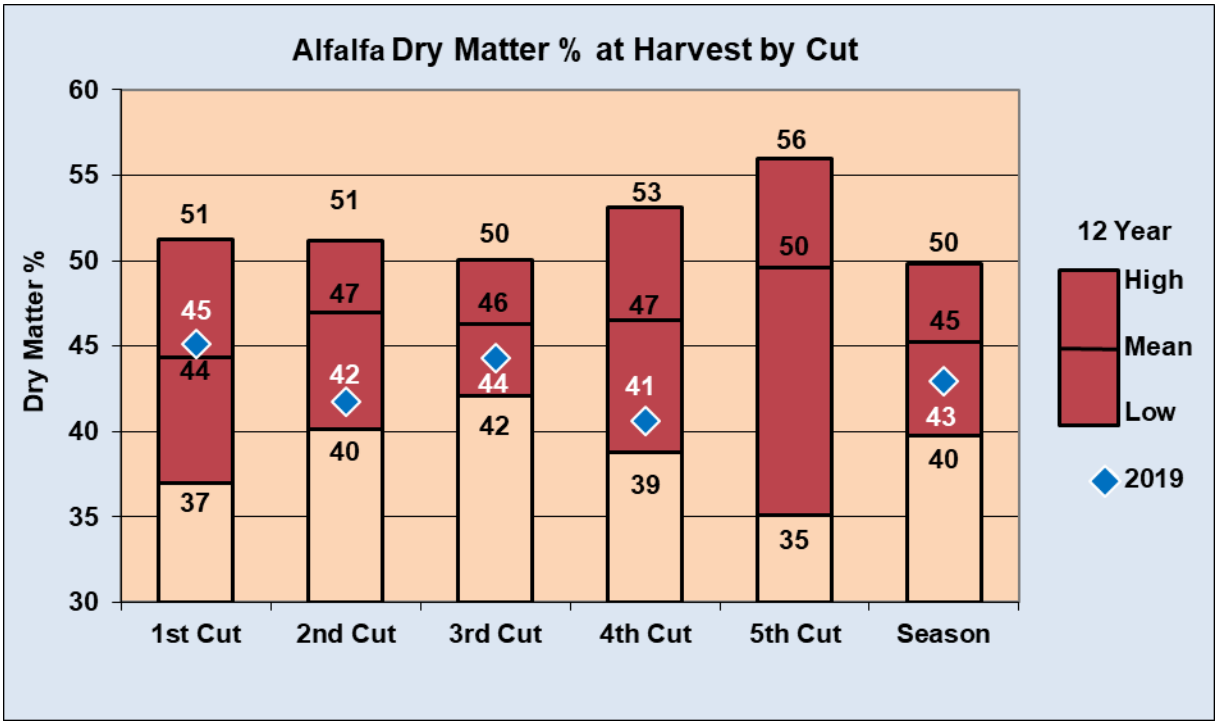
Table 3. Summary of 2019 Cutting Dates

Field ID#	County	1st Cut Date	2nd Cut Date	3rd Cut Date	4th Cut Date	5th Cut Date
117	Door	6-Jun	7-Jul	8-Aug		
217	Kewaunee	9-Jun	15-Jul	13-Aug		
317	Outagamie	3-Jun	8-Jul	2-Aug	7-Sep	
517	Outagamie	3-Jun	8-Jul	2-Aug	7-Sep	
617	Columbia	3-Jun	5-Jul	5-Aug	4-Sep	
917	Columbia	3-Jun	5-Jul	5-Aug	4-Sep	
1017	Columbia	3-Jun	5-Jul	5-Aug	4-Sep	
118	Kewaunee	5-Jun	7-Jul	7-Aug	16-Sep	
318	Dane	30-May	5-Jul	1-Aug	4-Sep	
518	Fond du Lac	10-Jun	2-Jul	13-Aug	17-Sep	
618	Fond du Lac	4-Jun	8-Jul	2-Aug	6-Sep	
718	Fond du Lac	5-Jun	9-Jul	9-Aug	6-Sep	
818	Fond du Lac	4-Jun	8-Jul	2-Aug	30-Aug	
918	Fond du Lac	4-Jun	7-Jul	1-Aug	31-Aug	
1018	Columbia	3-Jun	7-Jul	5-Aug	7-Sep	
1118	Outagamie	4-Jun	9-Jul	3-Aug	8-Sep	
1318	Outagamie	4-Jun	9-Jul	3-Aug	8-Sep	
1418	Marathon	19-Jun	29-Jul	29-Aug		
119	Columbia	3-Jun	5-Jul	5-Aug	4-Sep	
219	Marathon	18-Jun	24-Jul	29-Aug	7-Oct	
319	Marathon	19-Jun	24-Jul	29-Aug	8-Oct	
419	Marathon	25-Jun	29-Jul	29-Aug	9-Oct	
MEAN		**7-Jun**	**10-Jul**	**9-Aug**	**6-Sep***	**14-Sep**
EARLIEST		**30-May**	**2-Jul**	**1-Aug**	**30-Aug**	**14-Sep**
LATEST		**25-Jun**	**29-Jul**	**29-Aug**	**17-Sep**	**14-Sep**

*average excludes data where a 4th-cut was taken in October

Forage Dry Matter at Harvest:
Alfalfa was harvested as haylage for all but 20 individual cuttings over the thirteen years. Harvest dry matter data from the dry hay harvests was not included in the forage dry matter data means. Although project participants are not asked about storage structure, there is good reason to believe most of the farms are storing this forage in bunkers, piles, or bags.

Throughout the duration of this project total season dry matter percentage of harvested forage has ranged from 40 to 50% (Figure 1), though individual cuttings and total-season field means sometimes exceeded 50%, especially later in the season. It's been questioned if this is too dry for obtaining optimum storage porosity in a bunker or pile. The trend had been toward higher dry matter percentages in recent years, but 2019 was an exception. Cut 1 was near normal, but the other cuts and average season dry matter was below normal. Cut 2, cut 4, and season dry matter ranked or tied for 3rd lowest while cut 3 was 2nd lowest. The 2019 season dry matter was 43% and ranged from 35 to 50%. Five fields finished the season with total-season dry matter means under 40% and no fields were above 50%. This was attributed to wet environmental conditions. Normally, first cut tends be harvested at a lower dry matter than other cuts. This is likely because drying weather improves through the season.



Total Season Range for individual fields:
2007 (n=8): 49.8%
42% - 54% DM
2008 (n=16): 47.1%
37% - 54% DM
2009 (n=23): 48.8%
38% - 59% DM
2010 (n=23): 48.8%
37% - 55% DM
2011 (n=21): 44.6%
35% - 52% DM
2012 (n=16): 46.6%
40% - 51% DM
2013 (n=13): 39.7%
33% - 43% DM
2014 (n=24): 42.7%
34% - 56 % DM
2015 (n=23):42.0%
31% - 51% DM
2016 (n=26): 43.6%
36% - 50% DM
2017 (n=18): 43.7%
32% - 52% DM
2018 (n=27): 45.0%
37% - 66% DM
2019 (n=22): 42.9%
35% - 50% DM

Figure 1. Average dry matter of harvested forage by cutting and as a weighted average for the total season (2007-2019).

Forage Dry Matter Yield:
Average yield by cutting and for the season in each project year are presented in Figure 2. The highest average dry matter yields of just over 5.0 tons per acre were obtained in 2007 and 2010. A record low total-season dry matter yield average was set in 2013 at 3.7 tons per acre.

The average yield across all fields was 4.15 tons per acre in 2019, much below the thirteen-year average of 4.42 tons per acre. This yield was similar to 2009 and 2017, both which were wetter years. First-cut yield of 1.46 tons per acre was below average. This is because of delayed green up in May due to cold temperatures, heavy rain, and snowstorms. Other cut yields varied with Cut 2 slightly above normal, cut 3 slightly below and cut 4 was normal. Detailed yield data for each field by year are presented in Appendix A.

Once again there was extreme variation between fields in 2019 (Figure 3). Yields ranged from a high of 6.40 (the second highest project yield recorded) to a low of 2.81 tons per acre. One field exceeded 6.0 tons per acre which is the benchmark for top yields in the study having only been reached 11 times over 13 years. The highest yielding field since the project's inception was 6.55 tons per acre in 2012. Five fields were below 3.0 tons per acre in 2019. That level has now been reached by 17 fields in 13 years (Appendix A). These fields likely received substantial winter injury, but were left because producers didn't have better options for forage.

