WISCONSIN ALFALFA YIELD AND PERSISTENCE (WAYP) PROGRAM
2018 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.

2018 Overview:

This summary has now reached twelve years of project data. UW-Extension agents were asked to identify forage producers willing to weigh and sample forage from a 2017-seeded field and continue to do so for the life of the stand. A total of 14 new fields from 11 different farms were enrolled in the program in 2018 and 11 fields continued from previous years. Fields in Dane County were measured for the first time and several farms in Fond du Lac County rejoined the program. The current summary includes data for the first, second, third, and fourth production years from fields entered into the program in 2015 through 2018 (2014-2017 seedings). There were two fourth-year stands remaining in the project, which 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 5 fields dropped from the project that participated in 2017. Most of these were older stands and some likely experienced some winterkill the previous winter. Production data was collected from 25 fields in 2018 with a total of 5,613 dry matter tons of forage harvested, weighed, and sampled from 1,358 acres. Over 12 years, data was collected from 103 fields with a total of 58,252 dry matter tons of forage harvested, weighed, and sampled from 6,611 acres. A summary of all project fields (current and past) is presented in Table 1.

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.

2016 Weather

The growing season overall was above average in terms of temperature and precipitation in most areas of the state. Similar to previous years, this varied across the state and though the season. Many areas had normal temperatures with dry conditions in early spring, leading to quick greenup, rapid growth, and an early first cut. However, by early June, regular and sometimes flooding rains started and persisted through the summer. This made timely harvest and drydown challenging. First cutting again varied widely with some fields being

harvested the week before Memorial Day at high quality and others being delayed two weeks or more. Despite the wet weather and flooding, the southern part of the state stayed extremely dry through much of the summer. Late summer and autumn saw above average temperature and rainfall. Many fields were not harvested after mid-late August because of wet field conditions or the producers did not need additional forage. These stands had better than normal fall growth and went into the fall looking good. New seedings had a tough year. Planting was generally timely, but cool and dry conditions in early May slowed growth and allowed disease to thin stands. Wet fields, especially those with previous tillage, had noticeable wheel traffic damage.

2015 Weather

The growing season overall was very close to normal in terms of temperature and precipitation for many areas. Some areas were cooler and drier in early summer, but this balanced out in late summer. September was the warmest on record for many places. Significant winterkill and heaving affected eastern and central areas of the state. The spring was mostly dry and warm, which resulted in timely planting and rapid alfalfa growth in May. First cutting varied widely with many fields being harvested the week before Memorial Day at high quality and others being delayed one to two weeks because of heavy rains that started on Memorial Day weekend. Some of these delayed fields caught up and still had four cuts while other only had three. Many stands had good fall growth and went into the fall looking good.

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

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

Field #	1st Production Year	County	Seeding Mo/Yr.	Seeding Rate (lb/ac)	Field Size (ac)	Last Production Year
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
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	active
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	active
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

Table 1. Field background information (**continued**)						
Field #	**1st Production Year**	**County**	**Seeding Mo/Yr.**	**Seeding Rate (lb/ac)**	**Field Size (ac)**	**Last Production Year**
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	active
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	active
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	active
817	2017	Marathon	08/16	12	42.4	active
118	2018	Kewaunee	05/17	18	40.0	active
218	2018	Dane	08/17	18	102.5	active
318	2018	Dane	08/17	20	52.6	active
418	2018	Manitowoc	05/17	18	53.9	active
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	active
1318	2018	Outagamie	05/17	16	60.3	active
1418	2018	Marathon	08/17	15	9.7	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 2018 are presented in Table 3. The 2018 season was marked by near average harvest dates for the first three cuts (Table 2). The average date of each cut was within 2 days of the twelve-year average. However, fourth cut was five days later than average because of heavy rains in late August and September. 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 large majority of fields in this study and in 2018 were cut four times. Across years and sites, 26 fields were cut three times, 182 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 19 day range (May 24 to June 10) which matches the average (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. Fifteen of the fields were cut the last week on May and ten were first-cut in June. Throughout the season,

cutting date was affected by weather and individual producer's decisions, contributing to wider ranges in subsequent cuttings. Only one field was cut 3 times this year and one was cut 5 times. The average days between cutting for 4-cut fields was 1st to 2nd- 28, 2nd to 3rd- 30, and 3rd to 4th- 38. Third cut was later in some fields that were very dry weather in July and fourth cut was generally delayed by wet weather in late summer.

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
MEAN	**29-May**	**30-Jun**	**30-Jul**	**29-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

