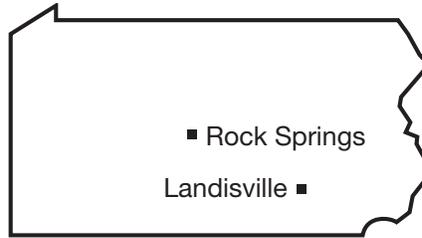




2018 FORAGE TRIALS REPORT

SUMMARY

The 2018 Forage Trials Report summarizes performance data collected from ongoing forage trials at two sites in Pennsylvania. The report includes data from alfalfa and cool-season (forage) grass trials established at the Russell E. Larson Agricultural Research Center at Rock Springs and the Southeast Research and Extension Center at Landisville.



Forage Growing Conditions and Insect Pressure in 2018

Water, water everywhere best describes the 2018 growing season. Weather in April for forage planting was good across much of Pennsylvania. However, by mid-May the rains had arrived and only let up for short periods of time through September. Rock Springs and Landisville had about 15 inches more rain than normal from May through September. The wet weather made it extremely challenging to make dry hay. The wet soils also resulted in soil compaction during harvesting of many fields. Ultimately, there was a lot of forage in the field, but getting it into the barn or silo was difficult. Some dry weather periods in October provided an additional harvest for some producers.

Potato leafhopper infestations started with a bang in June and were high across most of the state, but the moist weather in some areas allowed the alfalfa to rebound quickly from leafhopper damage. Leaf diseases and leaf mites continue to be a problem for grass production in some areas. Unfortunately, these areas seem to be expanding annually.

Criteria for Reporting Varieties

Many varieties listed in this report are

eligible for certification by seed-certifying agencies and are marketed in Pennsylvania (see Tables 1, 10, and 13). Some entries are experimental and may or may not be marketed in the future. Proprietary and public varieties are included; blends and “commons” are not included.

Interpreting Yield Data and Stand Scores

Yield summaries and stand scores for individual trials appear in Tables 2 through 9, and 11 through 17. Although the trials contain up to 58 total entries, many of these are advanced experimental varieties or not currently offered for sale in Pennsylvania. After these entries are named and/or become available for purchase in Pennsylvania, they will be included in future reports.

Experimental alfalfa entries that become named varieties will be footnoted as such. They will be published in the “Forage Trials Report” only if the newly named variety is entered as a commercial variety in the next available trial.

Varieties are ranked according to their yield performance. In addition, yield totals for the previous harvest years and average yields over the life of the stand are reported. It is important to evaluate the average yields and the yields obtained

this year because performance over a three- to four-year period is valuable in a long-term forage rotation.

The stand score is a visual estimation of the amount of groundcover following harvest in the fall. It is reported on a scale from 1 to 100, with 100 considered a perfect stand. This score is valuable as an indicator of varietal persistence.

Please keep in mind when reviewing the yield and stand tables that differences between varieties are significant only if the least significant difference (LSD) between varieties is exceeded. LSD is the minimum difference between any two varieties necessary for us to be 95 percent confident that this difference is not attributable to mere chance. For example, if variety A is 0.50 ton per acre higher in yield than variety B, then this difference is statistically significant if the LSD is 0.50 or less. If the LSD is 0.51 or greater, then we cannot be confident that variety A really yields higher than B under given environmental and management conditions.

The value for coefficient of variation (CV) is a measure of relative variation useful in evaluating the precision achieved in an experiment. In grain and forage trials, for example, the CV for yield often is between 5 and 20 percent. Acceptable levels of the CV vary for each trait measured. Confidence in the reliability of the experimental results declines as the CV increases. Uncontrollable or immeasurable variations in soil fertility, soil drainage, and other environmental factors contribute to increased CV levels.

Figure 1. 2018 Precipitation at Rock Springs (inches)

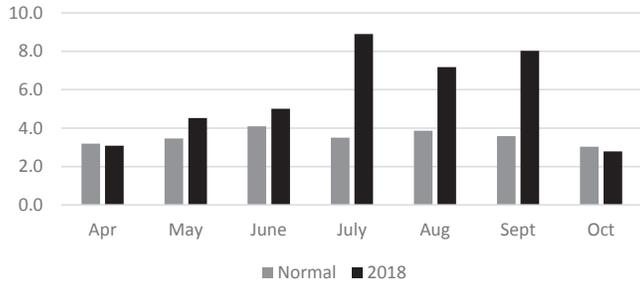


Figure 2. 2018 Precipitation at Landisville (inches)

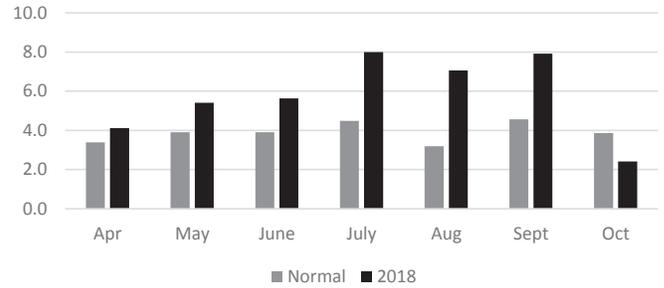


Figure 3. 2017 Precipitation at Rock Springs (inches)

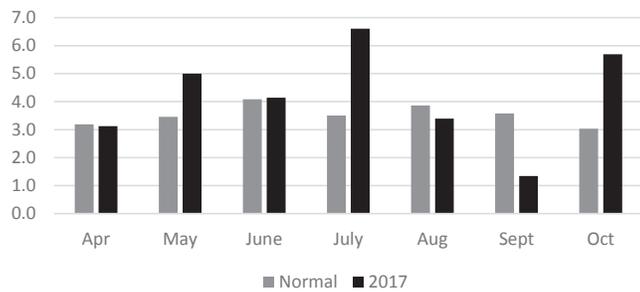


Figure 4. 2017 Precipitation at Landisville (inches)

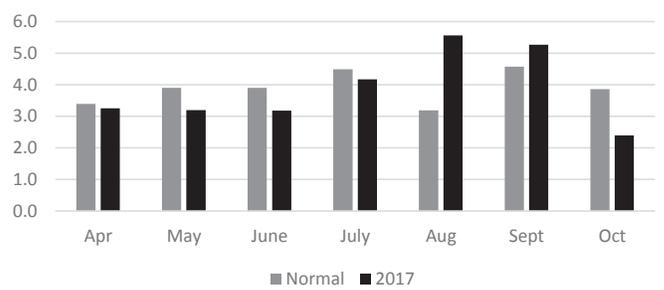


Figure 5. 2016 Precipitation at Rock Springs (inches)

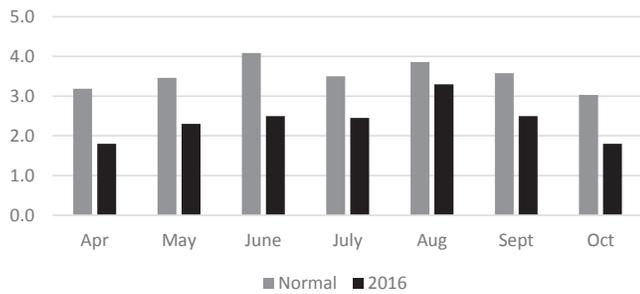


Figure 6. 2016 Precipitation at Landisville (inches)