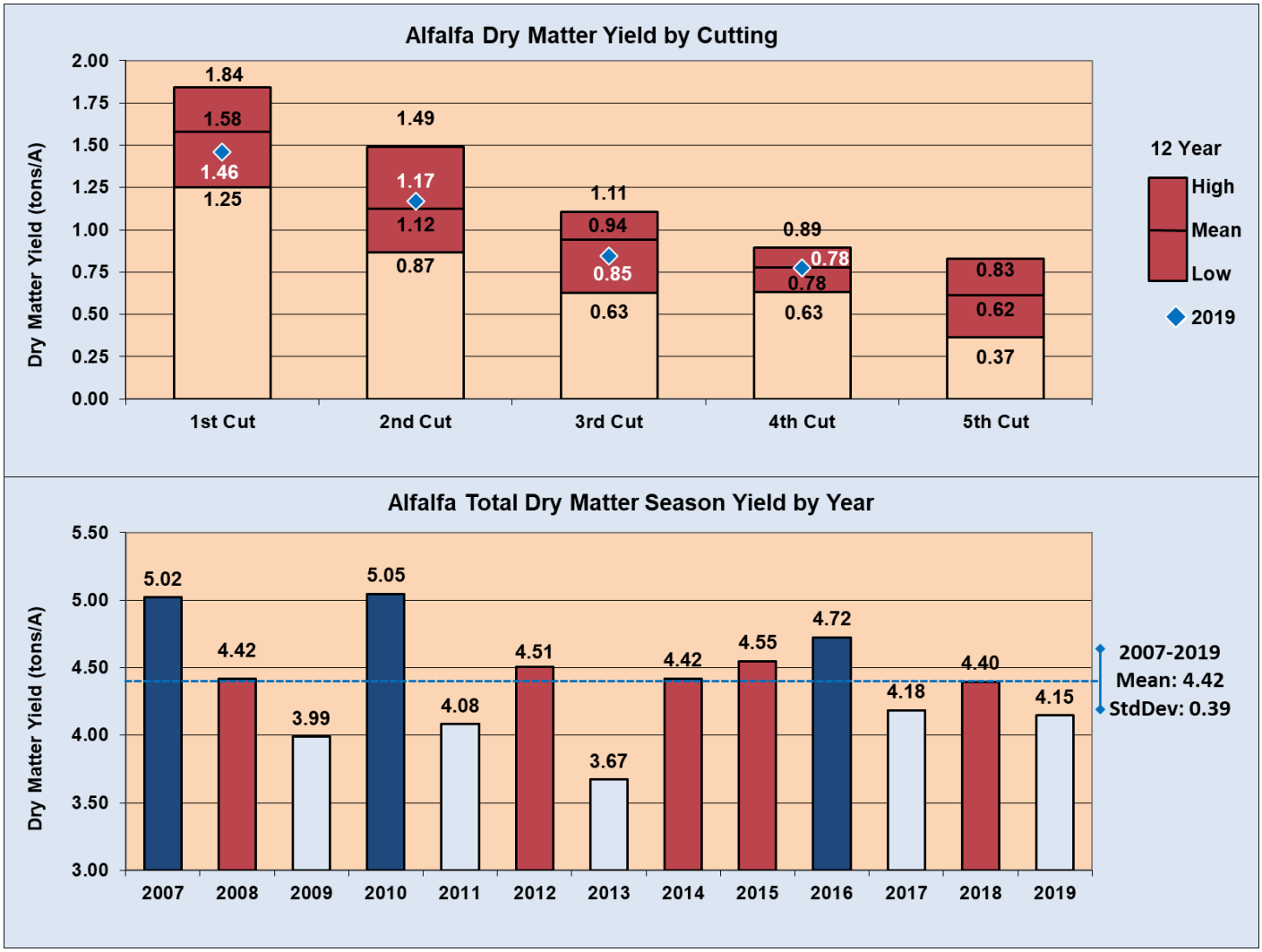


Figure 2. Average dry matter yield by cutting and for the total season yield by year. (2007-19)

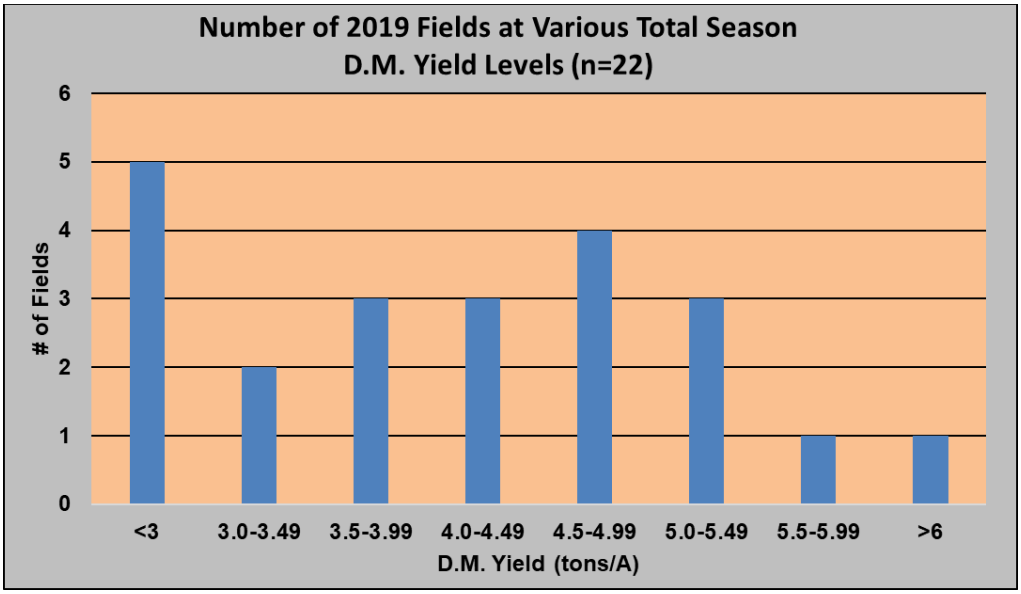


Figure 3. Number of 2019 fields at various total season dry matter yield levels (n=22)

Alfalfa Persistence:

In-season: An analysis was done to determine the percent of total season yield for each cutting (Table 4). Data was summarized for 3-, 4-, and 5-cut systems for all project years. Five-cut fields were also included in the 4-cut summary with the final fall harvest not included in the total season yield. It's significant to note the wide variation in percent yield for an individual cutting. In some cases this is the result of environmental conditions (e.g. drought) previous to the harvest while in other situations it's simply a function of cutting date (Tables 2 and 3). The sixteen 4-cut fields in 2019 had a slightly less proportion of yield in the 1st cut compared to the study mean, but this was balanced by 2nd cut having slightly more. The six fields cut three times had very similar proportional yield to the long-term mean. No fields were cut five times this year.

Table 4. Average percent of total season yield by cutting for 3, 4 and 5 cut harvest systems* (2007-19)

3-cut system (4-Fall) (n=36 site years)			
	1st cut	**2nd cut**	**3rd cut**
2019	47	29	24
Mean	46	29	26
Low	26	15	13
High	72	43	49

4-cut system (3+Fall, 5-Fall) (n=221 site years)				
	1st cut	**2nd cut**	**3rd cut**	**4th cut**
2019	34	28	20	18
Mean	36	25	21	18
Low	20	14	5	5
High	58	42	36	31

5-cut system (4+Fall) (n=23 site years)					
	1st cut	**2nd cut**	**3rd cut**	**4th cut**	**5th cut**
2019					
Mean	31	23	18	16	12
Low	21	14	10	9	6
High	41	39	26	24	18

* high and low figures are for individual cuttings and will not add to 100%

Between years: Persistence is influenced over time by the age of the stand, cutting schedule, and environment. For this project, persistence is being measured as a percent of 1st production year dry matter yield. Persistence data in Table 5 consists of 2006 through 2017-seeded fields and is averaged over all cutting schedules. Although ranges indicate a wide variation, average forage yield in the 2nd (103%) and 3rd (96%) production year have been comparable to the 1st production year. The yield for 4th-year stands drops to 80% of the 1st-production year. To date it appears that keeping stands for at least three production years seems to be the prudent decision, but the condition and productivity of individual fields are the most important factors in determining when to rotate to a different crop. The numbers could also be somewhat misleading because not all fields are kept for a full 3- or 4-year production cycle. Those that are removed earlier at the producer's discretion no longer generate data which would result in lower averages. Therefore this should be viewed as data from fields that producer's judge good enough to keep.