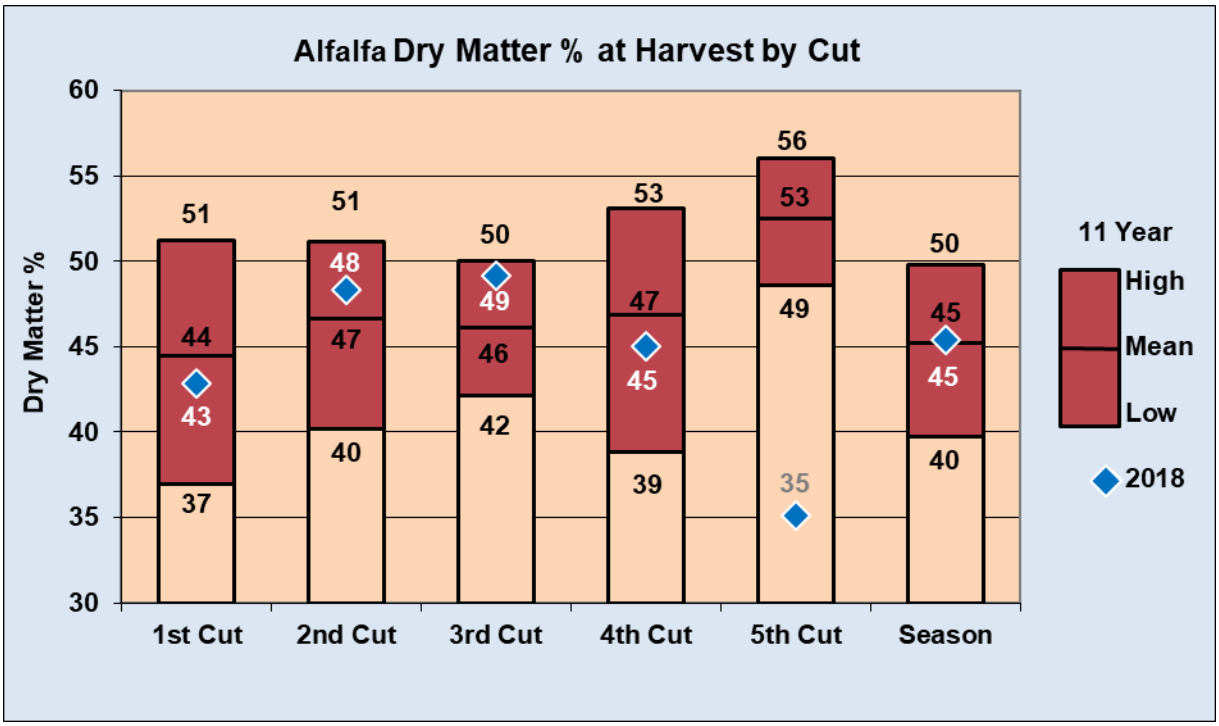
Table 3. Summary of 2018 Cutting Dates

Field ID#	County	1st Cut Date	2nd Cut Date	3rd Cut Date	4th Cut Date	5th Cut Date
515	Outagamie	2-Jun	28-Jun	29-Jul	6-Sep	
1015	Columbia	27-May	29-Jun	30-Jul	7-Sep	
716	Columbia	28-May	29-Jun	30-Jul	7-Sep	
117	Door	29-May	26-Jun	24-Jul	9-Sep	
217	Kewaunee	29-May	6-Jul	7-Aug		
317	Outagamie	2-Jun	29-Jun	30-Jul	6-Sep	
417	Outagamie	2-Jun	29-Jun	31-Jul	6-Sep	
517	Outagamie	2-Jun	30-Jun	31-Jul	6-Sep	
617	Columbia	27-May	24-Jun	30-Jul	7-Sep	
717	Marathon	5-Jun	28-Jun	6-Aug	10-Sep	
817	Marathon	7-Jun	7-Jul	7-Aug	12-Sep	
118	Kewaunee	31-May	28-Jun	27-Jul	7-Sep	
218	Dane	29-May	27-Jun	25-Jul	15-Sep	
318	Dane	25-May	23-Jun	23-Jul	28-Aug	
418	Manitowoc	23-May	22-Jun	18-Jul	13-Aug	14-Sep
518	Fond du Lac	26-May	28-Jun	25-Jul	15-Sep	
618	Fond du Lac	29-May	25-Jun	25-Jul	23-Aug	
718	Fond du Lac	27-May	27-Jun	23-Jul	1-Sep	
818	Fond du Lac	26-May	23-Jun	17-Jul	14-Aug	
918	Fond du Lac	25-May	22-Jun	16-Jul	13-Aug	
1018	Columbia	27-May	28-Jun	29-Jul	7-Sep	
1118	Outagamie	2-Jun	30-Jun	1-Aug	1-Sep	
1218	Outagamie	3-Jun	30-Jun	1-Aug	1-Sep	
1318	Outagamie	3-Jun	30-Jun	1-Aug	6-Sep	
1418	Marathon	11-Jun	6-Jul	6-Aug	12-Sep	

MEAN	**30-May**	**28-Jun**	**28-Jul**	**3-Sep**	**14-Sep**
EARLIEST	**23-May**	**22-Jun**	**16-Jul**	**13-Aug**	**14-Sep**
LATEST	**11-Jun**	**7-Jul**	**7-Aug**	**15-Sep**	**14-Sep**

Forage Dry Matter at Harvest:
Alfalfa was harvested as haylage for all but 18 individual cuttings over the twelve 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 has been toward higher dry matter percentages in recent years. For 2018 the average season dry matter was 45%, matching the long-term average, and ranged from 38 to 66%. Three fields finished the season with total-season dry matter means under 40% and two fields were above 50%. This was attributed to environmental conditions. First cut tends be harvested at a lower dry matter than other cuts. This is likely because drying weather improves through the season. First and fourth were slightly below average while second and third were slightly above. The one field harvested a fifth time was much below, likely due to a narrow harvest window.



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=16): 43.8%
32% - 52% DM
2018 (n=25): 45.2%
38% - 66% DM

Figure 1. Average dry matter of harvested forage by cutting and as a weighted average for the total season (2007-2018).

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 4.39 tons per acre in 2018, nearly identical to the twelve-year average of 4.41 tons per acre. This yield was also nearly identical to 2008 and 2014, both which were wetter years. First-cut yield of 1.43 tons per acre was below average. This is likely because of delayed green up in April due

to cold temperatures and snowstorms. Other cut yields were at or slightly above average. The five-cut field was the highest seen in the study at 0.83 tons dm/A. Detailed yield data for each field by year are presented in Appendix A.

Once again there was extreme variation between fields in 2018 (Figure 3). Yields ranged from a high of 5.69 to a low of 3.10 tons per acre. No fields exceeded 6.0 tons per acre which is the benchmark for top yields in the study having only been reached 10 times over 12 years. The highest yielding field since the project's inception was 6.55 tons per acre in 2012. No fields were below 3.0 tons per acre in 2018. That level has only been reached by 12 fields in 12 years (Appendix A).