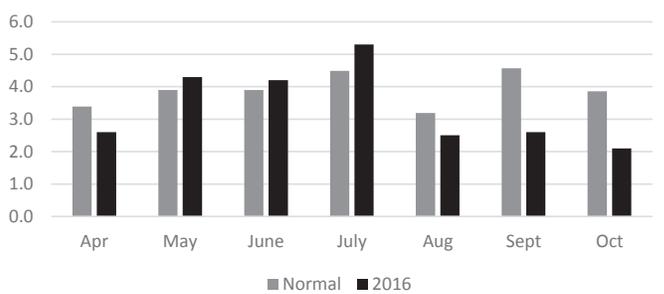


Figure 7. 2015 Precipitation at Rock Springs (inches)

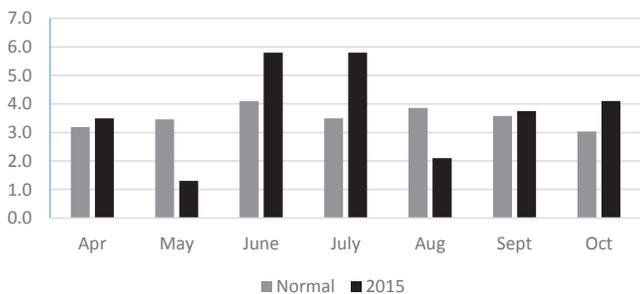
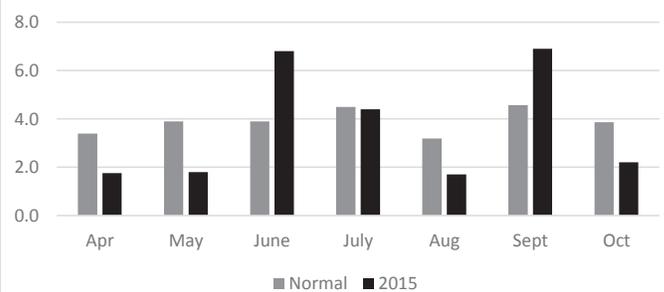


Figure 8. 2015 Precipitation at Landisville (inches)



ALFALFA

Many varieties of alfalfa exist, and selection of the appropriate variety is an important management decision. This report lists performance data for those varieties included in the Penn State Alfalfa Variety Testing Program. Evaluation trials include both commercially available and advanced experimental varieties. Trials are initiated each year at the Rock Springs and Landisville research stations. In each trial, collection of yield, stand, and other data continues for a maximum of four years or until the stand becomes so depleted that data collection is no longer worthwhile.

Trials at both locations are established on well-drained Hagerstown silt loam soils. Major site differences are likely to be reflected in the longer growing season, slightly elevated temperatures, and tendency toward late summer drought at the Landisville site.

Keep in mind a few points when evaluating alfalfa variety performance data:

- Selection of a variety on the basis of yield performance alone is generally less satisfactory than selections that also consider stand score and pest resistance.
- Conditions on most farms are such that several varieties may perform nearly equally. It usually is not necessary to rely on a single variety.
- No variety, regardless of its excellence, can thrive under poor management. Good management considers all aspects of alfalfa production, including seedbed preparation, lime and fertilizer, seeding, pest control, harvest, storage, and postharvest treatment. Many modern varieties are adapted to intensive management.

Fall Dormancy

Fall dormancy ratings of alfalfa range from one (very dormant) to nine (having no dormancy). Varieties that have less fall dormancy (higher numerical rating) regrow faster after harvest and exhibit greater growth in the fall compared to those varieties with more fall dormancy (lower numerical rating).

Pest Resistance

Disease and insect resistance may be the most important attributes of an alfalfa variety. The ratings for pest resistance given in this report can serve as a good indicator of a variety's potential performance in your area. Be aware of your pest resistance needs and choose the appropriate varieties.

Sclerotinia stem and crown rot is becoming a serious concern for growers throughout the state because there is little plant resistance to the disease. Late summer no-till seedings seem to be more susceptible to the disease. Newly established seedlings are very susceptible to infection in the fall when the fungus is active. Plants are attacked rapidly by the pathogen and die the following spring. Plants established in the spring are more resistant to the pathogen and are not as severely damaged as are the younger plants. The fungus survives as hard, black structures (sclerotia) on or near the soil surface. In the fall, the sclerotia produce spores that cause infection. Plowing buries sclerotia, thus reducing inoculum and subsequent infection.

Resistance to *Aphanomyces* can be found in some of the newest varieties. *Aphanomyces euteiches* is a soilborne fungus with behavior and requirements similar to *Phytophthora*. It is a wet-soil seedling pathogen and can be expected to thrive under cool, waterlogged conditions. Resistance may be beneficial when growing alfalfa on poorly drained soils. More specific information about many alfalfa diseases is included in the current *Penn State Agronomy Guide*.

Crown and root rot complex is still a problem. Because of the complexity of the pathogens involved, resistance to this disease is not very high in any variety. Good management slows the progress of this disease. More specific information is included in the current *Penn State Agronomy Guide*.

Plant breeders develop alfalfa varieties by selecting from genetically diverse populations. Within such populations, individual plants may vary widely in their response to a particular disease or

insect. Some may be highly resistant and others very susceptible. A particular pest resistance rating usually reflects the response of the majority of plants in the variety. In our trials, varieties with the most pest resistance ratings of "moderate" or higher usually have shown better long-term performance.

Guidelines for Selecting Alfalfa Varieties

To select alfalfa varieties on the basis of the trial results, follow these suggestions:

1. Determine which of the trial sites most resembles your farm in terms of soil and growing season. Performance data of varieties at this site are likely to provide more relevant selection information.
2. Look at the performances of the varieties at both trial sites. Varieties that do equally well at both sites are probably adapted to a wider range of environmental conditions.
3. Performance data over several years can be very useful in selecting a variety since some varieties seem to decline with age more rapidly than others.
4. For long-term rotations, the most recent harvest-year data should receive major consideration. If you plan to harvest the alfalfa for three years or fewer, then high performance during early years should be given major consideration.
5. Disease and pest resistance ratings should be examined in relation to yield, especially if your area is known to have problems with alfalfa diseases and pests. For example, *Phytophthora* root rot resistance may be exceptionally important on farms with moderately to poorly drained soils.

Table 1 lists the marketers of alfalfa varieties included in this report and the trial table numbers in which the varieties appear. Also included are fall dormancy ratings and selected disease and insect resistance ratings. Tables 2 through 9 offer guidelines for assessing the production potential of various alfalfa varieties.

Table 1. Alfalfa varieties marketed in Pennsylvania and listed in this report.