Table 5. Percent of 1st production year yield by cutting and total season for 2nd, 3rd, and 4th production year stands. (2007-18)

2nd Production Year Stands (n=85 site years)

	1st cut	2nd cut	3rd cut	4th cut	Season
Mean	112	107	115	104	103
Low	44	39	23	39	63
High	275	291	491	279	236

3rd Production Year Stands (n=52 site years)

	1st cut	2nd cut	3rd cut	4th cut	Season
Mean	104	104	102	98	96
Low	57	43	32	23	63
High	250	299	370	172	183

4th Production Year Stands (n=15 site years)

	1st cut	2nd cut	3rd cut	4th cut	Season
Mean	84	83	94	77	80
Low	38	47	54	23	59
High	138	147	141	132	115

Forage Quality:

Forage quality, although extremely important, is not the primary focus of this project. However, it is impossible to evaluate changes in management to maximize yield and persistence without considering the impact on forage quality. Overall harvested forage quality of 169 (Figure 8) was near average in 2019 season. Results of the four cuts ranged from 154 to 201 with cut 1 and cut 2 below average and cut 3 and cut 4 above. Cut 2 RFQ was the fourth lowest recorded while cut 3 and cut 4 were both the second highest seen, trailing only 2014 and 2009, respectively. Despite the weather challenges, most producers were able to harvest dairy quality forage.

Other notable forage quality results from 2019 included:

- Season crude protein percent was the second lowest in 13 years (Figure 4). Season CP had increased to the long-term mean in 2018 after decreasing the four previous years, but now decreased again. Cut 1 was the second lowest after 2017 while cut 2 and cut 4 were third lowest and cut 3 tied for second lowest. This was caused by a late first cut and frequent in-season rains which extended time between cuts.
- NDF percent was above average for all cuts and for the season (Figure 5). Cut 2 was the second highest seen, trailing only 2010. Season NDF had decreased in 2018 from the record high set in 2017 but increased again this year similar to the trend of the previous five years of increasing values.
- NDFD percent was above average for all cuts and for the season (Figure 6). Cut 3 and cut 4 both set new records with both beating 2017 averages. The season average trailed only the record 2017

average. This is the sixth straight year with good NDFD levels (Figure 7). Four fields planted to reduced-lignin varieties have some influence, but improved conventional varieties and harvest timing are also likely factors.

- Milk/Ton was also above average for all cuts and for the season (Figure 9). Cut 3 and cut 4 both set new high marks by beating 2010 and 2017 averages, respectively. The season average trailed only the record 2018 average. This is also the sixth straight year with increasing milk/ton levels.
- Crude protein, NDF, and RFQ changes were tracked during 1st crop harvest since 2015 (Figures 10-12). Alfalfa had a shorter greenup window because of a cold, wet spring in 2019. A regression shows that crude protein dropped 0.21%/day, similar to 0.22 - 0.24% in previous years and the expected change of -0.25%/day. NDF increased 0.58%/day, similar to 0.54 - 0.57% in previous years and greater than the expected change of +0.41%/day. RFQ decreased 1.8 points/day, less than 2.2 - 3.1 points in previous years and the -4 to -5/day expected.

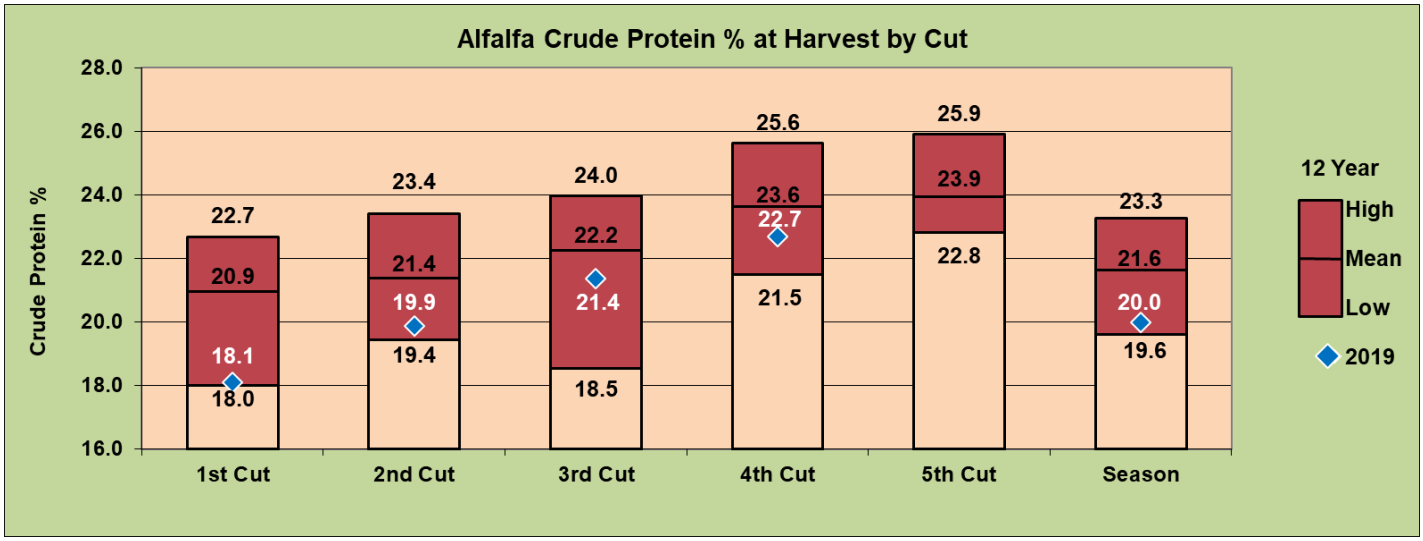


Figure 4. Average crude protein percent by cutting and weighted average for the total season (2007-2019).

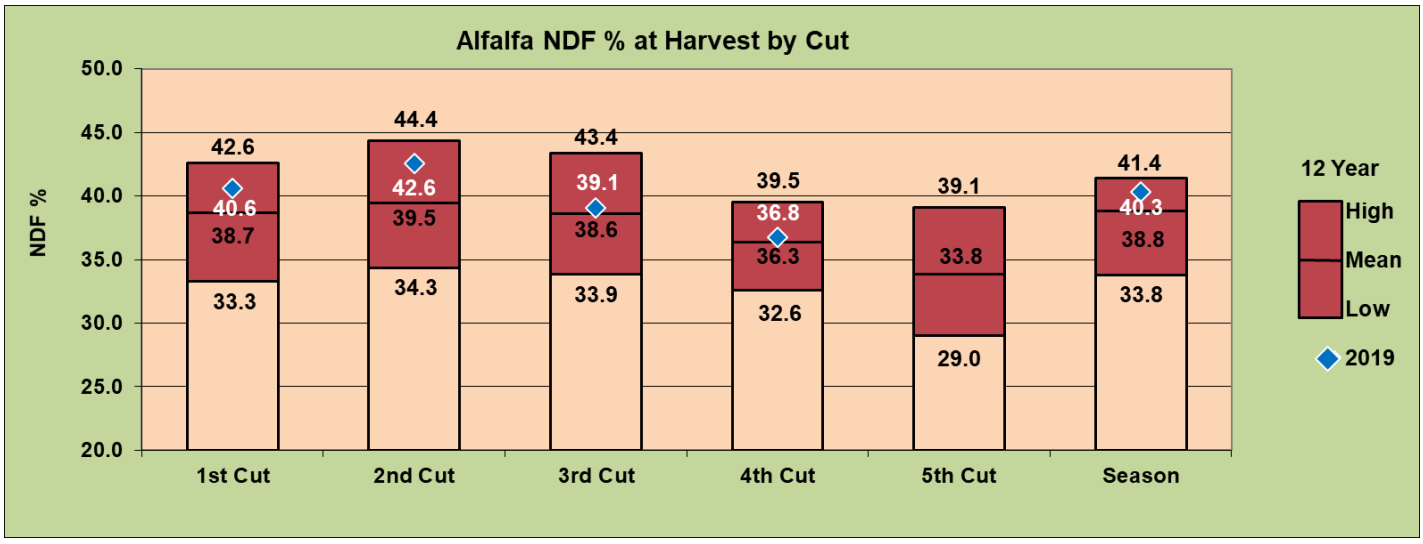


Figure 5. Average NDF percent by cutting and weighted average for the total season (2007-2019).

