

A comparison study of alfalfa (*Medicago sativa*) populations with long-term grazing history

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Outline

- **Background**
- **Plant materials**
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- **Objectives**
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Background

- Alfalfa and alfalfa mixture take up to 3,754,169 hectares of total Canadian field crop area, it is widely cultivated in the Canadian prairies, accounting for 75% of the total national production area (Statistics Canada, 2016).
- Stronger winterhardiness
- Lower fall dormancy
- Higher forage yield
- Higher verticillium wilt (*Verticillium albo-atrum* Reinke & Berth) resistance



14 Alfalfa populations collection sites

<i>No.</i>	<i>Population Name</i>	<i>Soil Zone</i>	<i>Rural Municipality (RM)</i>
1	Crooked River	Grey	RM 426
2	Shellbrook		RM 493
3	Erwood		RM 394
4	MacDowall	Black	RM 463
5	Duck Lake		RM 403
6	Rockhaven		RM 439
7	Arcola		RM 64
8	Dalmeny	Dark Brown	RM 344
9	Pike Lake		RM 345
10	Fillmore		RM 96
11	Ceylon	Brown	RM 39
12	Gull Lake		RM 139
13	Val Marie		RM 17
14	Moose Jaw		RM 45





Experimental design

- Randomized Complete Block Design (RCBD) with two replicates
- 14 alfalfa populations (25 years+ grazing history without renovating)
- 30 alfalfa plants per population



Hypothesis

1. The 14 alfalfa populations with 25 years+ grazing history will differ in agronomic traits (First cut dry matter, plant height, second cut dry matter, stem number, ADF, NDF, CP and fall dormancy), and verticillium wilt disease resistance;
2. The alfalfa populations from different soil zones will vary in agronomic traits.



Objectives

1. To compare DM, regrowth DM, Verticillium wilt disease resistance, ADF and CP among 14 alfalfa populations, and among four different soil zones;
2. To identify the correlation among DM, stem number, regrowth DM and PH within 14 alfalfa populations.



Forage agronomic traits of 14 alfalfa populations with long term grazing history

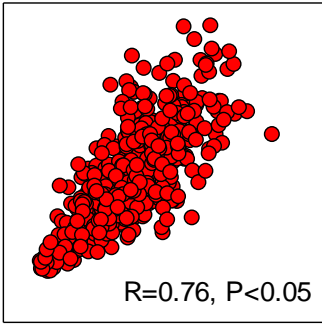
Locations	Val Marie	Ceylon	Moose Jaw	Fillmore	Pike Lake	Crooked River	Arcola	Rockhaven	Dalmeny	Duck Lake	Gull Lake	Shellbrook	Erwood	MacDowell	P values
Category															
DM	166.5 ^{ab}	207.8 ^{abc}	200.3 ^{abc}	218.1 ^{abcd}	213.6 ^{abc}	158.9 ^a	255.0 ^{cd}	256.4 ^{cd}	216.5 ^{abcd}	253.0 ^{cd}	214.0 ^{abc}	253.3 ^{cd}	237.3 ^{bcd}	287.7 ^d	<0.05
CP	11.3 ^d	15.8 ^{ab}	13.4 ^{bcd}	-	13.7 ^{bcd}	15.1 ^{ab}	14.7 ^{bc}	18.0 ^a	11.9 ^{cd}	16.3 ^{ab}	14.8 ^{bc}	15.0 ^b	14.2 ^{bcd}	13.8 ^{bcd}	<0.05
ADF	32.3 ^a	28.0 ^a	28.8 ^a	-	30.0 ^a	31.3 ^a	30.9 ^a	30.8 ^a	31.4 ^a	33.0 ^a	28.9 ^a	31.8 ^a	29.0 ^a	31.3 ^a	0.4972
NDF	42.0 ^a	40.4 ^a	39.6 ^a	-	41.8 ^a	40.8 ^a	41.0 ^a	39.8 ^a	44.7 ^a	42.7 ^a	36.9 ^a	41.5 ^a	40.3 ^a	40.8 ^a	0.3832
Regrowth DM	67.5 ^a	69.9 ^{ab}	77.7 ^{abc}	78.3 ^{abc}	81.6 ^{abcd}	82.3 ^{abcd}	84.0 ^{abcd}	93.2 ^{abcde}	93.5 ^{abcde}	100.9 ^{bcde}	105.2 ^{cde}	105.3 ^{cde}	108.1 ^{de}	121.8 ^e	<0.05
Plant Height	67.2 ^a	75.1 ^{abc}	76.3 ^{abc}	75.3 ^{abc}	83.2 ^{bcd}	73.3 ^{ab}	88.5 ^d	82.2 ^{bcd}	84.2 ^{bcd}	75.9 ^{cd}	84.6 ^{abc}	81.9 ^{bcd}	84.4 ^{cd}	90.3 ^d	<0.05
Stem Number	67.1 ^a	83.4 ^{ab}	70.5 ^{ab}	74.0 ^{ab}	72.9 ^{ab}	73.9 ^{ab}	75.9 ^{ab}	89.3 ^{ab}	77.1 ^{ab}	83.0 ^{ab}	80.5 ^{ab}	85.9 ^{ab}	81.6 ^{ab}	97.8 ^b	<0.05
Fall Dormancy	2.5 ^{ab}	2.4 ^a	2.7 ^{ab}	2.7 ^{ab}	2.3 ^a	3.1 ^{bc}	2.4 ^a	2.5 ^{ab}	3.2 ^{bc}	3.3 ^c	3.3 ^c	2.5 ^{ab}	2.6 ^{ab}	3.3 ^c	<0.05