Fall dormancy ratings of alfalfa range from one (very dormant) to nine (having no dormancy). Varieties that are less fall dormant (higher numerical rating) regrow faster after harvest and exhibit greater growth in the fall compared to those varieties with greater fall dormancy (lower numerical rating).

BW = Bacterial Wilt, **VW** = Verticillium Wilt, **FW** = Fusarium Wilt, **AN** = Anthracnose, **PRR** = Phytophthora Root Rot, **APH1** = Aphanomyces Race 1.

The Fall Dormancy and Pest Resistance Ratings in this table are from the National Alfalfa Alliance and/or the alfalfa variety breeder and have not been verified by Penn State.

Resistance Key (%): **S** = 0 to 5%; **LR** = 6 to 14%; **MR** = 15 to 30%; **R** = 31 to 50%; **HR** = 51% or greater. If the resistance rating for a variety is not listed, the information is not available.

Variety	Marketer	Pest Resistance Ratings							Appears in Table No.
		Fall Dormancy	BW	VW	FW	AN	PRR	APH1	
55Q27	Pioneer Hi-Bred	5	HR	HR	HR	HR	HR	HR	2, 6
55V12	Pioneer Hi-Bred	5	R	HR	HR	HR	HR	HR	6
55V50	Pioneer Hi-Bred	5	HR	HR	R	HR	HR	HR	2, 6
428RR	Seedway/Growmark FS	4	HR	HR	HR	HR	HR	HR	3, 7
4H400	Mycogen Seeds	4	HR	HR	HR	HR	HR	HR	3
AFX 469	Alforex Seeds	4	HR	HR	HR	HR	HR	HR	5, 9
DKA 40-51 RR	Dekalb	4	HR	HR	HR	HR	HR	HR	8
DKA 41-18 RR	Dekalb	4	HR	HR	HR	HR	HR	HR	2, 6
DKA 44-16 RR	Dekalb	4	HR	HR	HR	HR	HR	HR	8
430RRLH	Seedway	4	HR	HR	HR	HR	HR	HR	9
FF42.A2	LaCrosse Seed	4	HR	HR	HR	HR	HR	HR	3, 4, 7, 8
FSG 408 DP	Seedway	4	HR	R	HR	HR	HR	HR	3, 7
FSG 415 BR	Seedway	4	HR	HR	HR	HR	HR	HR	3, 5, 9
FSG 426	Seedway	4	HR	HR	HR	HR	HR	HR	3, 5, 7, 9
HiGest 360	Chemgro	3	HR	HR	HR	HR	HR	HR	4, 6
KF-406 A2	Byron Seeds, LLC	4	HR	HR	HR	HR	HR	HR	4, 8
KF 425 HD	Byron Seeds, LLC	4	HR	HR	HR	HR	HR	HR	4, 8
Octane	BrettYoung	3	HR	HR	HR	HR	HR	HR	6
Oneida VR	Public	3	R	HR	HR	MR	MR	—	3, 4, 5, 6, 7, 8, 9
Persist III	Doebler's	4	HR	HR	HR	HR	HR	HR	2, 4, 7, 8,
Plus III	Doebler's	4	HR	HR	HR	HR	HR	HR	3, 4, 7, 8
Rebound 6.0	Croplan	4	HR	HR	HR	HR	HR	HR	4
Rebound 6XT	Croplan	4	HR	HR	HR	HR	HR	HR	4, 8
ReNew+	TA Seeds	4	HR	HR	HR	HR	HR	HR	3
RR Vamoose	Croplan	4	HR	HR	HR	HR	HR	HR	4
SW 4107	S&W Seed Co.	4	HR	HR	HR	HR	HR	HR	4, 5, 9
SW 4113	S&W Seed Co.	4	HR	HR	R	HR	HR	HR	3
SW 5210	S&W Seed Co.	5	HR	HR	HR	HR	HR	HR	4, 5, 8
SW 5213	S&W Seed Co.	5	HR	HR	HR	HR	HR	HR	3, 4, 7, 8
SW 5512Y	S&W Seed Co.	5	HR	HR	HR	HR	HR	HR	3, 7
SW 5909	S&W Seed Co.	5	HR	HR	HR	HR	HR	HR	3, 7
Vernal	Public	4	R	S	MR	S	S	S	2, 3, 4, 5, 6, 8, 9
WL 365 HQ	W-L Alfalfas	5	HR	HR	HR	HR	HR	HR	4, 8

Alfalfa Marketers Listed in This Report

Alforex Seeds

Woodland, CA 95695
Phone: 530-666-3331
www.alforesseeds.com

BrettYoung Seeds

Winnipeg, MB M3V 1L5, Canada
Phone: 204-261-7932
www.byseeds.com

Byron Seeds, LLC

Rockville, IN 47872
Phone: 765-569-3555
www.byronseeds.net

Chemgro Seeds

E. Petersburg, PA 17520
Phone: 800-346-4769
www.chemgro.com

Croplan

St. Paul, MN 55164
www.croplan.com

Dekalb

St. Louis, MO 63167
Phone : 800-768-6387
www.asgrowanddekalb.com

Doebler's

Jersey Shore, PA 17740
Phone: 570-753-3210
www.doeblers.com

Growmark FS

York, PA 17402
Phone: 800-338-4769
home.gromarkfs.com

LaCrosse Seed

LaCrosse, WI 54603
Phone: 608-783-9560
www.lacrosseseed.co

Mycogen Seeds

Indianapolis, IN 46268
www.mycogen.com

Pioneer Hi-Bred Int'l, Inc.

Mount Joy, PA 17552
Phone: 717-653-5605
www.pioneer.com

S&W Seed Co.

Fresno CA 93720
Phone: 559-884-2535
www.swseedco.com

Seedway

Mifflinburg, PA
Phone: 800-338-2137
www.seedway.com

TA Seeds

Jersey Shore, PA
Phone: 570-753-17740
www.taseeds.com

W-L Alfalfas

Ozark, MO. 65721
www.wlalfalfas.com

Table 2. 2014 alfalfa variety trial—Rock Springs.

Variety	2018 Yield	2017 Yield	2016 Yield	2015 Yield	Four-year Avg.	Stand 10/15/2018
55Q27	10.98	11.80	7.92	9.41	10.04	90
Sundance III**	10.60	11.70	7.80	9.02	9.77	91
AFX065033**	10.64	11.12	8.04	9.21	9.72	91
55V50	10.01	11.34	7.86	8.92	9.55	90
AFX094017**	9.92	10.86	7.39	8.65	9.25	90
AFX085029**	9.53	10.80	7.05	8.30	8.96	90
DKA 41-18 RR	8.35	9.39	6.78	8.68	8.31	90
Persist III	8.04	9.30	7.14	8.73	8.25	90
Vernal	6.49	7.37	5.90	7.99	6.89	90
GRAND MEAN	9.39	10.41	7.32	8.77	8.97	90
CV (%)	8.17	10.83	14.71	9.07	0.88	1.00
LSD (p = 0.05)	1.07	1.58	1.51	1.11	1.11	1.26

*Variety tested with experimental seed that may or may not give performance similar to commercially available seed.