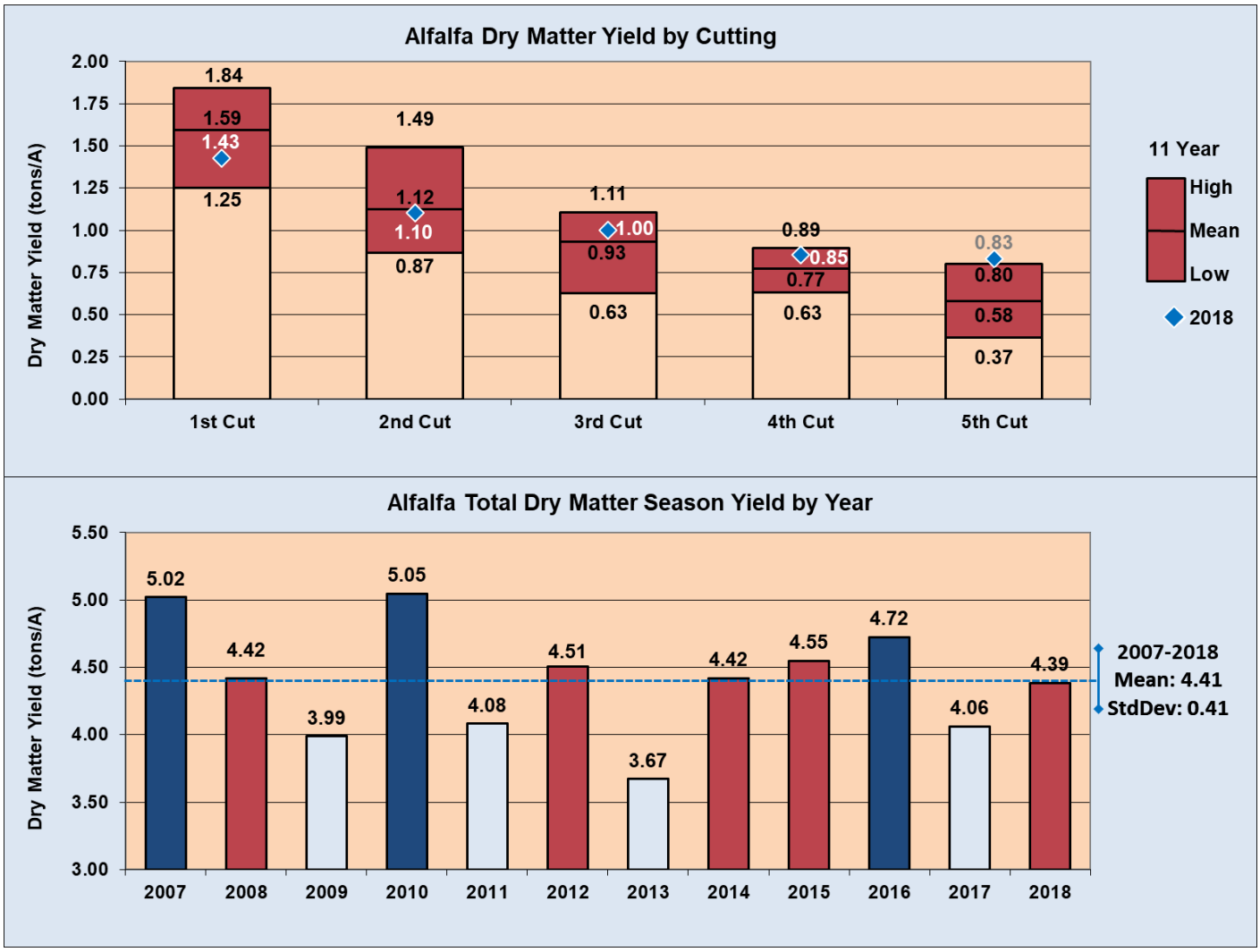


Figure 2. Average dry matter yield by cutting and for the total season yield by year. (2007-18)

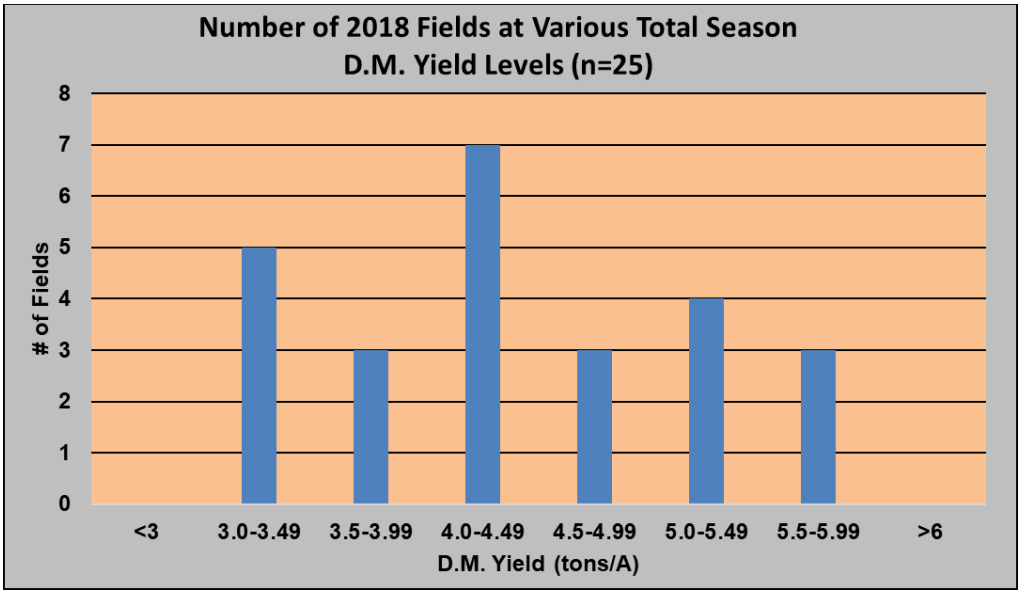


Figure 3. Number of 2018 fields at various total season dry matter yield levels (n=25)

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 24 4-cut fields in 2018 had slightly less proportion of yield in the 1st cut than average. The fields cut three times or five times (one each) also had a lower proportion of 1st cut yield than the long-term mean.