Note: DM=Dry matter; CP=Crude protein; ADF=Acid detergent fiber; NDF=Neutral detergent fiber; Means with different letters in a row are significantly different at 0.05 level.

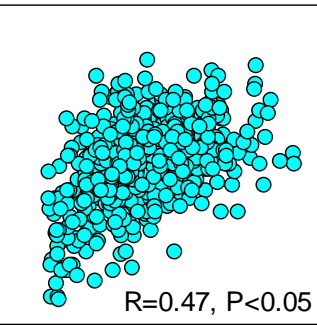
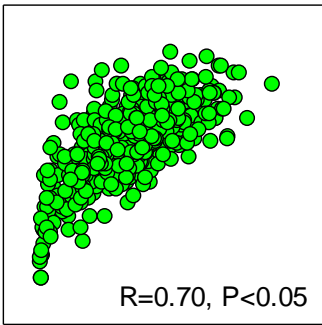


Correlation within four agronomic traits in 14 alfalfa populations

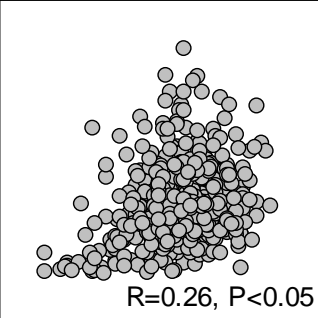
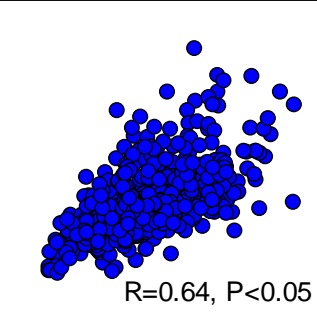
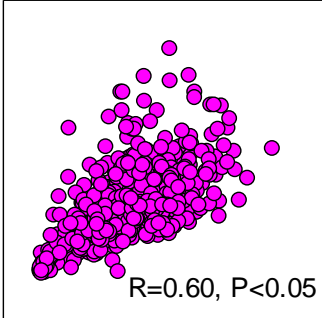
Dry Matter



