Perennial Forage Longevity Study Report 2020

Introduction

Perennial Forage were initiated in 2016 by the Applied Research Associations in Alberta to fill the knowledge gap of perennial forage data available for producers in the region. First study was completed in 2018 and 2nd phase of the project (to study on longevity) initiated in 2019 and implemented in 2020 as a CAP funded project.

Objective of this Perennial forage longevity trial is to,

1. Study the ability of established perennial forage verities to survive (especially during winter), grow, yield potential and feed quality variations over the years
2. Knowledge transfer: To share information among Ranchers and stakeholders

This project consists of three trials,

1. Legumes – 14 Varieties
2. Grasses – 11 Varieties
3. Legume-Grass mixture - 3 legumes and 3 grasses used to make 9 combinations

Methodology

All the 3 trials were mowed in 1st week of June 2020 to remove most of the debris accumulated over the years (four years after establishing the trial). Legume variety trial has 3 replications and grass and legume/grass mix trials have 4 replications.

Data were collected on plant height selecting 3 random plants within each plot and from all the replicates. The average height was calculated for each variety. Plant stand was measured as a percentage stand coverage within each plot and average plant stand was calculated using 4 replicates. Samples from each variety within 4 replications were harvested at late flowering stage (early September) to prepare a one composite sample and analysed feed quality and nutrient composition using Wet-Chemistry method. Yield data were collected by harvesting forages within 1 m^2 of each plot using Swift walk-behind Forage Harvester. Average yield was calculated for each variety using data from 4 replications.

Herbicide (Basagran) was applied in late July to control broad leaf weeds within the plots. Average precipitation was around 75-100 mm throughout the season.

Results and Discussion

Legumes

Data collected on plant height and plant stand from 3 replicates and 14 varieties were used to calculate the average plant height and average plant stand as a percentage (Table 1). Average plant heights from 2018 are listed beside to compare the yield differences over two different years.

Table 1: Average Heights and Plant Stands of 14 Legume Varieties in 5th Year at Fort Vermilion, AB, Measured on 28/07/2020

Legume Variety	Average Plant Height (cm) 2020	Average Plant Height (cm) 2018	Average Plant Stand % -2020
20-10	90	108	94
44--44	86	105	94
Assalt ST Alfalfa	89	99	90
Dalton	88	109	91
Halo	89	110	88
PV Ultima	94	98	91
Rugged	90	103	92
Spredor 4	94	108	90
Spredor 5	90	107	90
Yellowhead	92	105	94
AC Mountainview Sainfoin	52	88	47
Nova Sainfoin	82	103	64
Veldt Cicer Milk Vetch	100	105	97
Oxley 2 Cicer Milk Vetch	90	103	86

In 2020, Veldt Cicer Milk Vetch was recorded the highest plant height, 100 cm and plant stand of 97%. The next highest values of plant heights were recorded from Spredor-4 94 cm and PV Ultima 94 cm and second best plant stands were 20-10, 94% and 44—44, 94% . Average plant heights in 2020 were little lower in-comparison to year 2018 (Table 1).

The highest percentage of Crude Protein was reported in Halo alfalfa 22% and AC Mountainview Sainfoin 20% in 2020. The lowest Crude Protein percentage was recorded in Nova Sainfoin 14% and Veldt Cicer Milk Vetch 15% (Table 2)

Table 2: Feed Quality Parameters (protein, energy and relative feed values) Measured in 5th year using Wet Chemistry Method, Harvested on 8th September 2020