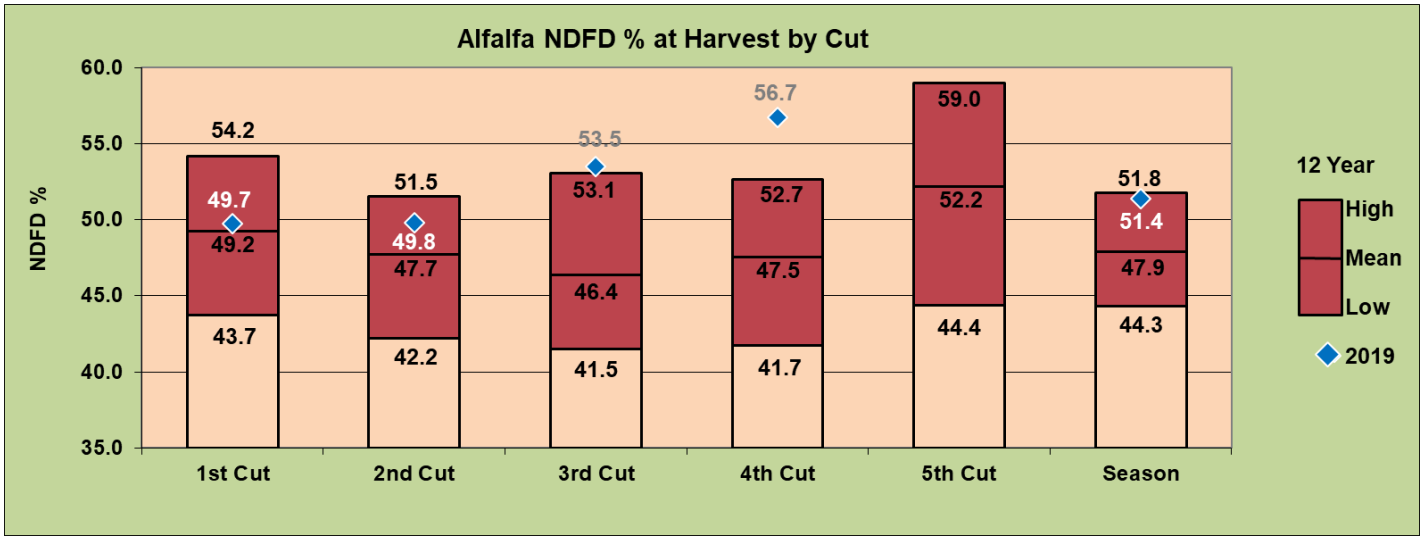


Figure 6. Average NDFD percent by cutting and weighted average for the total season (2007-2019).

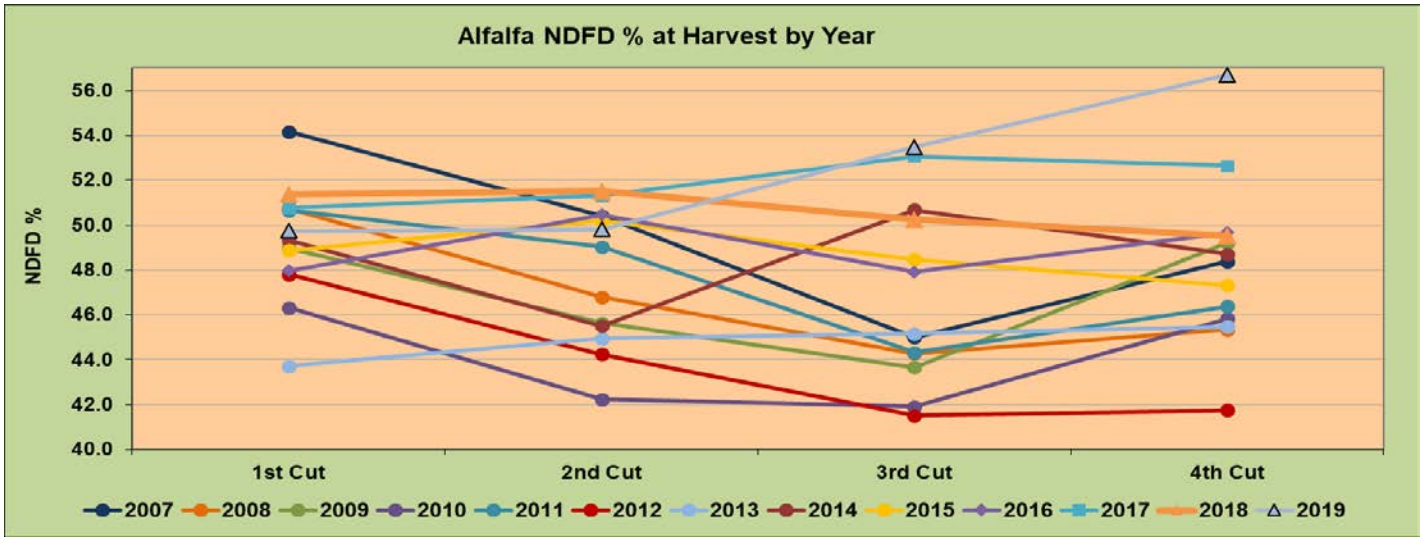


Figure 7. Average NDFD percent by cutting (2007-2019).

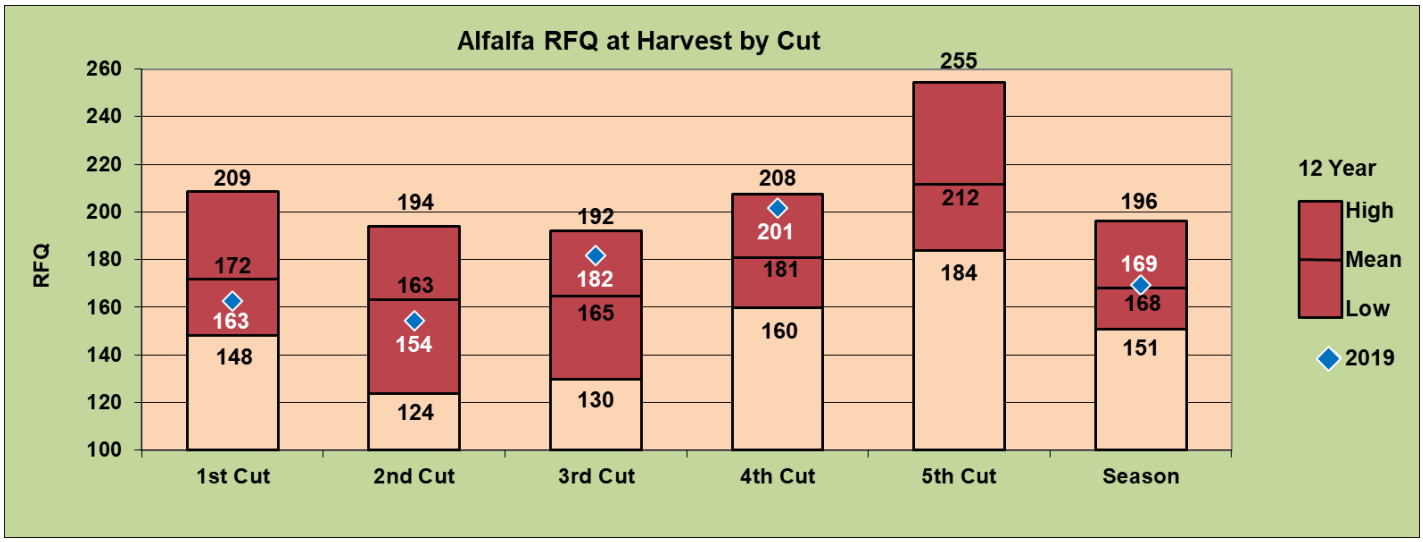


Figure 8. Average Relative Forage Quality (RFQ) by cutting and weighted average for the total season (2007-2019).