Table 4. Average percent of total season yield by cutting for 3, 4 and 5 cut harvest systems* (2007-18)

3-cut system (4-Fall) (n=30 site years)					
	1st cut	**2nd cut**	**3rd cut**		
2018	39	37	23		
Mean	46	28	26		
Low	26	15	13		
High	72	43	49		
4-cut system (3+Fall, 5-Fall) (n=198 site years)					
	1st cut	**2nd cut**	**3rd cut**	**4th cut**	
2018	33	25	23	19	
Mean	36	25	21	18	
Low	20	14	5	5	
High	58	42	36	30	
5-cut system (4+Fall) (n=23 site years)					
	1st cut	**2nd cut**	**3rd cut**	**4th cut**	**5th cut**
2018	22	23	18	22	15
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 2016-seeded fields and is averaged over all cutting schedules. Although ranges indicate a wide variation, average forage yield in the 2nd (103%) and 3rd (98%) 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=72 site years)

	1st cut	2nd cut	3rd cut	4th cut	Season
Mean	112	106	114	101	103
Low	44	39	23	39	63
High	275	291	491	279	236

3rd Production Year Stands (n=45 site years)

	1st cut	2nd cut	3rd cut	4th cut	Season
Mean	106	105	105	95	98
Low	57	43	32	23	63
High	250	299	370	169	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. Harvested forage quality (Figure 8) continued to improve in 2018 and was above average for the season for the first time since 2012. Results of the first 4 cuts ranged from 162 to 180 which matched the trial averages (162 to 181). However, the cut averages were reversed from expectations. Usually cut 1 and cut 4 have better quality because of a cooler growing season than mid-summer cuts. Adverse growing and harvest conditions early and late with generally dry weather in between led to the mid-season cuts having better quality. Top 3 RFQ values in cut 2 and cut 3, combined with a lower proportion of total yield from cut 1 led to above average season RFQ. Cut 4 RFQ was the second lowest observed, ahead of only 2008.

Other notable forage quality results from 2018 included:

- Season crude protein percent was similar to the long-term average (Figure 4). Season CP increased from the record low set in 2017 and stopped a trend of four years of decreasing values. Cut 1 was the third lowest after 2016 and 2017 and cut 4 and cut 5 were each the second lowest after 2016. Cut 2 was the third highest after 2008 and 2012.

- NDF percent was above average and the second highest seen for cut 1 and cut 4 (Figure 5). Other cuts were below average, but the total season was slightly above. Season NDF decreased from the record high set in 2017 and stopped a trend of five years of increasing values.
- NDFD percent was above average for all cuts (Figure 6). Cut 2 tied the record from 2017 and cut 5 was the record high. Other cuts were top 3 (Figure 7) and the season total was second behind 2017. This is the fifth straight year with good NDFD levels. Three fields planted to reduced-lignin varieties have some influence, but weather and harvest timing are more likely factors.
- Milk/Ton was above average for all cuts except cut 4 (Figure 9). Cut 2 and total season set new high marks. The 2018 season average of 3,020 lbs/tn slightly bests the 3,015 lbs/tn observed in 2017. This is the fifth 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 growth window in 2018 followed by hot weather in late May. A regression shows that crude protein dropped 0.22%/day, similar to 0.22 - 0.24% in previous years and the expected change of -0.25%/day. NDF increased 0.78%/day, greater than 0.54 - 0.57% in previous years and the expected change of +0.41%/day. RFQ decreased 4.7 points/day, well above 2.2 - 3.1 points in previous years, but similar to -4 to -5/day expected.

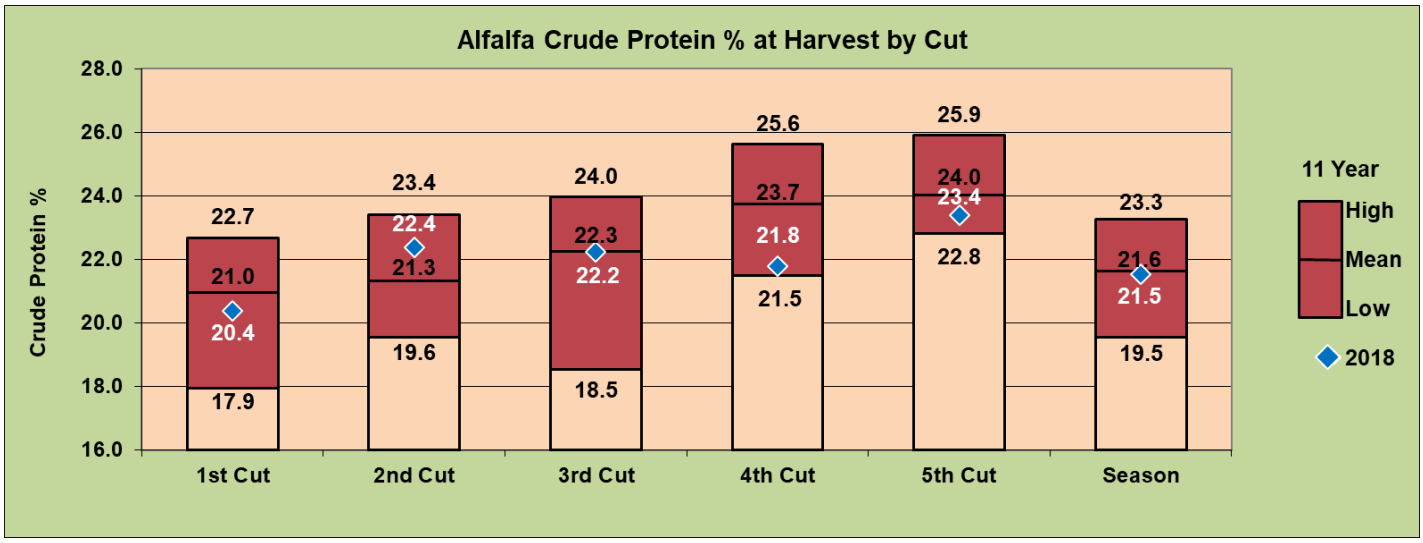


Figure 4. Average crude protein percent by cutting and weighted average for the total season (2007-2018).