Regrowth Dry Matter



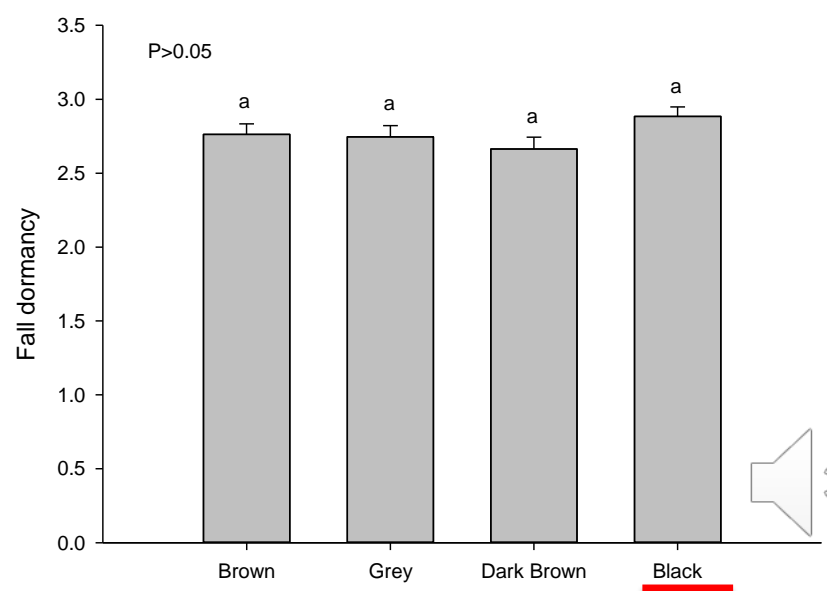
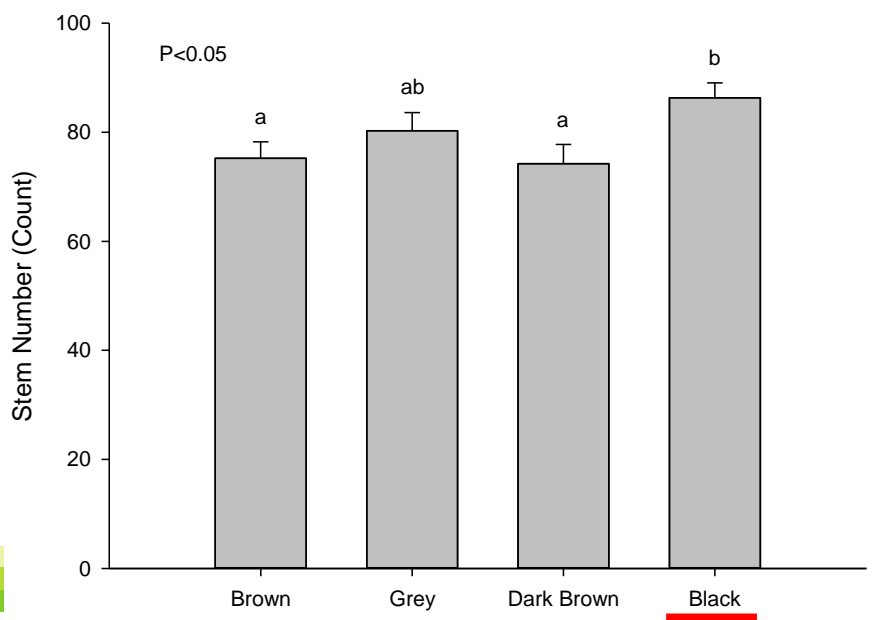
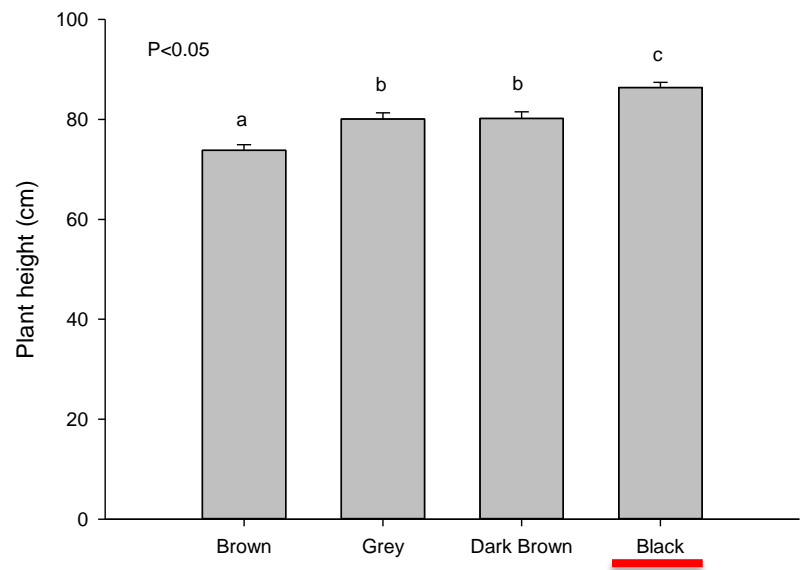
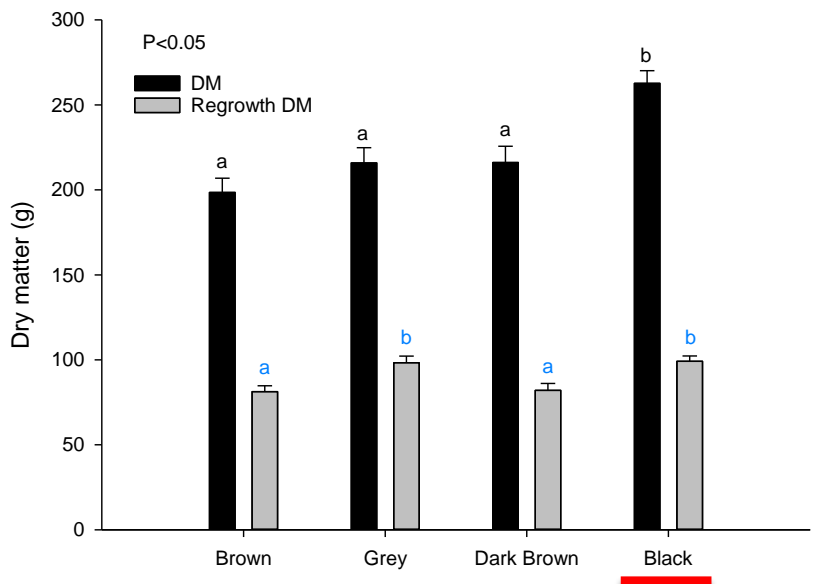
Plant Height