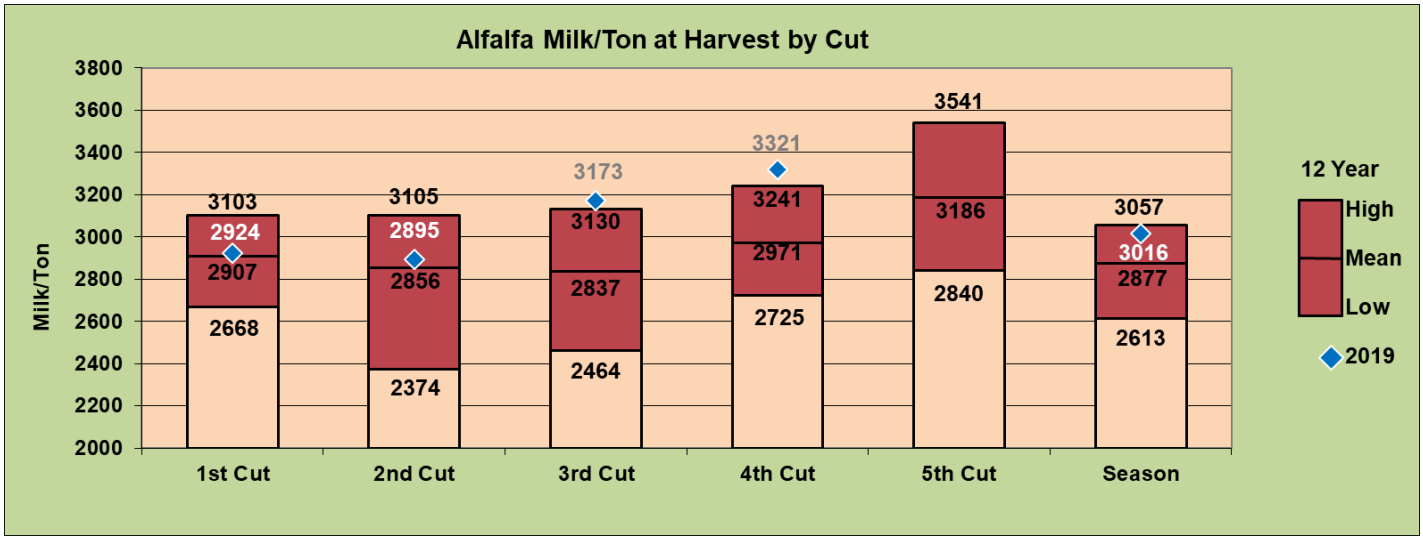


Figure 9. Average Milk per Ton by cutting and weighted average for the total season (2007-2019).

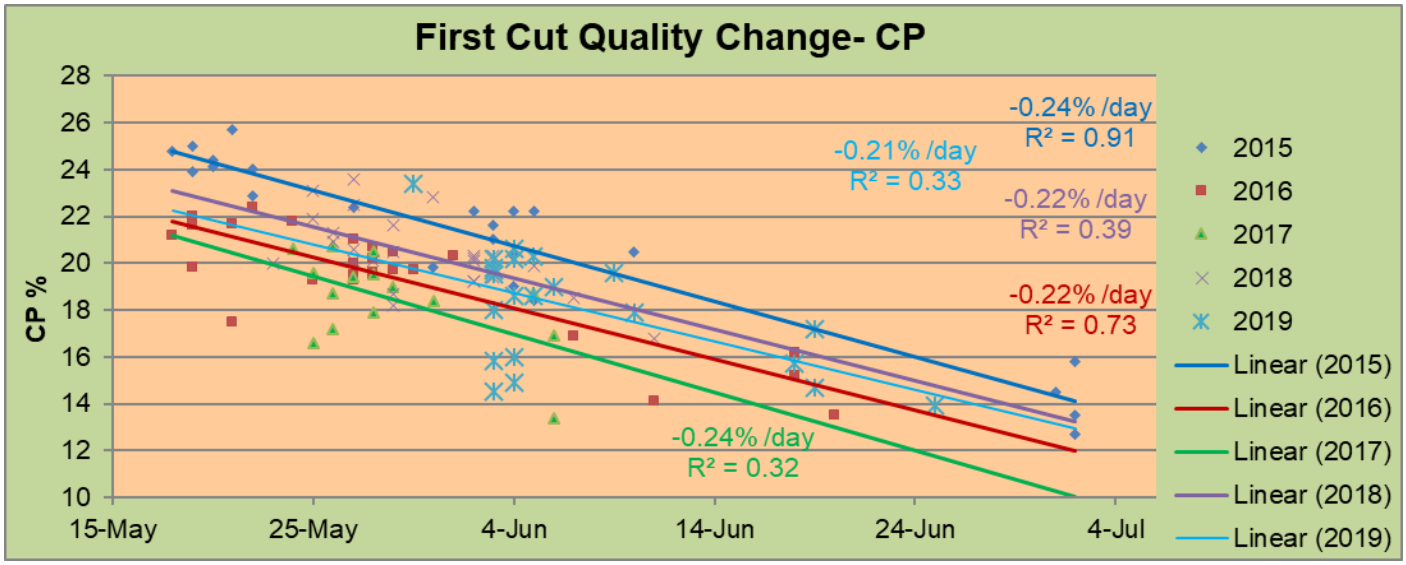


Figure 10. Change in Crude Protein percent during First-Cut Harvest (2015-2019).

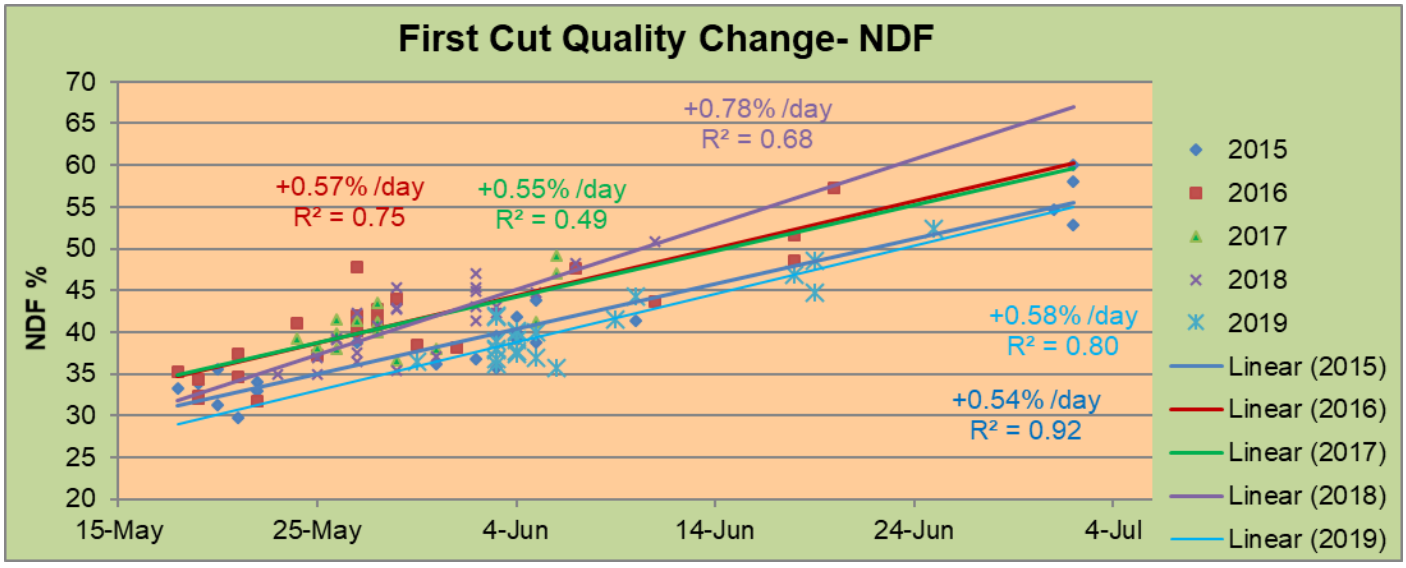


Figure 11. Change in NDF percent during First-Cut Harvest (2015-2019).