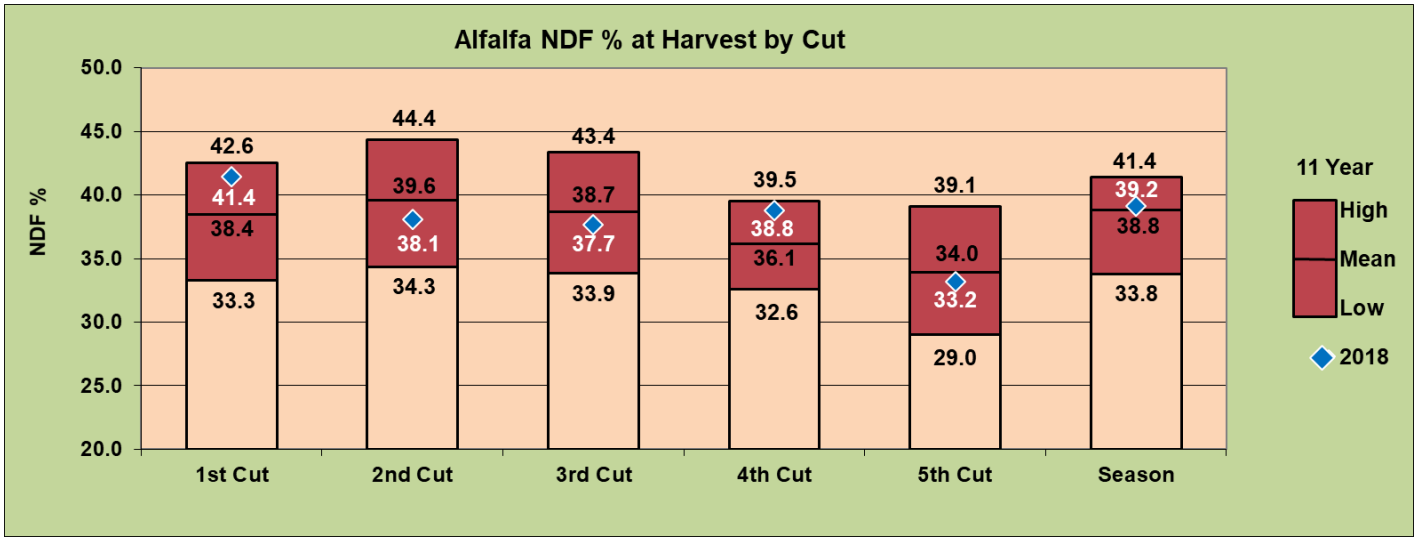


Figure 5. Average NDF percent by cutting and weighted average for the total season (2007-2018).

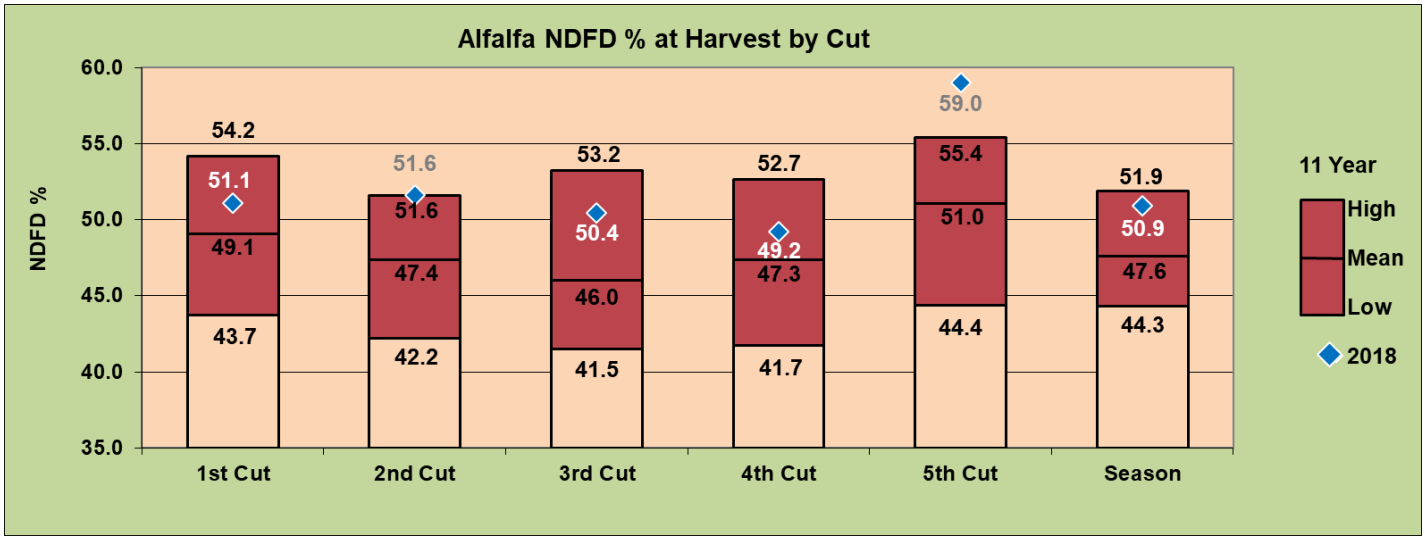


Figure 6. Average NDFD percent by cutting and weighted average for the total season (2007-2018).