Variety	Crude Protein %	NDF %	ADF %	NEGain Mcal/Kg	NELac Mcal/Kg	NEMain Mcal/Kg	TDN %	RFT
20-10 Alfalfa	16.6	47.3	39.2	0.7	1.3	1.4	58	115
44--44 Alfalfa	18.7	46.6	37.5	0.7	1.3	1.4	60	119
Assalt ST Alfalfa	17.4	48.3	37.1	0.7	1.4	1.5	60	116
Dalton Alfalfa	15.6	55.9	42.2	0.6	1.3	1.3	56	93
Halo Alfalfa	22.4	40.3	31.6	0.9	1.5	1.6	64	148
PV Ultima Alfa	18.5	48.0	36.8	0.7	1.4	1.5	60	117
Rugged Alfa	18.7	43.6	35.1	0.8	1.4	1.5	62	132
Spredor 4 Alfa	17.5	49.3	38.3	0.7	1.3	1.4	59	11
Spredor 5 Alfa	17.9	49.9	38.9	0.7	1.3	1.4	59	109
Yellowhead Alfa	14.8	52.5	41.1	0.6	1.3	1.4	57	101
AC Mountainview Sainfoin	20.3	41.2	34.9	0.8	1.4	1.5	62	139
Nova Sainfoin	14.3	45.8	36.6	0.7	1.4	1.5	60	123
Veldt Cicer M Vetch	14.8	39.8	31.3	0.9	1.5	1.6	65	151
Oxley 2 Cicer Mvetch	16.3	40.8	31.2	0.9	1.5	1.6	65	147

Figure1: Alfalfa Captured on July 2020 at MARA Fort Vermilion

Table 3: Legume Feed Quality Parameters (mineral nutrient values) in 5th year, Harvested on 8th September 2020

Variety	Calcium %	Phosphorus%	Potassium %	Magnesium %	Copper ug/g	Iron ug/g	Zinc ug/g
20-10 Alfalfa	1.7	0.2	1.7	0.2	4.9	85	13
44--44 Alfalfa	1.5	0.2	1.6	0.2	4.4	59	16
Assalt ST Alfalfa	1.3	0.2	1.6	0.2	4.2	68	15
Dalton Alfalfa	1.3	0.2	1.6	0.1	4.5	66	14
Halo Alfalfa	2.1	0.3	1.8	0.2	4.9	83	20
PV Ultima Alfa	1.5	0.2	1.6	0.2	4.1	63	15
Rugged Alfa	2.0	0.2	1.6	0.2	4.4	68	18
Spredor 4 Alfa	1.6	0.3	2.2	0.2	3.9	52	18
Spredor 5 Alfa	1.5	0.3	1.8	0.2	4.0	59	18
Yellowhead Alfa	1.4	0.2	1.3	0.2	3.9	60	14
AC Mountainview Sainfoin	1.2	0.3	2.1	0.2	6.0	66	28
Nova Sainfoin	1.5	0.3	1.6	0.2	3.3	48	20
Veldt Cicer M Vetch	1.3	0.2	2.4	0.3	3.9	63	14
Oxley 2 Cicer Mvetch	1.1	0.2	2.1	0.3	4.6	56	12

Mineral contents of different legume varieties are not considerably different from each other, similar to previous years (Table 3).

Average yield and percentage dry matter of legume varieties from 2 years are listed in Table 4. In 2020, 20-10 aflalfa has recorded highest average yield of 3548 Kg/Acre and 44—44 alfalfa recorded the second highest yield of 2790 Kg/Acre whereas the lowest yield recorded from Sainfoins and Rugged alfalfa. Dalton alfalfa recorded highest yield in 2017 and the next highest was reported from Assalt ST and 44—44 Alfalfa. 2020 dry matter percentage of all legume varieties are lower than 2018.

Table 4: Comparison of Average Yield and Percentage Dry Matter of Legume varieties with respect to previous Years

Variety	2020 Avg. Yield lbs/ac	2017 Avg. Yield lbs/ac	2020 Dry Matter %	2018 Dry Matter %
20-10	7841	4265	30	49
44--44	6174	4906	31	44
Assalt ST Alfalfa	4819	5260	30	44
Dalton	3784	5613	34	47
Halo	4786	4796	25	51
PV Ultima	4988	4663	28	55
Rugged	2930	5105	28	50
Spredor 4	5535	4332	25	44
Spredor 5	5750	3470	29	44
Yellowhead	4090	4508	32	49
AC Mountainview Sainfoin	3171	2011	21	50
Nova Sainfoin	3041	1923	26	47
Veldt Cicer Milk Vetch	4207	3050	24	48
Oxley 2 Cicer Milk Vetch	6427	3381	27	49

Grasses

Data collected on plant height and plant stand from 9 varieties and 4 replicates were used to calculate the average plant height and average plant stand as a percentage (Table 5). Average plant height from 2018 listed beside to compare the differences over two different years.

