

Physicochemical, Molecular Structural and Nutritional Evaluation of Whole Crop Faba Bean Plant as Silage for Ruminants

8th Annual Dairy Info Day

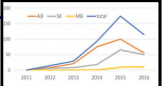
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January 24, 2019

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I. Research Motivation & Originality

- The production of **Pulses** in Canada is increasing (Booker, 2016).
 - International market opportunities;
 - Implementation of new technologies (Gilmour, 2016).
- Alberta, Manitoba and **Saskatchewan** are the main producers. (Saskatchewan Pulse Growers, 2017).
- The production of **Faba bean** increased almost **200%**.
- Therefore **Faba forage available increases as well**



I. Research Motivation & Originality

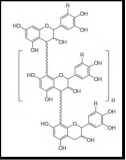
- Faba bean (*Vicia faba* L.), originated in the **Mediterranean region** (north Africa) or **southwestern Asia** (Singh and Bhatt, 2012).
- Capable of growing in **cool** and **wet environments** (Tanno and Willcox, 2006).
- Recognized due to the **ecological properties (N fixation)**.
- There are two types of faba bean:
 - **Tannin** - Human consumption
 - **Low Tannin** - Human and Animal consumption



(Fleury and Barker, 2016)

I. Research Motivation & Originality

- Condensed Tannins are **secondary metabolites** (Frutos et al., 2004).
 - **Anti-nutritive** properties affecting palatability and digestion.
 - Possible **positive** effect in ruminants (Addisu, 2016).
- **Reduction in ruminal protein degradation** and, as a consequence, a greater availability of amino acids for absorption in the small intestine.
- Levels exceeding **5 %** in the diet significantly **reduces voluntary feed intake**, negatively affecting growth and milk production. (Cannas, 2015)



I. Research Motivation & Originality

Silage



- **Mycotoxin** is a **problem** for cereal grain and cereal silage in **western Canada** and seems that this issue is increasing (McKinnon, 2014).
- **Limited data** from previous studies demonstrated that whole plant **faba bean silage is comparable to grass-legume silage** (Ingalls et al., 1974).

I. Research Motivation & Originality

Silage



- Faba bean silage was **higher in protein** and **lower in crude fibre** grass-legume silage (McKnight and MacLeod, 1977)
- **Soluble protein fraction** was highest for pea silage, intermediate for soybean silage, and **lowest for faba bean silage**.
- The **effective ruminal degradability of CP** for the three silages was high, and higher for soybean silage and pea silage than for faba bean silage. (Mustafa and Seguin, 2003)
- In this case, **faba bean forage can be used as excellent alternative** feed to be used in Western Canadian Farms.

II. Objectives

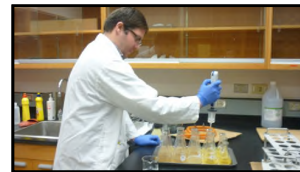
Short-Term:

- To conduct comprehensive **nutritional evaluation** of faba forage varieties for silage with a systematic approach.
- To carry out **dairy production performance** and **metabolic trials** with faba silage to develop an efficient feeding strategy of faba silage.
- To reveal **intrinsic molecular structure changes** that affect nutrient utilization and availability in cattle by using cutting-edge molecular spectroscopic techniques.
- **Effect of variety/tannin level and growth stage on feed and feeding values of faba silage and hay in ruminant livestock systems.**

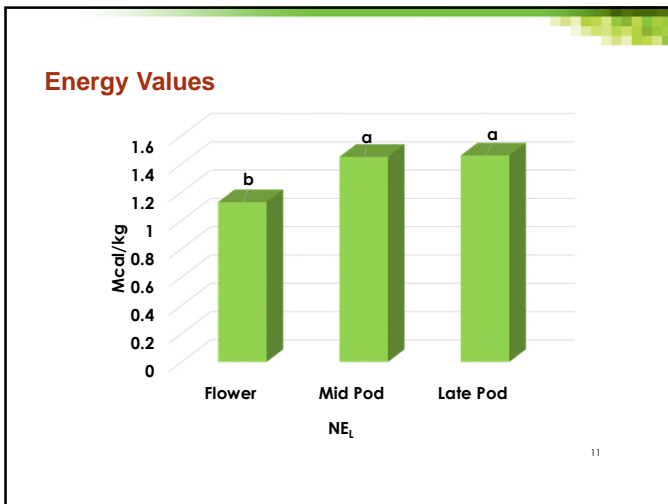
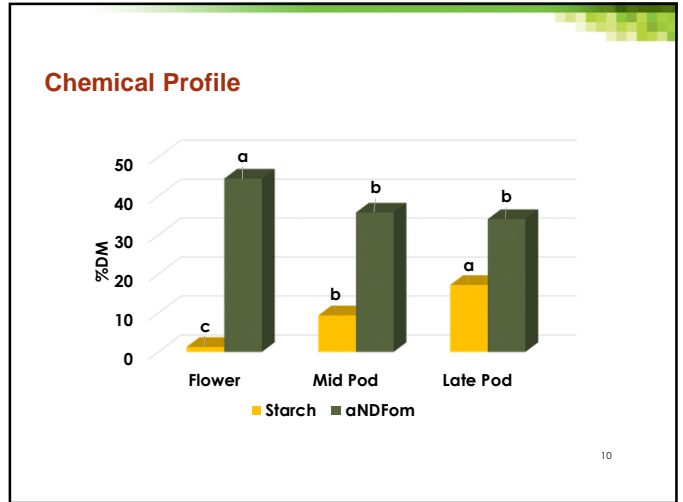
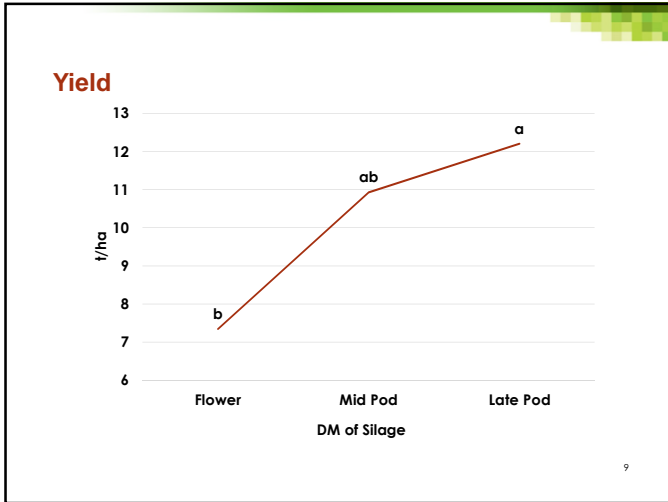
III. Results