**Not commercially available.

CV = coefficient of variation

LSD = least significant difference

- Seeded August 27, 2014.
- Yields are given in tons per acre (DM Basis).
- Yields indicated represent four cuttings.
- Stand score based on a scale from 1 to 100. A 100 is considered to be a perfect stand.
- Grand Mean, CV, and LSD values represent 9 total entries.
- Entries are ranked in order of decreasing yield based on the four-year average.
- Means are LSMeans derived from statistical analysis. Therefore, season or multiple-year totals may not be the arithmetic sum of individual cuts or years, respectively.

Table 3. 2015 alfalfa variety trial—Rock Springs.

Variety	2018 Yield	2017 Yield	2016 Yield	Three-year Avg.	Stand 10/15/2018
FF42.A2	10.44	12.57	9.04	10.71	96
SW 5909	10.58	12.25	8.85	10.57	96
SW 5213	10.40	12.14	8.33	10.25	95
FSG 426	10.19	11.84	8.56	10.18	96
Plus III	10.10	11.47	8.58	10.08	95
Vernal	9.98	11.79	8.15	10.08	96
4H400*	9.67	12.09	8.24	10.04	97
Renew+*	9.94	11.49	8.43	10.04	95
428RR	9.95	11.92	8.07	9.98	96
FSG 408DP	9.25	12.02	8.15	9.81	96
SW 4113	9.77	11.77	7.76	9.72	97
Persist III	8.79	11.48	8.64	9.59	96
SW 5512Y	7.97	11.01	8.00	8.92	95
5312**	7.77	10.88	7.53	8.68	95
FSG 415 BR	7.69	10.12	7.14	8.26	94
Oneida VR	7.15	9.61	6.43	7.61	94
GRAND MEAN	9.36	11.58	8.20	9.71	92
CV (%)	8.34	6.07	9.22	0.70	1.71
LSD (p = 0.05)	1.09	0.98	1.06	0.89	2.19

*Variety tested with experimental seed that may or may not give performance similar to commercially available seed.

**Not commercially available.

CV = coefficient of variation

LSD = least significant difference

- Seeded April 16, 2015.
- Yields are given in tons per acre (DM Basis).
- Yields indicated represent four cuttings.
- Stand score based on a scale from 1 to 100. A 100 is considered to be a perfect stand.
- Grand Mean, CV, and LSD values represent 28 total entries.
- Entries are ranked in order of decreasing yield based on the three-year average.
- Means are LSMeans derived from statistical analysis. Therefore, season or multiple-year totals may not be the arithmetic sum of individual cuts or years, respectively.

Table 4. 2016 alfalfa variety trial—Rock Springs.

Variety	2018 Yield	2017 Yield	Two-year Avg.	Stand 10/15/2018
SW 5213	10.71	11.07	10.90	95
SW 5210	10.64	10.53	10.60	94
WL 365 HQ	10.57	10.45	10.53	95
Rebound 6XT	10.81	10.16	10.51	95
SW 4107	10.43	10.38	10.42	95
FF42.A2	10.37	10.44	10.42	96
KF-425 HD	10.25	10.17	10.20	95
LS 1302*	9.75	10.36	10.04	94
KF-406 A2	9.50	10.37	9.97	95
Rebound 6.0	9.58	10.15	9.85	96
Plus III	9.96	9.68	9.85	95
GA-497 HD*	9.43	10.15	9.82	95
HiGest 360	9.01	10.53	9.75	95
Persist III	7.22	9.55	8.40	95
RR Vamoose	7.75	8.75	8.26	95
Oneida VR	7.28	8.93	8.08	95
Vernal	7.21	8.60	7.89	95
GRAND MEAN	9.52	10.09	9.81	95
CV (%)	8.26	8.08	7.45	1.08
LSD (p = 0.05)	1.10	1.14	1.02	1.43

*Not commercially available.

CV = coefficient of variation
LSD = least significant difference

- Seeded August 19, 2016.
- Yields are given in tons per acre (DM Basis).
- Yields indicated represent four cuttings.
- Stand score based on a scale from 1 to 100. A 100 is considered to be a perfect stand.
- Grand Mean, CV, and LSD values represent 20 total entries.
- Entries are ranked in order of decreasing yield based on the two-year average.
- Means are LSMeans derived from statistical analysis. Therefore, season or multiple-year totals may not be the arithmetic sum of individual cuts or years, respectively.

Table 5. 2017 alfalfa variety trial—Rock Springs.

Variety	2018 Yield	Stand 10/15/2018
SW4107	9.61	97
55V50	9.50	96
SW 5210	9.43	97
SW 3407*	9.20	97
AFX469	8.55	96
FSG 415BR	8.36	97
FSG 426	8.29	98
Oneida VR	7.66	97
Vernal	5.95	98
GRAND MEAN	8.40	97
CV (%)	17.61	1.05
LSD (p = 0.05)	2.07	1.42

*Not commercially available.

CV = coefficient of variation
LSD = least significant difference

- Seeded September 1, 2017.
- Yields are given in tons per acre (DM Basis).
- Yields indicated represent four cuttings.
- Stand score based on a scale from 1 to 100. A 100 is considered to be a perfect stand.
- Grand Mean, CV, and LSD values represent 12 total entries.
- Entries are ranked in order of decreasing yield based on the year total.
- Means are LSMeans derived from statistical analysis. Therefore, season or multiple-year totals may not be the arithmetic sum of individual cuts or years, respectively.

Table 6. 2014 alfalfa variety trial—Landisville.

Variety	2018 Yield	2017 Yield	2016 Yield	2015 Yield	Four-Year Avg.	Stand 10/31/2018
55Q27	8.65	11.43	11.51	12.87	11.21	89
55V50	7.65	11.08	11.76	11.55	10.54	88
Octane*	8.49	10.96	12.05	11.45	10.53	88
Hi-Gest 360*	7.21	10.46	9.79	11.88	9.97	88
Persist III	7.14	10.96	9.83	10.87	9.92	88
DKA 41-18 RR	7.16	10.05	9.98	11.19	9.60	87
55V12	5.81	9.69	10.95	11.98	9.46	87
Oneida VR	5.57	9.74	8.86	11.14	8.79	89
Vernal	6.32	9.12	8.70	10.63	8.54	87
GRAND MEAN	6.85	10.19	10.18	11.42	9.67	88
CV (%)	12.28	12.88	15.06	6.59	8.59	0.43
LSD (p = 0.05)	1.18	1.84	2.15	1.05	1.16	0.53

*Variety tested with experimental seed that may or may not give performance similar to commercially available seed.

CV = coefficient of variation

LSD = least significant difference

- Seeded April 5, 2014.
- Yields are given in tons per acre (DM Basis).
- Yields indicated represent five cuttings.
- Stand score based on a scale from 1 to 100. A 100 is considered to be a perfect stand.
- Grand Mean, CV, and LSD values represent 12 total entries.
- Entries are ranked in order of decreasing yield based on the four-year average.
- Means are LSMeans derived from statistical analysis. Therefore, season or multiple-year totals may not be the arithmetic sum of individual cuts or years, respectively.