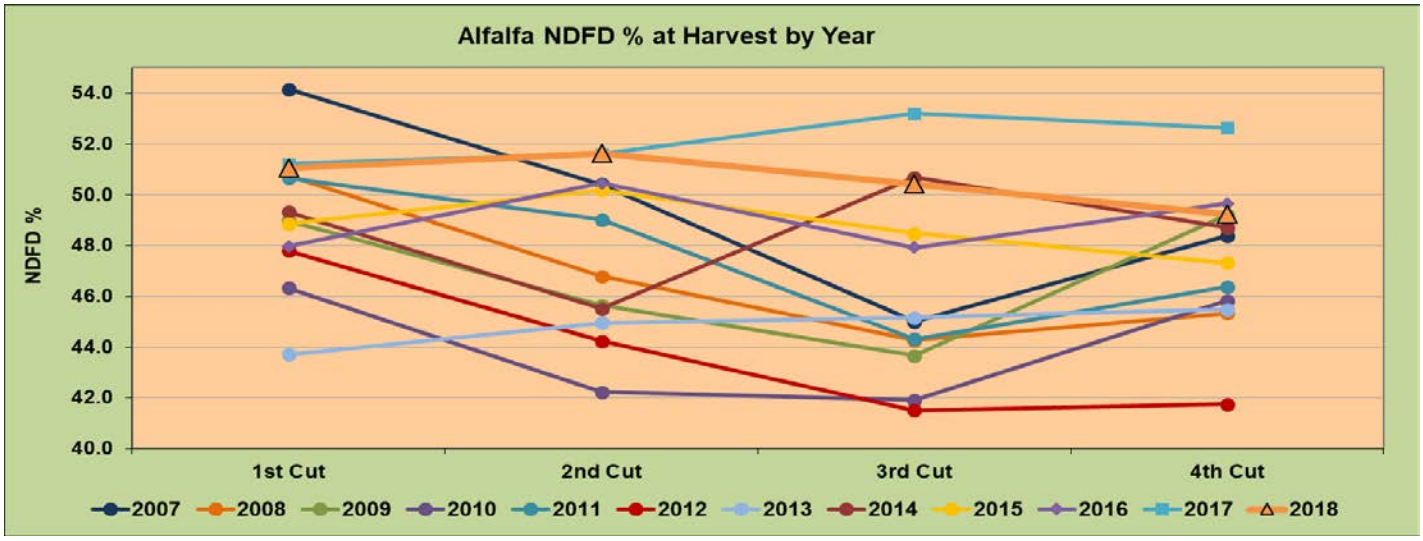


Figure 7. Average NDFD percent by cutting (2007-2018).

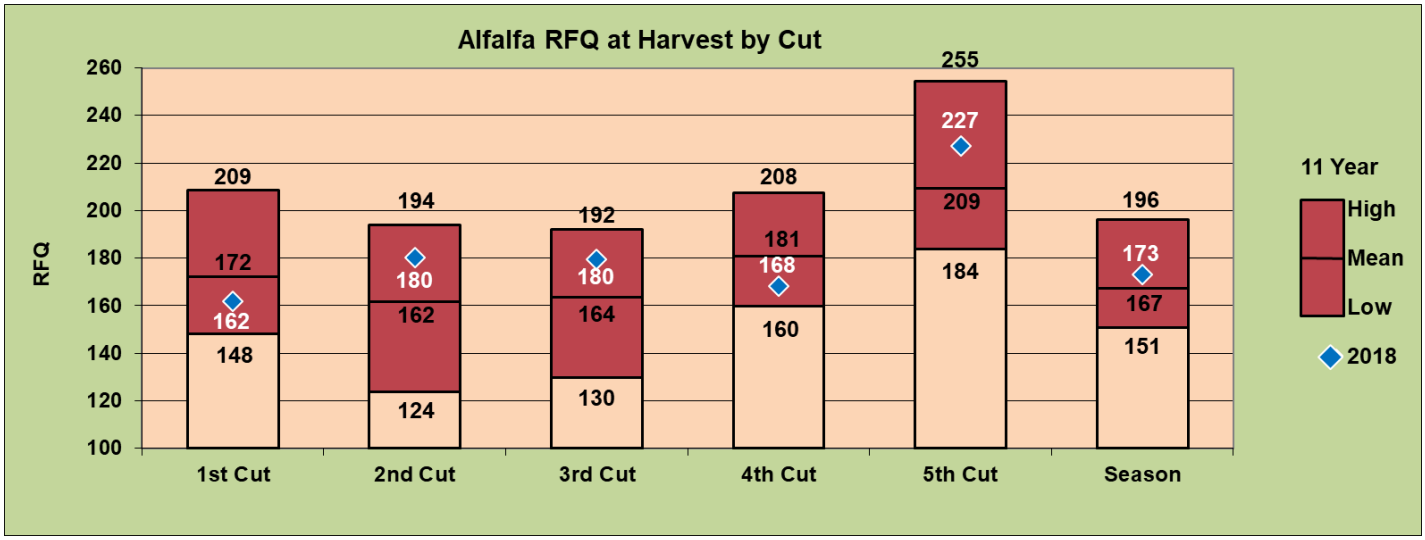


Figure 8. Average Relative Forage Quality (RFQ) by cutting and weighted average for the total season (2007-2018).