PHASE 1

Characterization of Chemical and Nutrient Profiles and Bioactive Compounds of Faba Silage




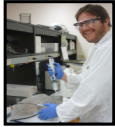
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III. Results

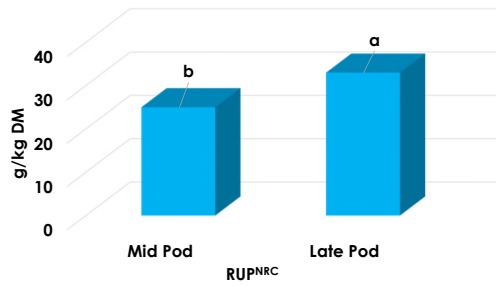
PHASE 2

Metabolic Study to Understand Rumen Degradation Kinetics, Intestinal Digestion of Whole Crop Faba Forage Silage

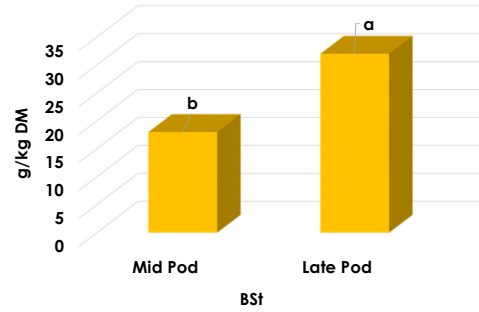
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Degradation Kinetics of CP



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Degradation Kinetics of Starch



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III. Results

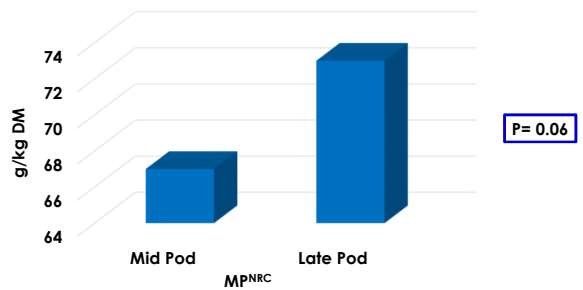
PHASE 3

Determine Truly Absorbed Nutrient Supply and Feed Milk Value (FMV) from Whole Crop Faba Forage Silage to Dairy Cattle

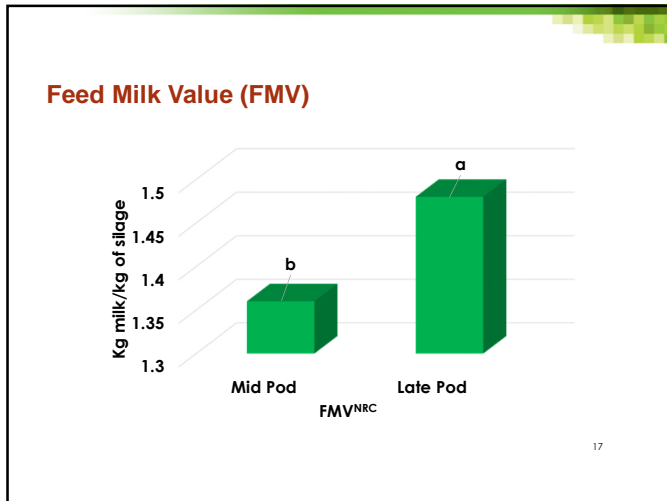


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Metabolic Characteristics



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IV. Conclusions

- **Silage at late pod stage** provide:
 - Highest DM yield
 - Highest Starch yield
 - Highest NE_L
 - Highest Bypass Protein (RUP)
 - Highest Predicted Production Performance (FMV)

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V. Industrial and Commercial Applications

	FMV (kg milk/kg feed)
Barley Silage	1.06
Barley Grain	1.36
Faba Silage	1.48
Canola Meal	2.36

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V. Industrial and Commercial Applications

- Whole crop faba bean silage at late pod stage showed a **superior feed quality**.
- It can be used as a **potentially high value ingredient for dairy cows**.
- **Animal trials are needed to support this study.**

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THANK YOU VERY MUCH !!