Table 7. 2015 alfalfa variety trial—Landisville.

Variety	2018 Yield	2017 Yield	2016 Yield	Three-year Average.	Stand 10/31/2018
SW 5909	8.85	11.30	10.62	10.31	90
SW 5213	8.20	11.09	10.71	10.01	91
FSG 408DP	7.28	10.88	11.20	9.78	91
FF42.A2	8.69	10.30	10.49	9.76	92
Plus III	7.89	10.49	10.41	9.63	91
428RR	7.47	10.39	10.62	9.45	92
FSG 426	7.54	9.84	10.80	9.38	92
Persist III	6.70	10.56	10.71	9.32	91
SW 5512Y	6.70	10.41	10.21	9.08	91
5312*	6.37	10.22	9.91	8.91	92
Oneida VR	6.67	10.17	9.94	8.88	91
GRAND MEAN	7.46	10.51	10.49	9.48	91
CV (%)	10.91	9.90	7.10	7.95	1.36
LSD (p = 0.05)	1.14	1.46	1.04	1.06	1.74

*Not commercially available.

CV = coefficient of variation

LSD = least significant difference

- Seeded April 15, 2015.
- Yields are given in tons per acre (DM Basis).
- Yields indicated represent five cuttings.
- Stand score based on a scale from 1 to 100. A 100 is considered to be a perfect stand.
- Grand Mean, CV, and LSD values represent 16 total entries.
- Entries are ranked in order of decreasing yield based on the three-year average.
- Means are LSMeans derived from statistical analysis. Therefore, season or multiple-year totals may not be the arithmetic sum of individual cuts or years, respectively.

Table 8. 2016 alfalfa variety trial—Landisville.

Variety	2018 Yield	2017 Yield	Two-year Average.	Stand 10/31/2018
WL 365 HQ	9.40	8.94	9.20	94
Rebound 6XT	9.03	9.08	9.11	93
SW 5210	8.81	8.94	8.83	94
KF-425 HD	8.64	8.88	8.75	94
KF-406 A2	8.41	9.11	8.71	93
Plus III	8.81	8.51	8.68	92
LS 1302*	8.40	8.90	8.64	93
FF42.A2	8.56	8.51	8.58	94
Oneida VR	8.16	8.95	8.51	94
DKA 44-16 RR	8.38	8.66	8.48	93
SW 5213	8.38	8.52	8.43	93
59W205*	8.31	8.47	8.34	93
Persist III	7.49	9.18	8.32	93
GA-497 HD*	7.66	8.49	8.10	94
DKA 40-51 RR	7.58	7.95	7.77	93
Vernal	6.72	7.78	7.20	93
GRAND MEAN	8.38	8.82	8.59	93
CV (%)	11.86	12.07	10.44	1.41
LSD (p = 0.05)	1.39	1.49	1.26	1.84

*Not commercially available.

CV = coefficient of variation

LSD = least significant difference

- Seeded April 15, 2016.
- Yields are given in tons per acre (DM Basis).
- Yields indicated represent five cuttings.
- Stand score based on a scale from 1 to 100. A 100 is considered to be a perfect stand.
- Grand Mean, CV, and LSD values represent 21 total entries.
- Entries are ranked in order of decreasing yield based on the two-year average.
- Means are LSMMeans derived from statistical analysis. Therefore, season or multiple-year totals may not be the arithmetic sum of individual cuts or years, respectively.

Table 9. 2017 alfalfa variety trial—Landisville.

Variety	2018 Yield	Stand 10/31/2018
msSunstra-144110*	9.62	97
FSG 426	9.38	97
Galaxy	9.34	97
SW4107	9.33	98
55V50	9.31	97
SW 5210	9.28	98
SW3407*	9.18	98
AFX469	8.77	97
FSG 415BR	8.74	96
430RRLH	8.48	97
CW A113005*	8.17	97
CW 104014*	8.16	97
Oneida VR	8.03	98
Vernal	6.68	98
GRAND MEAN	8.71	97
CV (%)	11.23	1.03
LSD (p = 0.05)	1.37	1.41

*Not commercially available.

CV = coefficient of variation

LSD = least significant difference

- Seeded May 3, 2017.
- Yields are given in tons per acre (DM Basis).
- Yields indicated represent five cuttings.
- Stand score based on a scale from 1 to 100. A 100 is considered to be a perfect stand.
- Grand Mean, CV, and LSD values represent 16 total entries.
- Entries are ranked in order of decreasing yield based on the year total.
- Means are LSMMeans derived from statistical analysis. Therefore, season or multiple-year totals may not be the arithmetic sum of individual cuts or years, respectively.

COOL-SEASON GRASSES

Table 10 and table 13 list cool-season perennial grass varieties in our testing program that are currently marketed in Pennsylvania or may be available in the near future (please check with marketers for availability). Tables 11 through 12 and 14 through 17 offer guidelines for assessing the production potential of various grass varieties.

Perennial Cool-Season Trial

Many farmers in Pennsylvania could benefit from including some cool-season grasses as an integral part of their forage program. The following tables summarize the yield potential of many perennial grass varieties in our research trials at Penn State's Russell E. Larson Research Center at Rock Springs.

Our soil fertility program is designed around maintenance applications of phosphorus and potash to meet the soil test requirements. Seventy pounds of available nitrogen is applied in early April with an additional 50 pounds applied after each harvest except the last one.

The first cutting in the perennial cool-season forage grass trials is made when an individual variety reaches mid-to late boot. Subsequent harvests are then made at intervals of 35 to 40 days, with the exception of the final harvest, when all plots are harvested on the same day. All plots are harvested four times throughout the growing season, weather permitting, except in the establishment year.

Although production for each cutting in a given year varies among species, most varieties produce one-third to one-half of the total annual production in the first cut. Yields are not greatly reduced if a three-cut system is used. Quality will be increased by early and frequent cutting. Choose a species that fits the farm's capabilities and the operator's management scheme. See the current *Penn State Agronomy Guide* for specific recommendations about establishment, fertilization, and other management considerations.

Table 10. Cool-season grass varieties marketed in Pennsylvania and listed in this report.