Figure 2: Grasses Captured on July 2020 at MARA Fort Vermilion

Table 5: Average Heights and Plant Stands of Grass Varieties in 5th Year at Fort Vermilion, AB, Measured on 28/07/2020

Grass Variety	Average Plant Height (cm) 2020	Average Plant Height (cm) 2018	Average Plant Stand %
Success Hybrid Brome	88	117	96
AC Admiral Hybrid Brome	64	115	100
Knowles Hybrid Brome	78	106	99
Fleet Meadow Brome	53	104	98
Greenleaf Pubescent Wheatgrass	79	125	75
Kirk Crested Wheatgrass	57	89	86
AC Saltlander Green Wheatgrass	54	95	83
Fojtan Festulolium	-	-	-
Courtney Tall Fescue	-	-	-
Killarney Orchard Grass	45	-	55
Grinstat Timothy	67	101	65

Success Hybrid Brome recorded the highest plant height 88 cm in 2020 and it recorded 117 cm in 2018. AC Admiral Hybrid Brome showed 100% plant stand coverage and the lowest plant stand of 54% was recorded from Killarney Orchard grass. Killarney Orchard grass performed well in 2020 compared to years 2017 and 2018.

Table 6: Feed Quality Parameters (protein, energy and relative feed values) of Grasses measured in 5th year, using Wet Chemistry Method, Harvested on 10th September 2020

Variety	Crude Protein %	NDF %	ADF %	NEGain Mcal/Kg	NELac Mcal/Kg	NEMain Mcal/Kg	TDN %	RFT
Success HB	6.9	59.7	38.5	0.7	1.3	1.4	59	92
AC Admiral HB	7.1	62.2	40.2	0.7	1.3	1.4	58	86
Knowles HB	7.2	59.7	36.4	0.8	1.4	1.5	61	94
Fleet MB	7.4	58.6	40.6	0.7	1.3	1.4	57	91
Greenleaf WG	5.7	58.9	36.4	0.8	1.4	1.5	61	96
Kirk Crested WG	10.2	59.2	36.6	0.7	1.4	1.5	60	95
AC Saltlander WG	8.7	59.8	36.4	0.8	1.4	1.5	61	94
Killarney Orchard	9.0	54.1	37.0	0.7	1.4	1.5	60	103

The highest amount of crude protein (CP) was recorded from Kirk Crested Wheat Grass whereas lowest CP was recorded from Green Leaf Wheat Grass. On average most of the grasses recorded lower percentage of CP percentage in 2020.

Table 7: Grass Feed Quality Parameters (mineral nutrient values) in 5th year, Harvested on 10th September 2020

Variety	Calcium %	Phosphorus %	Potassium %	Magnesium %	Copper ug/g	Iron ug/g	Zinc ug/g
Success HB	0.6	0.2	1.3	0.1	3.0	83	9
AC Admiral HB	0.5	0.2	2.0	0.1	1.6	106	8
Knowles HB	0.5	0.2	1.7	0.1	2.0	64	13
Fleet MB	0.6	0.3	1.8	0.1	2.1	102	6
Greenleaf WG	0.3	0.2	1.1	0.1	2.6	64	12
Kirk Crested WG	0.3	0.2	1.3	0.1	1.7	62	14
AC Saltlander WG	0.4	0.2	1.6	0.1	2.7	61	11
Killarney Orchard	0.5	0.4	2.5	0.2	3.2	187	13

The mineral nutrient content of different grass varieties did not differ significantly among different varieties similar to previous years.