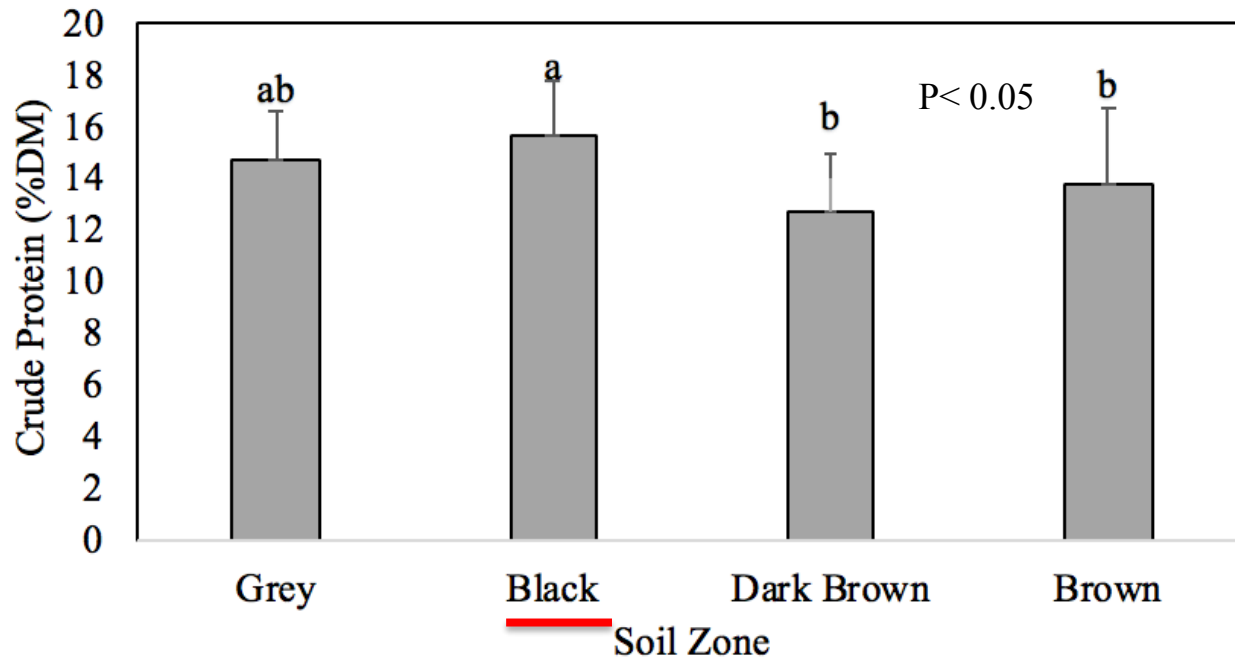
Stem Number



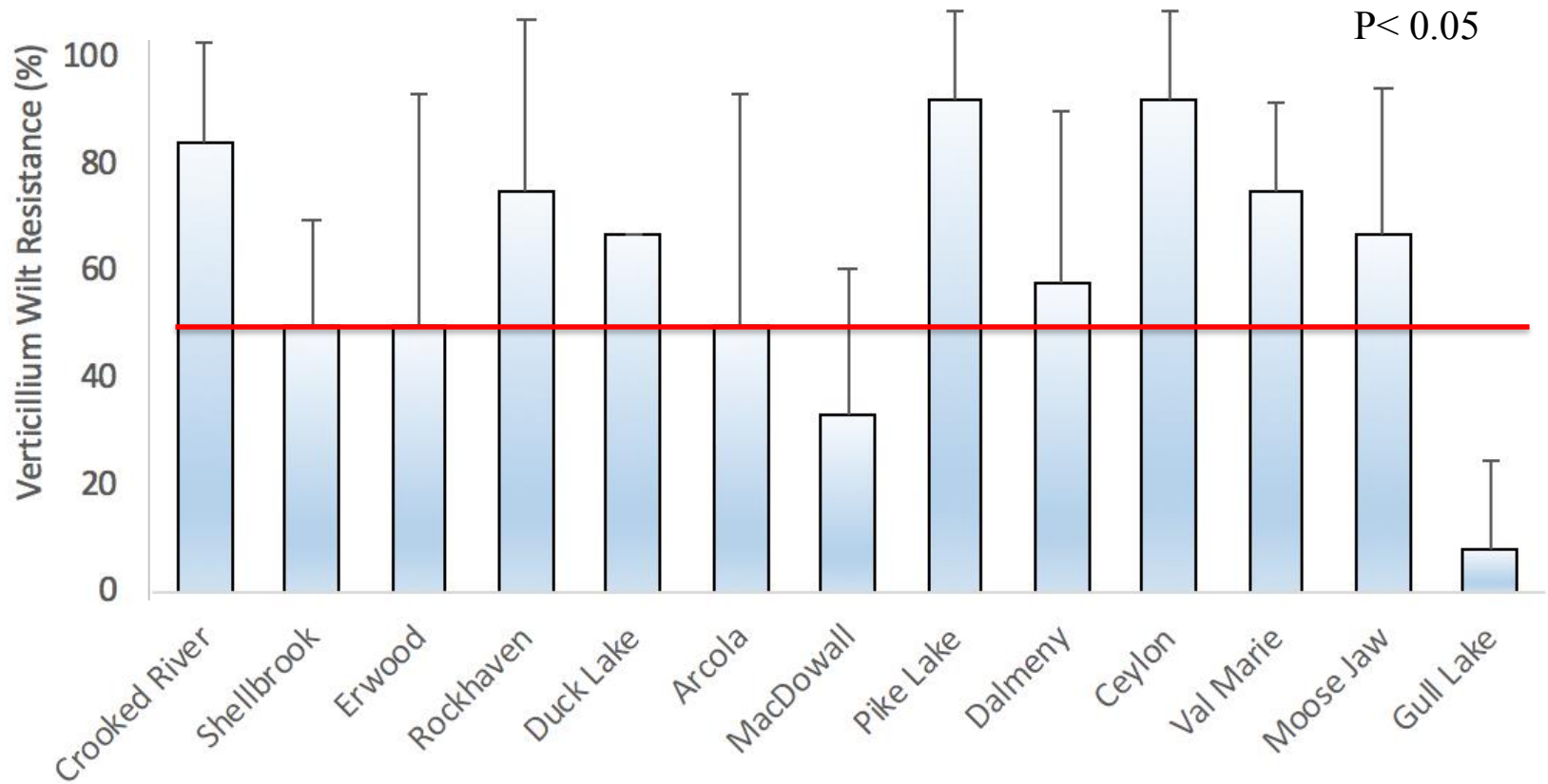
Forage agronomic traits by different soil zones



Forage agronomic traits by different soil zones



Verticillium wilt disease resistance



Conclusions

- Alfalfa population from MacDowell can be used to improve for higher DM, regrowth DM, and lower dormancy;
- Alfalfa populations from the black soil have higher DM, more stem number and higher plant height.
- The 11 alfalfa populations have Verticillium wilt disease resistance greater than 50%;
- Regrowth DM, plant height, and stem number are positively associated with DM in 14 alfalfa populations.



Thank you