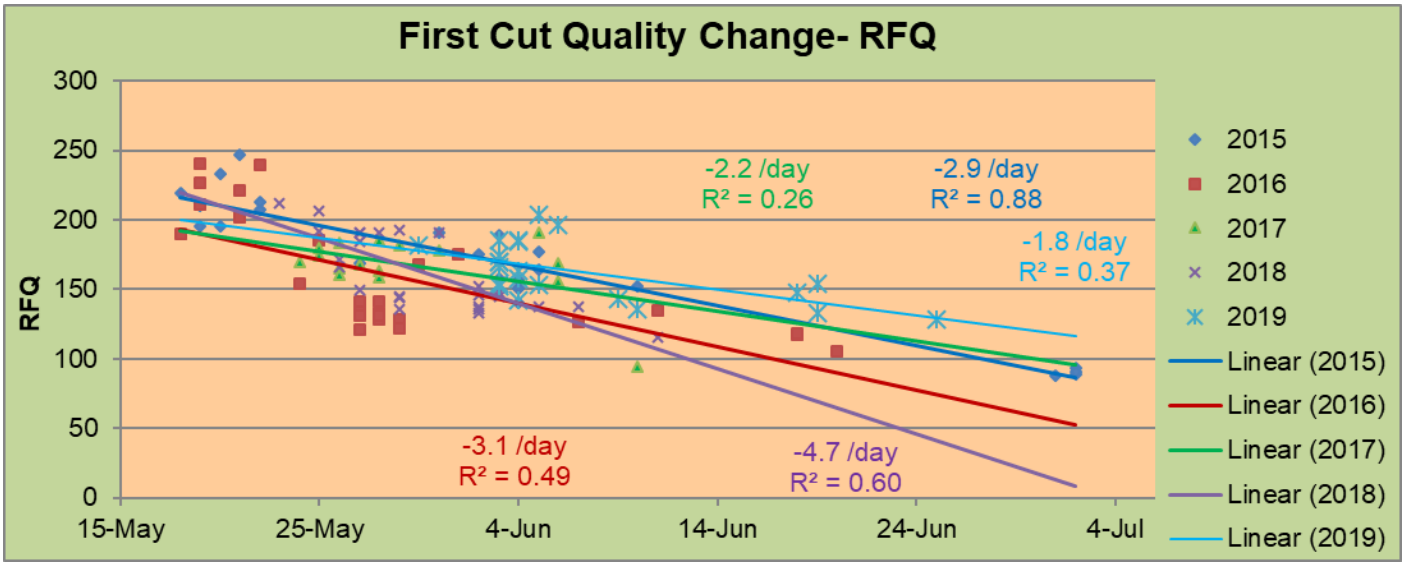


Figure 12. Change in RFQ during First-Cut Harvest (2015-2019).

Summary:
The Wisconsin Alfalfa Yield and Persistence Program is designed to provide forage growers and agricultural professionals a unique look at what is happening at the farm level. As more fields are entered and years pass, the reliability of information continues to increase. Four fields were planted to reduced-lignin varieties in 2019. It will be interesting to see if results change as more reduced-lignin varieties are used by producers. Environmental conditions have had a profound influence on both yield and quality with years being similar, but no two years being exactly alike.

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Appendix A. Dry matter yield by field, harvest year, cutting, and total season.

Field ID#	Harvest Year	1st Cut DM Yield	2nd Cut DM Yield	3rd Cut DM Yield	4th Cut DM Yield	5th Cut DM Yield	Season DM Yield
107	2007	1.57	1.53	0.95	0.59	0.34	4.98
207	2007	1.52	1.33	1.00	0.70	0.73	5.27
307	2007	1.54	1.51	1.30	0.90	0.88	6.12
407	2007	1.41	1.57	1.11	0.80	0.71	5.59
507	2007	1.00	1.02	0.37			2.39
607	2007	1.79	1.77	1.20	1.14		5.90
707	2007	1.75	1.23	0.81	0.63		4.41
807	2007	1.79	1.19	1.42	1.10		5.51
Mean	**2007**	**1.55**	**1.39**	**1.02**	**0.84**	**0.67**	**5.02**
Low	**2007**	**1.00**	**1.02**	**0.37**	**0.59**	**0.34**	**2.39**
High	**2007**	**1.79**	**1.77**	**1.42**	**1.14**	**0.88**	**6.12**
107	2008	1.28	1.11	1.07	0.43		3.89
207	2008	1.34	1.08	1.14	0.68		4.23
307	2008	NA	0.86	0.91	0.78		---
407	2008	NA	1.14	1.09	0.68		---
507	2008	1.95	1.08	0.76			3.79
807	2008	2.23	1.73	1.31	0.82		6.08
108	2008	1.38	0.74	1.15			3.27
208	2008	2.08	1.54	0.84			4.46
308	2008	1.46	0.83	1.27	0.93	0.45	4.95
408	2008	0.86	0.49	0.85	0.50		2.70
508	2008	2.01	0.72	1.20	0.98	0.37	5.29
608	2008	1.39	1.78	1.54	0.92		5.63
708	2008	1.28	1.05	1.18	0.89		4.40
808	2008	1.81	1.20	1.27	0.79		5.07
908	2008	0.73	0.94	0.89	1.12		3.68
1008	2008	NA	1.06	0.97	0.83		---
Mean	**2008**	**1.52**	**1.08**	**1.09**	**0.80**	**0.41**	**4.42**
Low	**2008**	**0.73**	**0.49**	**0.76**	**0.43**	**0.37**	**2.70**
High	**2008**	**2.23**	**1.78**	**1.54**	**1.12**	**0.45**	**6.08**
107	2009	0.95	1.06	0.30	0.99		3.31
207	2009	1.28	1.23	0.53	1.00		4.04
307	2009	1.02	1.23	0.69	0.93		3.87
407	2009	1.59	1.02	0.53	0.85		3.99
507	2009	1.38	0.90	0.49	0.76		3.53
807	2009	1.56	0.99	0.98	0.62		4.15
108	2009	1.52	0.83	0.80			3.15
208	2009	1.77	1.18	1.33			4.28
308	2009	1.24	0.94	0.56	1.15		3.89
408	2009	1.80	0.80	0.20	0.64		3.43
508	2009	1.74	1.00	0.59	0.98		4.32
608	2009	2.19	1.23	0.88	0.78		5.07
708	2009	1.40	1.34	0.63	0.98		4.35
808	2009	2.07	1.16	0.59	0.55		4.37
908	2009	1.88	0.99	0.30	0.95		4.13
109	2009	0.57	0.55	1.09			2.21
209	2009	1.92	1.60	0.69	1.06		5.27
309	2009	1.14	0.84	0.43	1.05		3.46
409	2009	1.45	1.24	0.35	0.32		3.37
509	2009	2.05	0.88	0.57			3.49
609	2009	2.36	0.58	0.20	0.95		4.10