Table 8: Comparison of Average Yield and Percentage Dry Matter of Grass varieties in 2020 with Previous Years

Variety	2020 Avg. Yield lbs/ac	2017 Avg. yld lbs/ac	2020 Dry Matter %	2018 Dry Matter %
Success Hybrid Brome	6387	6011.2	37	59
AC Admiral Hybrid Brome	8693	6254.3	29	58
Knowles Hybrid Brome	7227	4994.6	33	61
Fleet Meadow Brome	7308	5038.8	29	61
Greenleaf Pubescent Wheatgrass	7470	5480.8	40	54
Kirk Crested Wheatgrass	8634	4176.9	42	60
AC Saltlander Green Wheatgrass	8707	4729.4	37	65
Fojtan Festulolium	-	-	-	-
Courtney Tall Fescue	-	-	-	-
Killarney Orchard Grass	7669	-	24	-
Grinstat Timothy	6652	3094	36	52

Average fresh yield of grasses are higher in 2020 compared to 2017 and AC Admiral Hybrid Brome, Kirk Crested Wheat Grass and AC Salt Lander Green Wheat Grass were recorded 3900 Kg/Acre average yield. However, percentage dry matter content in 2020 is lower compared to year 2018.

Legume Grass Mix

Plant height and stand percentage were measured on grass and legume varieties separately within each plot and all 4 replicates, to calculate the average values of grasses and legumes.

Figure 3: Legume/Grass Mixture Captured on July 2020 at MARA Fort Vermilion

Table 9: Average Heights and Plant Stand percentage of Grass Varieties and Legume Varieties within Legume/Grass Mixture Trial in 5th Year at Fort Vermilion, AB, Measured on 28/07/2020

Mixture Varieties	Avg. Grass Height (cm)	Avg. Grass Stand %	Avg. Legume Height (cm)	Avg. Legume Stand %
Fleet MB / Yellowhead	74	65	103	35
AC Knowles/Yellowhead	80	69	98	31
Success HB / Yellowhead	83	74	109	26
Fleet MB / Spredor 5	69	94	94	6
AC Knowles/Spredor 5	85	86	86	14
Success HB/Spredor 5	84	83	109	18
Fleet MB/AC Mountainview	68	100	-	0
AC Knowles/AC Mountainview	82	100	-	0
Success HB/AC Mountainview	96	99	72	1

In Legume/grass mix trial, Sainfoin was less competitive with grass varieties and average stand percentage was o or 1%. In general grass coverage within the plot is considerably higher compared to legumes. Yellowhead alfalfa has the better competing ability with grass varieties compared to Spredor 5.

Table 10: Feed Quality Parameters (protein, energy and relative feed values) of Legume/Grass Mixture measured in 5th year using Wet Chemistry Method, Harvested at Fort Vermilion, AB on 11th September 2020

Variety	Crude Protein %	NDF %	ADF %2	NEGain Mcal/Kg	NELac Mcal/Kg	NEMain Mcal/Kg	TD N%	RFT %
Fleet MB/ Yellowhead Alfa.	9.1	55.5	35.3	0.8	1.4	1.5	61	103
Knowles HB/ Yellowhead Alfa.	6.6	57.5	36.1	0.8	1.4	1.5	61	98
Success HB/ Yellowhead Alfa.	7.8	59.4	37.1	0.7	1.4	1.5	60	94
Fleet MB/ Spredor 5	6.8	60.5	36.0	0.8	1.4	1.5	61	94
Knowles HB/ Spredor 5	7.1	59.4	36.9	0.7	1.4	1.5	60	94
Success HB/ Spredor 5	6.4	62.4	39.3	0.7	39.3	0.7	58	87
Fleet MB/ AC Mountainview	10.3	53.2	36.5	0.7	1.4	1.5	60	106
Knowles HB/ AC Mountainview	7.7	58.4	39.1	0.7	1.3	1.4	58	93
Success HB/ AC Mountainview	8.0	57.9	36.1	0.8	1.4	1.5	61	98

There is an increase in crude protein content in few mixtures such as Fleet MB/ AC Mountainview, Success HB/ AC Mountainview and Fleet MB/ Yellowhead Alfa compared to grass alone trial (Table 6). However, percentage of grass in the sample was higher compared to legume due to highly competitive nature of grass establishment compared to Legumes. Some volunteer Yellowhead and Spredor 5 were also observed in plots where AC Mountainview was supposed to grow.