Species/Variety	Marketer	Appears in Table Number
PERENNIAL RYEGRASS		
Payday	Smith Seed Services	11
Remington	Barenbrug USA	11
Barvitra	Barenbrug USA	
Melpetra	Hood River Seed	12
Elena	Farm Science Genetics	12
Remington	Barenbrug USA	12
BAREXTRA	Barenbrug USA	12
TetraSweet	Mountain View Seeds	12
TetraMag	Mountain View Seeds	12
Quartermaster	Chemgro Seeds	12
Premium	DLF Pickseed USA Inc.	12
Polim	DLF Pickseed USA Inc.	12
Dexter I	DLF Pickseed USA Inc.	12
Garbor	DLF Pickseed USA Inc.	12
Kentaur	DLF Pickseed USA Inc.	12
TALL FESCUE		
Bardoux	Barenbrug USA	11
Bardelice	Barenbrug USA	11
Bariane	Barenbrug USA	11
Otaria	Hood River Seed	12
Dominate	Seedway, LLC	12
Teton II	Mountain View Seeds	12
FESTULOLIUM		
Mahulena	DLF Pickseed USA Inc.	11
TIMOTHY		
Barfleo	Barenbrug USA	11
Tenho	Barenbrug USA	11
Catapult	BrettYoung Seeds	12
Zenyatta	DLF Pickseed USA Inc.	12
Winnetou	DLF Pickseed USA Inc.	12
Dawn	Hood River Seed	12

Continued

Table 10. (continued)

Species/Variety	Marketer	Appears in Table Number
Anjo	Hood River Seed	12
Climax	Public	12
MEADOW FESCUE		
Pradel	Barenbrug USA	11
Raskila	Hood River Seed	12
Pradel	Barenbrug USA	12
ORCHARDGRASS		
Trailburst	BrettYoung Seeds	12
Alpine II	Mountain View Seeds	12
Bighorn	Mountain View Seeds	12
Devour	Mountain View Seeds	12
Aldebaran	DLF Pickseed USA Inc.	12
Invale	DLF Pickseed USA Inc.	12
Olathe	DLF Pickseed USA Inc.	12

Forage Grass Marketers Listed in This Report

Barenbrug USA

Tangent, OR 97389
 Phone: 541-926-5801
www.barusa.com

BrettYoung Seeds

Box 99 ST. Norbert P.S.
 Winnipeg, MB Canada
www.brettyoung.ca

Chemgro Seeds

East Petersburg, PA 17520
 Phone: 570-847-5846
www.chemgro.com

DLF Pickseed USA Inc.

Halsey, OR 97348
 Phone: 541-369-2251
www.dlfpickseed.com

Farm Science Genetics-Allied Seed

Macon, MO 63552
 Phone: 660-385-6690
www.alliedseed.com/farm-science-genetics/

Hood River Seed

Evansville, IN 47715
 Phone: 855-406-2696
www.hoodriverseed.com

Mountain View Seeds

Salem, OR 97305
 Phone: 503-588-7333
www.mtviewseeds.com

Seedway, LLC

Mifflinburg, PA 17844
 Phone: 570-966-3841
www.seedway.com

Smith Seed Services

Halsey, OR 97348
 Phone: 888-550-2930
www.smithseed.com

Table 11. 2015 cool-season grass variety trial—Rock Springs.

	First Cut Date*	2018 Yield	2017 Yield	2016 Yield	Three-year Average	Stand 10/15/17	Crude Protein%	30-hr NDFD
TIMOTHY								
DSV 15-08**	5/24	5.72	9.18	6.81	7.23	70	19.7	56
Tenho	5/24	5.81	8.98	6.67	7.16	68	24.4	65
Barfleo	5/24	5.46	7.67	7.30	6.81	60	22.2	60
DSV 15-07**	5/24	5.49	7.66	7.00	6.72	69	20.9	60
GRAND MEAN		5.62	8.37	6.95	6.98	67	21.8	60.1
CV (%)		6.18	4.03	4.46	3.26	12.40		
LSD (p = 0.05)		0.56	0.54	0.50	0.36	13.21		
TALL FESCUE								
DLFPS-FTF-73**	5/18	7.21	9.98	7.58	8.26	98	20.1	65
Bardoux	5/23	6.96	9.31	7.45	7.91	96	19.8	63
DLFPS-FTF-70**	5/23	7.14	9.40	6.65	7.73	96	18.6	59
BAR FA 13131**	5/18	6.99	8.92	7.00	7.64	97	21.4	65
Bariane	5/23	7.01	8.20	6.22	7.14	97	22.3	65
Bardelice	5/23	5.69	8.19	6.94	6.94	97	18.2	63
GRAND MEAN		6.83	9.00	6.98	7.60	97	20.0	63.4
CV (%)		6.85	6.25	5.31	5.36	3.28		
LSD (p = 0.05)		0.71	0.85	0.56	0.61	1.87		
RYEGRASS								
LPTNEAROM**	5/24	5.42	7.19	7.79	6.80	96	21.65	68
Remington	5/24	5.18	7.51	7.62	6.77	95	22.64	71
DSV 15-05**	5/30	5.04	7.59	6.63	6.42	94	23.26	72
Barvitra	5/23	5.11	5.64	8.39	6.38	92	19.03	57
DSV 15-03**	5/30	4.44	6.89	7.72	6.35	95	21.38	65
DSV 15-04**	5/30	5.28	7.36	6.23	6.29	93	21.49	65
DSV 15-01**	5/24	5.37	6.76	6.57	6.23	94	20.04	68
DSV 15-06**	5/30	4.84	6.67	7.14	6.21	94	20.88	64
DSV 15-02**	5/23	4.52	6.61	7.16	6.10	94	23.79	73
Payday	5/23	4.43	5.65	6.90	5.66	95	21.75	75
GRAND MEAN		4.96	6.79	7.21	6.32	94	21.6	67.8
CV (%)		5.34	6.10	4.40	3.29	1.45		
LSD (p = 0.05)		0.38	0.60	0.46	0.30	1.98		
ORCHARDGRASS								
Bounty II	5/18	7.15	8.96	7.79	7.97	91	23.7	64
DSV 15-10**	5/23	5.46	8.53	6.62	6.87	86	21.7	69
DSV 15-11**	5/21	5.11	7.98	6.86	6.65	66	21.9	61
DSV 15-09**	5/23	4.87	7.59	6.04	6.16	87	21.1	62
GRAND MEAN		5.65	8.27	6.83	6.91	82	22.1	64.1
CV (%)		8.35	5.89	4.90	4.18	6.64		
LSD (p = 0.05)		0.75	0.78	0.54	0.46	4.04		

Continued

Table 11. (continued)

	First Cut Date*	2018 Yield	2017 Yield	2016 Yield	Three-year Average	Stand 10/15/17	Crude Protein%	30-hr NDFD
MEADOW FESCUE								
Pradel	5/21	5.55	6.92	6.29	6.25	89	22.0	62
BAR FPF32**	5/23	4.66	6.33	5.68	5.56	90	21.8	59
DSV 15-12**	5/23	4.35	6.34	5.83	5.51	87	23.4	56
GRAND MEAN		4.85	6.53	5.93	5.77	89	22.4	59.3
CV (%)		4.71	4.52	7.02	2.09	1.65		
LSD (p = 0.05)		0.40	0.51	0.61	0.21	2.53		
FESTULOLIUM								
Mahulena	5/18	8.03	10.49	7.20	8.58	97	21.5	62
GRAND MEAN		8.03	10.49	7.20	8.58	97	21.5	62
CV (%)		na	na	na	na	na		
LSD (p = 0.05)		na	na	na	na	na		
OVERALL								
GRAND MEAN		5.65	7.80	6.93	6.80	89		
CV (%)		7.60	5.85	5.65	4.46	10.54		
LSD (p = 0.05)		0.60	0.65	0.55	0.43	13.13		

*Date when the first cutting was made in 2018. First cutting was made at the early boot stage.