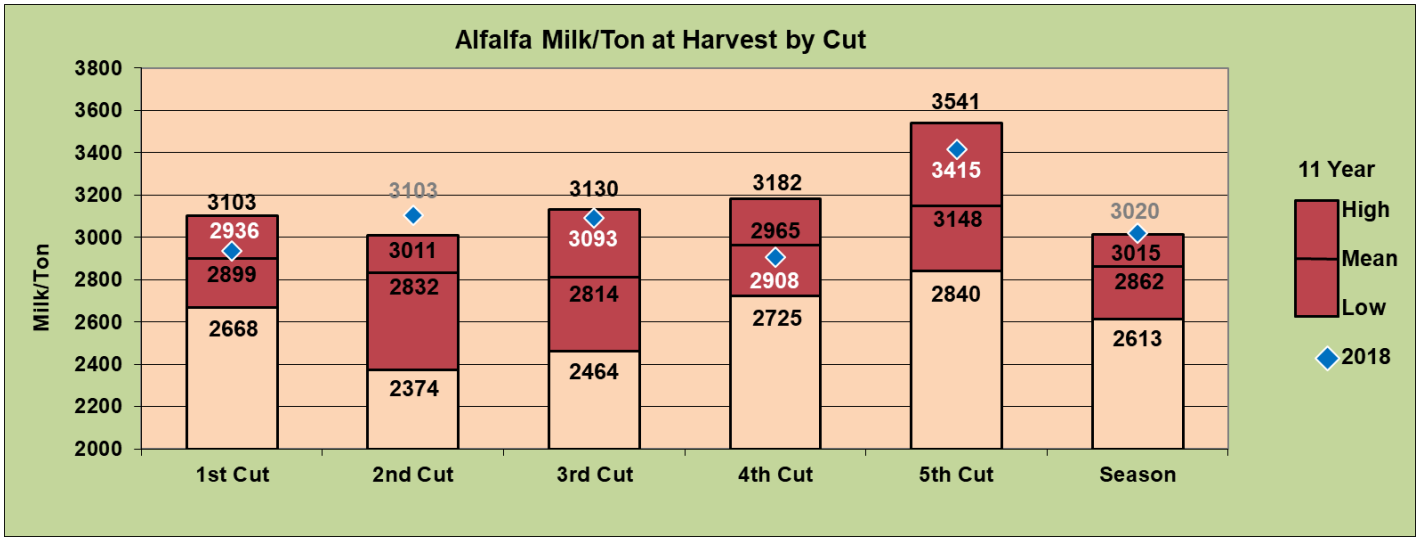


Figure 9. Average Milk per Ton by cutting and weighted average for the total season (2007-2018).

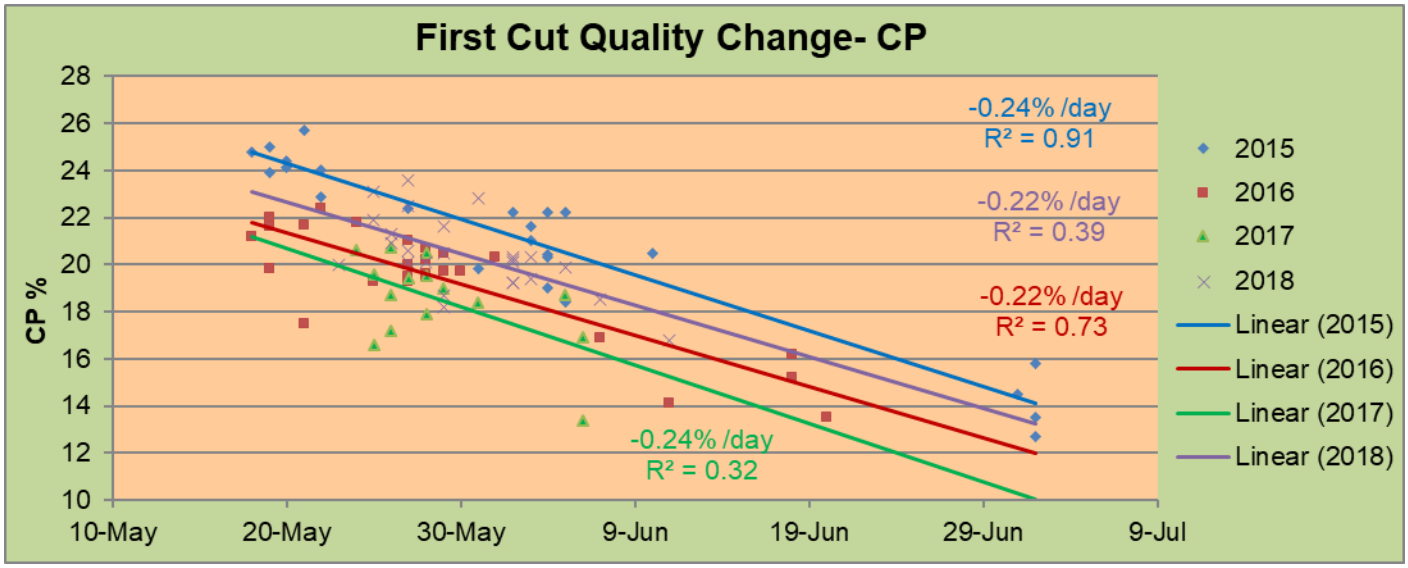


Figure 10. Change in Crude Protein percent during First-Cut Harvest (2015-2018).