Field ID#	Harvest Year	1st Cut DM Yield	2nd Cut DM Yield	3rd Cut DM Yield	4th Cut DM Yield	5th Cut DM Yield	Season DM Yield
709	2009	2.27	1.25	0.82	0.92		5.26
809	2009	2.08	1.03	0.85	0.72		4.68
Mean	**2009**	**1.62**	**1.04**	**0.63**	**0.85**		**3.99**
Low	**2009**	**0.57**	**0.55**	**0.20**	**0.32**		**2.21**
High	**2009**	**2.36**	**1.60**	**1.33**	**1.15**		**5.27**
307	2010	1.16	1.24	1.24	0.52		4.17
807	2010	1.38	1.32	1.22	0.81		4.74
208	2010	1.99	1.65	1.26	0.62		5.52
308	2010	1.65	1.66	0.85	0.41		4.57
408	2010	1.85	1.46	0.76	0.51		4.58
508	2010	1.88	1.81	0.69	0.48		4.86
608	2010	2.09	1.79	1.46	0.82		6.16
708	2010	1.45	1.33	1.39	0.67		4.84
808	2010	1.66	1.77	1.57	0.90		5.91
908	2010	1.83	0.84	1.27	0.51		4.45
109	2010	1.57	1.42	0.90	1.33		5.23
209	2010	1.91	1.80	1.09	0.91		5.71
309	2010	2.16	1.85	0.91	0.70		5.61
409	2010	1.43	0.96	0.55	0.39		3.33
609	2010	2.34	1.78	1.05	1.00		6.17
709	2010	2.32	0.94	1.08	0.57		4.90
809	2010	1.86	1.67	1.07	0.47		5.07
110	2010	1.46	1.65	1.40	0.54		5.05
210	2010	2.07	1.76	0.94	0.51		5.28
310	2010	1.59	1.21	0.97	0.57		4.33
410	2010	2.00	1.26	0.94	0.41		4.61
510	2010	1.87	1.69	1.05	0.62	0.39	5.62
610	2010	2.08	1.40	1.09	0.46	0.34	5.37
Mean	**2010**	**1.81**	**1.49**	**1.08**	**0.64**	**0.37**	**5.05**
Low	**2010**	**1.16**	**0.84**	**0.55**	**0.39**	**0.34**	**3.33**
High	**2010**	**2.34**	**1.85**	**1.57**	**1.33**	**0.39**	**6.17**
208	2011	0.78	0.90	1.05	0.45		3.18
308	2011	1.31	1.12	0.85	0.79		4.06
408	2011	1.19	0.72	0.67	0.51		3.09
508	2011	1.25	0.85	0.65	0.69		3.44
608	2011	1.10	0.83	1.16	0.45		3.54
708	2011	1.50	0.75	1.37	0.78		4.41
808	2011	1.07	0.65	1.15	0.90		3.77
908	2011	0.92	0.52	0.87	0.49		2.80
109	2011	1.29	0.97	1.03	0.76		4.05
209	2011	1.59	1.02	0.92	0.92		4.45
309	2011	1.53	1.15	1.14	0.95		4.77
409	2011	1.27	0.81	0.47	0.48		3.03
609	2011	1.76	0.90	1.68	0.78		5.12
210	2011	1.13	0.72	1.04	0.80		3.69
310	2011	1.25	0.63	0.97	0.78		3.63
410	2011	1.33	0.60	1.08	0.57		3.58
510	2011	1.47	1.08	1.07	0.73		4.35
610	2011	1.41	0.92	0.88	0.83		4.04
111	2011	2.45	1.29	1.32	1.19		6.26
211	2011	1.39	0.85	1.20	1.10		4.55
311	2011	2.30	0.94	1.66	1.00		5.90
411	2011	1.70	NA	1.68	0.64		NA

Field ID#	Harvest Year	1st Cut DM Yield	2nd Cut DM Yield	3rd Cut DM Yield	4th Cut DM Yield	5th Cut DM Yield	Season DM Yield
Mean	**2011**	**1.41**	**0.87**	**1.09**	**0.75**		**4.08**
Low	**2011**	**0.78**	**0.52**	**0.47**	**0.45**		**2.80**
High	**2011**	**2.45**	**1.29**	**1.68**	**1.19**		**6.26**
209	2012	1.47	1.01	0.97	0.40		3.85
210	2012	1.46	0.75	0.43	0.80	0.76	4.20
310	2012	1.22	0.67	0.45	0.69	0.45	3.48
410	2012	1.14	0.62	0.38	0.66	0.56	3.36
510	2012	1.20	1.13	0.74	0.63	0.73	4.44
610	2012	2.33	1.18	1.12	0.66		5.30
111	2012	2.03	1.79	1.55	1.18		6.55
211	2012	1.11	1.10	0.78	0.79	0.48	4.26
112	2012	1.46	0.85	1.11	0.85	0.63	4.90
212	2012	1.74	1.21	1.32	1.27		5.55
312	2012	1.65	0.78	0.59	0.70	0.68	4.40
412	2012	2.06	0.81	0.64	0.86	0.64	5.00
Mean	**2012**	**1.46**	**1.01**	**0.82**	**0.78**	**0.58**	**4.51**
Low	**2012**	**0.84**	**0.62**	**0.38**	**0.40**	**0.34**	**3.36**
High	**2012**	**2.33**	**1.88**	**1.55**	**1.27**	**0.76**	**6.55**
111	2013	1.70	0.85	0.87	0.94		4.35
212	2013	1.89	1.47	1.06	0.99		5.40
312	2013	1.20	1.02	0.65	0.48		3.35
412	2013	1.26	1.16	0.74	0.63		3.79
512	2013	1.30	1.11	0.80	0.65		3.87
612	2013	0.86	0.86	0.63	0.43		2.78
712	2013	0.83	1.03	0.65	0.44		2.95
812	2013	1.94	1.26	1.03	0.84		5.07
113	2013	2.27	1.80	1.19			5.26
213	2013	0.82	1.08	0.62	0.76		3.28
313	2013	0.82	0.83	0.51	0.60		2.76
413	2013	0.92	1.11	0.72	0.50		3.25
513	2013	0.47	0.40	0.44	0.30		1.62
Mean	**2013**	**1.25**	**1.08**	**0.76**	**0.63**		**3.67**
Low	**2013**	**0.47**	**0.40**	**0.44**	**0.30**		**1.62**
High	**2013**	**2.27**	**1.80**	**1.19**	**0.99**		**5.40**
212	2014	1.76	1.53	0.77	0.88		4.93
312	2014	1.69	0.97	0.70	0.80		4.16
412	2014	1.56	0.89	0.75	0.70		3.90
512	2014	1.48	0.59	0.76	0.65		3.48
612	2014	1.41	0.66	0.54	0.59		3.20
113	2014	1.80	1.70	1.24	1.03		5.79
213	2014	1.39	0.51	0.64	1.05		3.58
313	2014	1.09	0.53	0.66	0.84		3.13
413	2014	1.87	0.68	0.67	0.90		4.12
114	2014	1.93	1.88	1.24	1.25		6.28
214	2014	1.49	1.77	1.36	0.88		5.50
314	2014	1.88	1.14	1.02	0.73		4.77
414	2014	1.74	1.99	1.19	1.09		6.02
514	2014	1.77	0.89	0.55	0.75		3.95
614	2014	2.13	0.88	0.35	0.73		4.09
714	2014	2.96	1.24	1.02	0.91		6.12
814	2014	1.42	1.22	0.42	0.70		3.75
914	2014	1.18	1.20	0.93			3.31
1014	2014	2.04	1.58	1.20			4.82
1114	2014	1.42	0.73	0.76	0.74		3.65