**Experimental entries that are not currently marketed.

CV = coefficient of variation

LSD = least significant difference

- Seeded September 1, 2015.
- Yield are given in tons per acre (DM Basis).
- Overall Grand Mean, CV, and LSD values represent 29 total entries.
- Variety means are means derived from LSMeans.
- Yields indicated represent the sum of four cuttings.

Table 12. 2017 cool-season grass variety trial--Rock Springs.

	First Cut Date*	2018 Yield	Stand 10/15	Crude Protein %	30-hr NDFD
TIMOTHY					
Catapult	5/24	6.58	89	18.9	60
Zenyatta	5/24	6.53	90	20.7	63
Dawn	5/24	6.40	90	20.4	61
Climax	5/30	6.26	70	20.0	59
TM 0704 DT**	5/24	6.25	87	21.9	58
Anjo	5/24	5.86	86	23.7	64
Winnetou	5/24	5.66	88	22.5	65
TM 9902**	5/24	5.66	87	21.1	59
GRAND MEAN		6.15	86	21.2	61
CV (%)		5.24	16.7		
LSD (p = 0.05)		0.47	21.1		
TALL FESCUE					
TF 0503**	5/18	8.63	95	24.0	65
Teton II	5/18	8.36	96	22.1	61
DSV 17-05**	5/18	7.97	95	23.1	67
FTF 84	5/18	7.89	94	24.2	64
Dominate	5/18	7.86	88	25.3	71
RAD-MRF201SE**	5/18	7.78	95	25.0	67
FTF 73**	5/18	7.61	93	23.1	66
FTF 70**	5/18	7.38	92	25.8	67
PPG-FTF-112**	5/18	7.25	95	23.8	64
Otaria	5/18	7.02	91	23.2	66
GRAND MEAN		7.78	93	24.0	66
CV (%)		5.73	2.30		
LSD (p = 0.05)		0.65	3.11		
RYEGRASS					
BAR LP 16237**	5/24	8.26	97	21.7	77
TetraMag	5/24	8.03	96	22.0	67
Remington	5/21	7.89	98	22.8	81
BAR LP 16371**	5/21	7.50	93	23.9	70
Elena	5/21	7.46	95	20.9	73
RAD-MFP-141**	5/21	7.32	97	20.9	79
TetraSweet	5/24	7.21	95	22.4	73
BAR LP 16370**	5/23	6.92	95	22.7	73
PST-2F44X**	5/21	6.87	97	22.4	75
Polim	5/24	6.82	95	23.7	73
Kentaur	5/23	6.66	97	22.8	77
Melpetra	5/30	6.53	95	20.1	71
Quartermaster	5/23	6.53	97	21.3	70
PST-2F42X**	5/21	6.38	97	21.4	78
DSV 17-02**	5/21	6.31	97	22.1	76
BAREXTRA	5/23	6.13	92	25.4	76
Garbor	5/23	6.10	98	21.8	71

Continued

Table 12. (continued)

	First Cut Date*	2018 Yield	Stand 10/15	Crude Protein %	30-hr NDFD
BAR LP 16238**	5/21	5.97	99	24.3	73
DSV 17-01**	5/23	5.75	97	23.2	74
Dexter I	5/23	5.73	97	23.6	79
Premium	5/23	5.44	96	19.7	70
GRAND MEAN		6.75	96	22.3	74
CV (%)		5.36	2.0		
LSD (p = 0.05)		0.51	2.7		
ORCHARDGRASS					
Bighorn	5/15	8.18	93	25.1	79
Trailburst	5/18	7.86	92	22.4	69
Olathe	5/15	7.75	89	25.3	78
OG 79**	5/18	7.75	94	23.9	72
Invale	5/15	7.70	93	25.9	78
Alpine II	5/18	7.42	91	23.6	75
RAD-LCF46**	5/21	7.28	94	22.1	70
Devour	5/18	6.93	92	25.3	68
OG 80**	5/18	6.87	94	24.2	73
DSV 17-07**	5/21	6.37	92	24.1	75
Aldebaran	5/23	6.34	91	21.1	69
DSV 17-06**	5/23	5.65	91	22.6	73
GRAND MEAN		7.17	92	23.8	73
CV (%)		4.62	2.5		
LSD (p = 0.05)		0.48	3.2		
MEADOW FESCUE					
Raskila	5/21	6.98	96	21.0	71
Pradel	5/21	6.71	95	22.3	71
DSV 17-03**	5/18	6.71	96	24.1	75
DSV 17-04**	5/18	6.70	96	23.4	69
BAR FP 16058**	5/18	6.53	97	19.2	75
GRAND MEAN		6.73	96	22.0	72
CV (%)		5.73	1.1		
LSD (p = 0.05)		0.59	1.6		
OVERALL					
GRAND MEAN		6.94	93		
CV (%)		6.26	6.51		
LSD (p = 0.05)		0.61	8.48		

*Date when the first cutting was made in 2018. First cutting was made at the early boot stage.

**Experimental entries that are not currently marketed.

CV = coefficient of variation

LSD = least significant difference

- Seeded August 22, 2017.
- Yield are given in tons per acre (DM Basis).
- Overall Grand Mean, CV, and LSD values represent 58 total entries.
- Variety means are means derived from LSM means.
- Yields indicated represent the sum of four cuttings.

2017–2018 Short-Lived Cool-Season Grass Trial

In the fall 2017, a Short-Lived Cool-Season Grass Trial was seeded at Rock Springs. The trial was planted on September 22, 2017. There were two different management treatments: a single-cut system and a multi-cut system. The cereal grasses were cut using the single-cut system and the annual ryegrasses were cut using the multi-cut system. Some of the ryegrass varieties were entered in both cutting systems. With the multi-cut system, grasses were cut about every three weeks and the plots were cut three different times based on maturity. The first cut was taken at flag leaf (target 20 inches). The varieties in the single-cut system were cut when they reached the early to mid-boot stage. Cutting started on May 11, 2018, and was completed June 21, 2018. Our soil fertility program is designed around maintenance applications of phosphorus and potash to meet soil test requirements. Plots received 30 units in the fall, 100 units of nitrogen in the spring at green-up, and for the multi-cut system, 50 units after each cutting. See the current *Penn State Agronomy Guide* for specific recommendations about establishment, fertilization, and other management considerations.

Table 13. Short-lived grass varieties listed in this report.