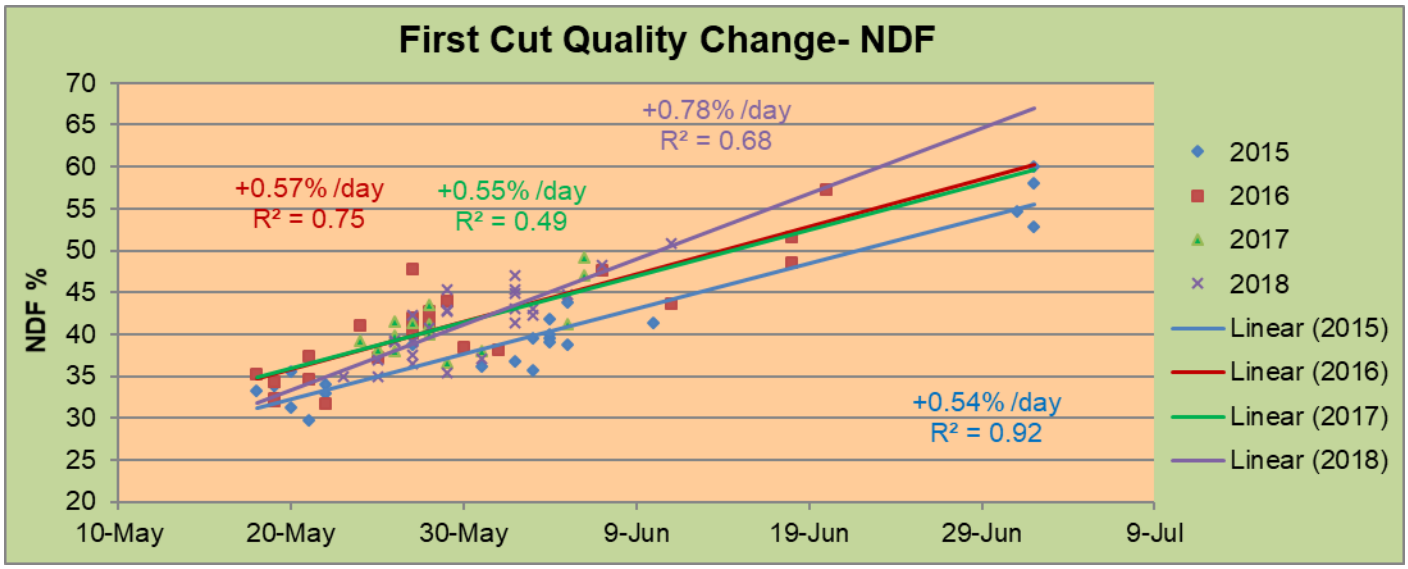


Figure 11. Change in NDF percent during First-Cut Harvest (2015-2018).

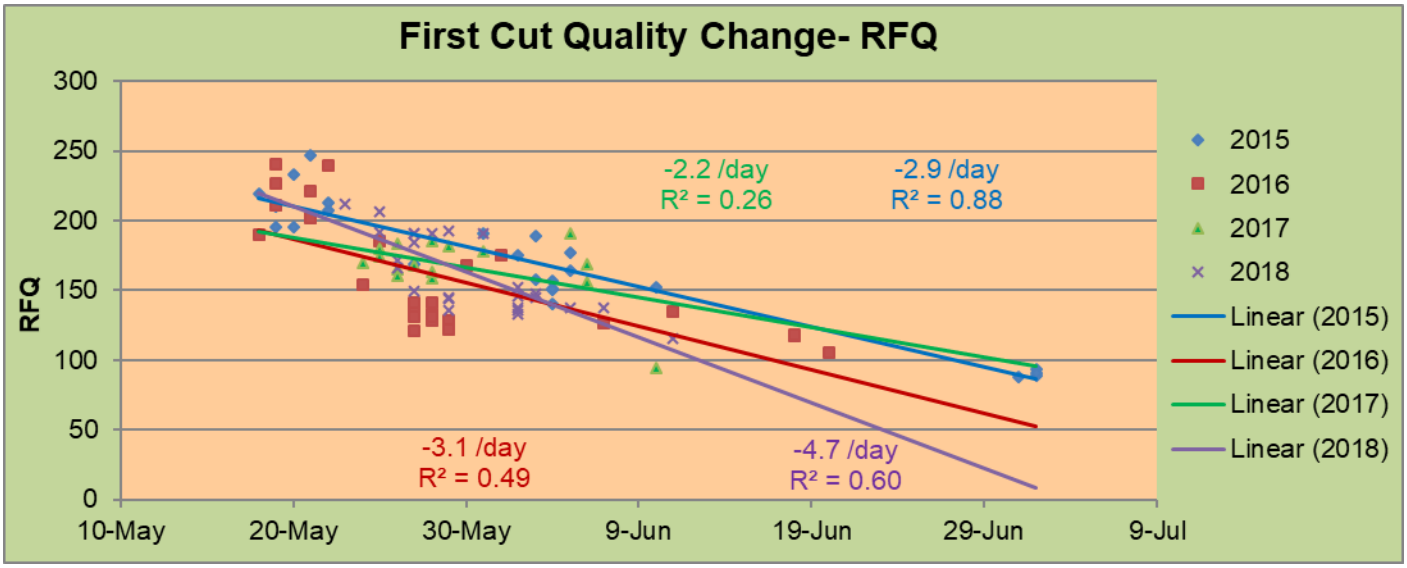


Figure 12. Change in RFQ during First-Cut Harvest (2015-2018).

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. Three fields were planted to reduced-lignin varieties in 2018. 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.

Acknowledgements:
First and foremost, UW-Extension Team Forage wishes to thank the producers who took the extra time and effort to obtain weights and forage samples for the project fields at each cutting.

Past and Present UW coordinators for this project:

Mike Bertram, Columbia County	Heidi Johnson, Dane County
Aerica Bjurstrom, Kewaunee County	Tina Kohlman, Fond du Lac County
Greg Blonde, Waupaca County	David Laatsch, Dodge County
Jason Cavadini, Marathon County	Bryce Larson, Calumet County
Jerry Clark, Chippewa County	Mike Rankin, Fond du Lac County
Scott Gunderson, Manitowoc County	Nick Schneider, Winnebago County
Mark Hagedorn, Brown County	Ryan Sterry, St. Croix County
Kevin Jarek, Outagamie County	Amy Vandebrake, Pierce County

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This report was written and data compiled by Mike Bertram, Superintendent, UW Arlington Agricultural Research Station and Jason Cavadini, Asst. Superintendent, UW Marshfield Agricultural Research Station. Questions may be directed to: mbertram@wisc.edu or jason.cavadini@wisc.edu Reports from 2007-2014 were written by Mike Rankin, Emeritus Crops and Soils Agent, Fond du Lac Co.

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
Mean	**2017**	**1.65**	**1.04**	**0.81**	**0.77**		**4.06**
Low	**2017**	**0.93**	**0.51**	**0.39**	**0.39**		**2.60**
High	**2017**	**2.37**	**1.50**	**1.12**	**1.20**		**5.35**
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
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
Mean	**2018**	**1.43**	**1.10**	**1.00**	**0.85**	**0.83**	**4.39**
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**