Similar to Grass and legume variety trials, there is no much difference in mineral contents among different mixtures (Table 11)

Table 11: Grass/Legume Mixture feed quality parameters (mineral nutrient values) in 5th year, Harvested at Fort Vermilion, AB on 11th September 2020

Variety	Calcium %	Phosphorus%	Potassium %	Magnesium %	Copper ug/g	Iron ug/g	Zinc ug/g
Fleet MB/ Yellowhead Alfa.	0.4	0.2	2.1	0.2	3.8	156	20
Knowles HB/ Yellowhead Alfa.	0.3	0.1	1.8	0.1	2.0	52	9
Success HB/ Yellowhead Alfa.	0.4	0.2	1.9	0.1	2.4	87	15
Fleet MB/ Spredor 5	0.3	0.2	1.8	0.1	2.5	51	14
Knowles HB/ Spredor 5	0.3	0.2	1.6	0.1	1.7	45	9
Success HB/ Spredor 5	0.3	0.2	1.5	0.1	2.2	51	11
Fleet MB/ AC Mountainview	0.7	0.3	3.0	0.2	2.8	57	17
Knowles HB/ AC Mountainview	0.5	0.2	2.3	0.1	2.1	67	14
Success HB/ AC Mountainview	0.3	0.2	1.6	0.1	1.7	46	14

Table 12: Comparison of Average Yield of Grass/Legume Mixtures in 2020 with 2017, Harvested at Fort Vermilion, AB on 14th September 2020

Column1	2020 Avg. Yield lbs/ac	2017 Avg. yld lbs/ac
Fleet MB / Yellowhead	12000	5370
AC Knowles/Yellowhead	2300	4906
Success HB / Yellowhead	1719	5017
Fleet MB / Spredor 5	1856	6144
AC Knowles/Spredor 5	1582	4531
Success HB/Spredor 5	2129	4398
Fleet MB/AC Mountainview	2457	6254
AC Knowles/AC Mountainview	2427	5812
Success HB/AC Mountainview	2305	4022

In general average yield of mixtures in 2020 is lower than 2017, which could be due to timing of harvesting, late September in 2020 (Table 12).

Conclusion

Year 2020 was an extremely wet year, both during growing and harvesting seasons. That increased the yield in certain forages but reduced the dry matter content as a result of higher moisture contents. All the plots were harvested during mid or late September as a result of wet weather.

The mineral content among different forage varieties did not differ significantly over five years. All the forage varieties were survived over 5 years in Fort Vermilion site except *Fojtan Festulolium* and Courtney Tall Fescue grasses (did not survive after winter 2016).

Average plant height of all legumes were ranged from 90 – 100 cm and average plant stand coverage was 90%. Average yield of alfalfa varieties were ranged from 3000-7000 lbs/ac and crude protein content ranged from 15 – 22%.

Veldt Cicer Milk Vetch recorded highest yields over several years, with a 15% crude protein content and 100% stand coverage. Oxley Cicer milk Vetch produced a lower biomass and lower stand compared to Veldt Cicer Milk Vetch.

Sainfoin is a good candidate to grow in alfalfa mixtures due to its anti-bloating qualities. However, AC Mountain View (50% stand) and Nova Sainfoin (64% stand) did not establish very well in fort Vermilion site over past five years. Hence, Sainfoin require more studies in this region with newly developed varieties and better seeding rates.

Average plant stand for most of the grasses were ranged from 85 – 100% except for Greenleaf Pubescent Wheat Grass (75%), Killarney orchard grass (55%) and Grinstat Timothy (65%). Killarney Orchard Grass performed well under higher moisture conditions compared to other grasses. Crude Protein content of grasses varied from 7-10% except Greenleaf Pubescent Wheat Grass (6%). The yield of grasses were higher and the dry matter content was lower in 2020 compared to year 2017 as a result of higher moisture levels in 2020.

Legume/Grass mix trial showed increased crude protein percentage in the tested feed samples where legumes were present. This mix trial was not very successful due to highly competitive nature of the grasses and poor establishment of legumes. Further, studies require with better seeding rates, quality seeds and competitive alfalfa/sainfoin varieties.

Please check out MARA's 2016, 2017 & 2018 Perennial Forage Research trial reports for more data and information