Variety/Species	Marketer	Appears in Table No.
ANNUAL RYEGRASS		
Barextra	Barenbrug USA	14
Hercules	Barenbrug USA	14
Jumbo	Barenbrug USA	14
Maximus	Barenbrug USA	14
Ribeye	Barenbrug USA	14
Andes	DLF Pickseed USA	14
Kodiak	DLF Pickseed USA	14
Mckinley	DLF Pickseed USA	14
KB Royal	Leabrook Ag, LLC	14
KB Supreme	Leabrook Ag, LLC	14
Jackson	The Wax Co., LLC	14, 15
Marshall	The Wax Co., LLC	14, 15
Nelson	The Wax Co., LLC	14, 15
TRITICALE		
Tricale 813	Tricale Superior Forage	16
Trical Gainer 154	Tricale Superior Forage	16
Trical Flex 719	Tricale Superior Forage	16
Traction	Growmark FS	16
HyOctane	Seedway LLC	16
Thundercale	Leabrook Ag, LLC	16
Short Beard Thunder	Leabrook Ag, LLC	16
Fredro	Leabrook Ag, LLC	16
Arcia	Eddie Mercer Agri-Services	16
RYE		
KWS Progas	KWS Cereals USA	16
KWS Propower	KWS Cereals USA	16
KWS Brasetto	KWS Cereals USA	16
KWS Binntto	KWS Cereals USA	16
Aroostook	Public	16
MIX		
King's Soil Builder Plus	King's Agriseeds	17

Forage Grass Marketers Listed in This Report

Barenbrug USA

Tangent, OR 97389
Phone: 541-926-5801
www.barusa.com

DLF Pickseed USA Inc.

Halsey, OR 97348
Phone: 541-369-2251
www.dlfpickseed.com

Eddie Mercer Agri-Services

Frederick, MD 21701
Phone: 410-409-7538
www.eddiemerceragri-services.com

Growmark FS

York, PA
Phone: 800-338-4769
www.growmarkfs.com

King's Agriseeds

Ronks, PA 17572
Phone: 717-687-6224
www.kingsagriseeds.com

KWS Cereals USA

Champaign, IL 61822
Phone: 303-489-4265
www.kws.com

Leabrook Ag

Lancaster, PA 17601
Phone: 717-898-9576

Seedway LLC

Emmaus, PA 18049
Phone: 800-225-4131
www.seedway.com

TriCal Superior Forage

Union, KY 41091
Phone: 859-802-2288
www.tricalforage.com

The Wax Company, LLC

Amory, MS 38821
Phone: 662-256-3511
www.mercolocal.com

Table 14. Annual ryegrass—multiple cut.

Variety	Harvest Date	DM Yield (tons per acre)				First Cut Analysis	
		Cut 1	Cut 2	Cut 3	Total	CP%	30-hr NDFD
Marshall	5/11, 6/1, 7/21	2.45	1.70	1.03	5.18	20.5	79
Kodiak	5/11, 6/1, 7/21	1.97	2.09	1.07	5.13	22.8	78
Mckinley	5/11, 6/1, 7/21	2.28	1.73	1.06	5.07	23.1	81
Ribeye	5/11, 6/1, 7/21	2.13	1.80	1.07	5.01	22.4	79
KB Supreme	5/11, 6/1, 7/21	2.02	1.84	1.08	4.94	22.2	80
Jackson	5/11, 6/1, 7/21	2.03	1.75	1.11	4.89	21.0	78
KB Royal	5/11, 6/1, 7/21	2.25	1.74	0.70	4.70	20.3	76
Nelson	5/11, 6/1, 7/21	1.40	1.84	0.99	4.23	25.4	87
Andes	5/11, 6/1, 7/21	1.38	1.74	0.92	4.04	24.2	84
Maximus	5/11, 6/1, 7/21	1.23	1.71	0.96	3.91	25.9	84
Jumbo	5/11, 6/1, 7/21	1.17	1.63	1.01	3.80	24.5	82
Hercules	5/11, 6/1, 7/21	1.28	1.54	0.82	3.64	24.5	85
Barextra	5/11, 6/1, 7/21	1.16	1.45	0.86	3.47	27.0	87
Mean		1.68	1.75	0.98	4.40	23.8	81.6
CV (%)		12.23	12.67	15.78	11.90		
LSD (p = 0.05)		0.29	0.32	0.22	0.49		

CV = coefficient of variation

LSD = least significant difference

- Planted September 22, 2017.
- Yields are given in tons per acre (DM basis).
- Stand score based on a scale of 1 to 100. A 100 is considered to be a perfect stand.
- Grand Mean, CV, and LSD values represent 29 total entries.
- Means are LSMeans derived from statistical analysis.
- Rankings are based on total yields.

Table 15. Annual ryegrass—single cut.

Variety	Harvest Date	DM Yield (tons per acre)	First Cut Analysis	
		Total	CP %	30-hr NDFD
Marshall	5/15	3.05	20.3	74
Jackson	5/18	2.18	22.7	73
Nelson	5/15	2.04	22.5	76
PST-3G16*	5/17	1.93	19.5	69
PPG-LWT 105*	5/18	1.91	21.5	71
Mean		2.22	21.3	72.7
CV (%)		8.99		
LSD (p = 0.05)		0.11		

*Not commercially available.

CV = coefficient of variation

LSD = least significant difference

- Planted September 22, 2017.
- Yields are given in tons per acre (DM basis).

- Stand score based on a scale of 1 to 100. A 100 is considered to be a perfect stand.
- Grand Mean, CV, and LSD values represent 5 total entries.
- Means are LSMeans derived from statistical analysis.
- Rankings are based on total yields.

Table 16. Short-season cereals.

Variety	Species	Harvest Date	Yield	First Cut Analysis	
				Crude Protein (%)	NDFD 30
HyOctane	Triticale	5/17	3.68	19.8	67
Traction	Triticale	5/18	3.67	18.8	65
Fredro	Triticale	5/17	3.59	18.7	64
Thundercale	Triticale	5/17	3.48	18.0	64
Trical Gainer 154	Triticale	5/15	3.35	20.5	66
KWS Binntto	Rye	5/9	3.28	22.2	73
KWS Progas	Rye	5/9	3.15	21.7	73
Trical Flex 719	Triticale	5/15	3.11	20.9	65
KWS Propower	Rye	5/9	3.11	21.5	73
Short Beard Thunder	Triticale	5/14	3.07	21.0	73
Arcia	Triticale	5/14	2.97	21.4	72
KWS Brasetto	Rye	5/9	2.92	22.1	74
Tricale 813	Triticale	5/14	2.88	21.1	71
Aroostook	Rye	5/8	2.64	21.0	64
Mean			3.26	20.6	69
CV (%)			10.08		
LSD (p = 0.05)			0.25		

CV = coefficient of variation

LSD = least significant difference

- Planted September 22, 2017.
- Yields are given in tons per acre (DM basis).
- Stand score based on a scale of 1 to 100. A 100 is considered to be a perfect stand.
- Grand Mean, CV, and LSD values represent 24 total entries.
- Means are LSMeans derived from statistical analysis.
- Rankings are based on total yields.

Table 17. Short-season mix.

Variety	Species	Harvest Date	Yield	First Cut Analysis	
				CP %	30-hour NDFD
King's Soil Builder Plus	66.7% Trical 815				
	11.7% Crimson Clover				
	10% Hairy Vetch	5/15	2.93	22.3	67
	10% Annual Ryegrass				
	1.5% Daikon Radish				

- Planted September 22, 2017.
- Yields are given in tons per acre (DM basis).

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