Field ID#	Harvest Year	1st Cut DM Yield	2nd Cut DM Yield	3rd Cut DM Yield	4th Cut DM Yield	5th Cut DM Yield	Season DM Yield
1214	2014	1.23	0.54	0.95	0.70		3.42
1314	2014	1.20	0.49	0.88	0.83		3.39
1414	2014	1.28	1.93	0.72	1.31		5.23
1514	2014	1.87	1.24	0.81	1.58		5.50
Mean	**2014**	**1.65**	**1.12**	**0.84**	**0.89**		**4.42**
Low	**2014**	**1.09**	**0.49**	**0.35**	**0.59**		**3.13**
High	**2014**	**2.96**	**1.99**	**1.36**	**1.58**		**6.28**
113	2015	1.59	1.50	1.61	0.85		5.55
114	2015	1.87	1.60	1.46	1.02		5.95
214	2015	1.25	0.88	0.88	0.72	0.66	4.40
314	2015	1.76	1.15	0.95	0.75		4.61
414	2015	1.67	1.60	1.24	0.64		5.14
514	2015	1.25	1.84	1.17			4.26
614	2015	2.89	1.21	0.86	0.70		5.67
714	2015	1.29	0.99	1.63	0.89		4.80
814	2015	1.30	0.77	0.95	0.35		3.37
914	2015	2.26	0.73	1.00			3.99
1014	2015	2.39	0.62	1.11			4.12
1414	2015	2.04	1.26	0.95	0.82		5.06
1514	2015	2.03	1.14	1.03	0.84		5.03
115	2015	1.16	1.30	0.87	0.77		4.10
215	2015	1.65	1.10	0.70			3.45
315	2015	1.53	0.76	1.19	1.07		4.55
415	2015	1.90	0.81	0.98	0.76		4.45
515	2015	1.98	0.91	1.02	0.76		4.66
615	2015	1.20	0.69	0.57	0.29		2.74
715	2015	1.51	0.83	0.95	0.63		3.92
815	2015	1.83	1.17	0.91			3.90
915	2015	2.33	1.05	1.91			5.28
1015	2015	1.81	1.36	1.49	0.95		5.60
Mean	**2015**	**1.76**	**1.10**	**1.10**	**0.75**	**0.66**	**4.55**
Low	**2015**	**1.16**	**0.62**	**0.57**	**0.29**	**0.66**	**2.74**
High	**2015**	**2.89**	**1.84**	**1.91**	**1.07**	**0.66**	**5.95**
114	2016	2.20	1.49	1.23	0.90		5.82
214	2016	1.74	1.12	0.76	0.45		4.06
314	2016	2.30	1.13	0.68	0.62		4.73
414	2016	1.97	1.47	1.12	0.80		5.35
514	2016	1.98	1.68	1.56			5.22
614	2016	2.22	1.12	1.28	1.07		5.70
714	2016	2.17	1.35	1.08	1.06		5.66
1014	2016	2.64	1.36	1.04	0.25		5.30
1414	2016	1.35	1.53	1.09	0.79		4.76
115	2016	1.57	1.40	1.00	0.67	0.80	5.44
215	2016	1.85	1.36	0.88	0.44		4.54
315	2016	1.61	0.88	0.79	0.42		3.70
415	2016	1.49	1.35	0.74	1.07		4.65
515	2016	2.37	0.88	0.83	1.03		5.10
615	2016	1.31	0.81	0.76	0.80		3.67
715	2016	1.28	1.09	1.10	0.84		4.31
815	2016	1.94	0.84	0.93			3.70
915	2016	2.54	1.17	1.21			4.93
1015	2016	1.92	1.40	1.31	1.07		5.70
116	2016	2.35	1.14	1.73			5.21
216	2016	1.24	0.94	0.86	0.89		3.94
316	2016	1.45	0.85	0.79	0.84		3.94

Field ID#	Harvest Year	1st Cut DM Yield	2nd Cut DM Yield	3rd Cut DM Yield	4th Cut DM Yield	5th Cut DM Yield	Season DM Yield
416	2016	1.30	0.85	0.71	0.57		3.43
516	2016	1.65	0.82	0.88	0.86		4.21
616	2016	1.36	0.71	0.67	0.89		3.64
716	2016	2.15	1.30	1.26	1.36		6.07
Mean	**2016**	**1.84**	**1.16**	**1.01**	**0.80**	**0.80**	**4.72**
Low	**2016**	**1.24**	**0.71**	**0.67**	**0.25**	**0.80**	**3.43**
High	**2016**	**2.64**	**1.68**	**1.73**	**1.36**	**0.80**	**6.07**
414	2017	1.97	1.47	1.12	0.80		5.35
714	2017	2.03	0.96	1.06	1.20		5.25
115	2017	1.12	1.14	1.04	0.94		4.23
515	2017	1.17	1.01	0.48	0.39		3.05
815	2017	1.97	0.61	0.75	0.57		3.89
1015	2017	2.04	0.98	0.58	0.79		4.39
116	2017	2.37	0.51	0.42			3.30
716	2017	2.00	1.33	1.10	0.90		5.32
117	2017	1.80	0.79	0.78			3.37
217	2017	1.64	1.50	1.10	0.89		5.13
317	2017	0.93	0.80	0.53	0.52		2.78
417	2017	0.97	0.83	0.39	0.42		2.60
517	2017	1.56	1.49	0.78	0.87		4.69
617	2017	1.75	1.15	0.97	0.92		4.79
717	2017	1.09	0.87	0.90			2.85
817	2017	1.99	1.12	0.88			3.99
917	2017	1.48	1.50	1.28	0.66		4.93
1017	2017	2.03	1.46	1.41	0.48		5.38
Mean	**2017**	**1.66**	**1.08**	**0.87**	**0.74**		**4.18**
Low	**2017**	**0.93**	**0.51**	**0.39**	**0.39**		**2.60**
High	**2017**	**2.37**	**1.50**	**1.41**	**1.20**		**5.38**
515	2018	1.03	0.56	0.92	0.59		3.10
1015	2018	1.74	1.29	1.43	0.93		5.40
716	2018	1.76	1.29	1.20	1.08		5.34
117	2018	1.32	1.76	0.86	0.26		4.20
217	2018	1.68	1.60	1.00			4.28
317	2018	1.07	0.85	0.62	0.71		3.25
417	2018	1.29	0.85	0.69	0.65		3.48
517	2018	1.54	1.02	0.78	0.82		4.15
617	2018	1.51	0.95	1.77	0.69		4.93
717	2018	1.43	0.63	1.14	0.78		3.99
817	2018	1.69	1.13	1.12	0.91		4.86
917	2018	1.62	0.76	1.13	0.82		4.33
1017	2018	1.48	0.84	1.42	0.98		4.72
118	2018	1.46	1.20	1.05	1.00		4.72
218	2018	1.73	1.00	1.44	1.39		5.56
318	2018	1.22	0.93	1.03	1.01		4.19
418	2018	1.19	1.22	0.99	1.16	0.83	5.39
518	2018	1.23	1.24	0.97	0.82		4.27
618	2018	2.01	1.67	0.81	1.20		5.69
718	2018	1.38	1.65	1.07	0.97		5.06
818	2018	1.43	0.72	0.50	0.65		3.30
918	2018	1.18	1.08	0.28	0.66		3.20
1018	2018	1.50	1.38	1.79	0.90		5.58
1118	2018	1.40	0.55	0.99	0.67		3.61
1218	2018	1.18	1.15	0.98	1.11		4.42
1318	2018	1.57	1.07	0.82	0.62		4.07
1418	2018	1.12	0.78	0.78	0.91		3.59

Field ID#	Harvest Year	1st Cut DM Yield	2nd Cut DM Yield	3rd Cut DM Yield	4th Cut DM Yield	5th Cut DM Yield	Season DM Yield
Mean	**2018**	**1.44**	**1.08**	**1.02**	**0.86**	**0.83**	**4.40**
Low	**2018**	**1.03**	**0.55**	**0.28**	**0.26**	**0.83**	**3.10**
High	**2018**	**2.01**	**1.76**	**1.79**	**1.39**	**0.83**	**5.69**
117	2019	1.42	0.88	0.65			2.95
217	2019	2.14	1.23	1.18			4.55
317	2019	0.80	1.01	0.41	0.66		2.89
517	2019	1.14	1.35	0.60	0.75		3.84
617	2019	1.30	0.92	0.76	0.64		3.62
917	2019	1.36	1.07	0.90	0.79		4.13
1017	2019	1.61	1.11	0.99	0.82		4.53
118	2019	1.04	0.91	0.57	0.86		3.37
318	2019	1.64	1.65	1.01	0.87		5.17
518	2019	1.53	1.44	1.18	1.83		5.98
618	2019	2.30	1.71	1.23	1.16		6.40
718	2019	1.72	1.24	1.13	0.74		4.83
818	2019	1.94	1.51	0.95	0.91		5.32
918	2019	1.79	1.18	0.91	0.62		4.50
1018	2019	1.56	1.72	1.27	0.66		5.22
1118	2019	0.61	0.93	0.52	0.75		2.81
1318	2019	1.14	1.16	0.53	0.73		3.55
1418	2019	1.66	1.09	0.63			3.38
119	2019	1.35	1.10	1.04	0.86		4.36
219	2019	1.54	1.18	0.86	0.46		4.04
319	2019	1.35	0.46	0.66	0.40		2.88
419	2019	1.14	0.85	0.67	0.23		2.89
Mean	**2019**	**1.46**	**1.17**	**0.85**	**0.78**	**#DIV/0!**	**4.15**
Low	**2019**	**0.61**	**0.46**	**0.41**	**0.23**	**0.00**	**2.81**
High	**2019**	**2.30**	**1.72**	**1.27**	**1.83**	**0.00**	**6.40**