



**VT Dairy Complex – 18 months**  
*Department of Dairy Science*


**VT Dairy Complex – 18 months**

*Research Team*



- 13 PhD students
- 6 MS students
- 5 laboratory technicians
- 3 post-docs
- Undergraduate students
- Farm staff
- Collaborating departments (CSES, BSE, etc)

**VT Dairy Complex – 18 months**

*Hanigan's Lab*



**VT Dairy Complex – 18 months**

*Hanigan's Lab – Protein Metabolism*



- Metabolic Trial #1 (Kari Estes)
  - Goal
    - Determine ruminal N degradability and intestinal amino acid availability from soybean meal, feather meal, and blood meal
  - Status
    - Publication in progress

**VT Dairy Complex – 18 months**

*Hanigan's Lab – Protein Metabolism*



- Metabolic Trial #2 (Xinbei Huang)
  - Goal
    - Determine ruminal N degradability and intestinal amino acid availability for corn silage, grass hay, alfalfa hay, soyhulls, dried distillers grains, wet brewers grains, and corn grain
  - Status
    - On-going

**VT Dairy Complex – 18 months**

*Hanigan's Lab – Protein Metabolism*



- Feeding Trial #1 (Michelle Aguilar)
  - Goal
    - Determine effect of amino acid supplementation in production performance and amino acid absorption
  - Status
    - Publication in preparation

**VT Dairy Complex – 18 months**

*Hanigan's Lab – Protein Metabolism*



- Feeding Trial #2 (Adelyn Myers)
  - Goal
    - Determine the effects of rumen protect lysine and methionine on animal performance
  - Status
    - On-going

**VT Dairy Complex – 18 months**  
*Hanigan's Lab – Rumen Metabolism*



- Metabolic Trial #3 (Meng Meng)
  - Goal
    - Determine effect of rumen pH on rumen microbiome
  - Status
    - On-going

**VT Dairy Complex – 18 months**  
*Knowlton's Lab*



**VT Dairy Complex – 18 months**  
*Knowlton's Lab – Antibiotic Resistance*



- Trial #1 (Dry Cow Therapy)
  - Goal
    - Determine timecourse of excretion of antibiotics from treated animals
  - Treatments
    - Control
    - Antibiotic 1
    - Antibiotic 2
    - Antibiotic 3

**VT Dairy Complex – 18 months**  
*Knowlton's Lab – Antibiotic Resistance*



- Trial #1 (Dry Cow Therapy)
  - Findings
    - Excretion of therapeutically dosed antibiotics by beef and dairy cattle is rapid (within hours or days of treatment)
    - This suggests that only manure from 3 to 5 days post-treatment is a risk factor for spread of antibiotics to the ecosystem

**VT Dairy Complex – 18 months**  
*Knowlton's Lab – Antibiotic Resistance*



- Trial #2 ("Manure composting")
  - Goal
    - Generate larger quantities of manure. This manure was used in large scale manure storage studies (manure in dumpsters)
  - Study
    - Groups of cows treated with AB
    - Manure collected from barn floor

**VT Dairy Complex – 18 months**  
*Knowlton's Lab – Antibiotic Resistance*




- Trial #2 ("Manure composting")
  - Findings
    - Two approaches to composting were effective in reducing antibiotic concentration in dairy and beef manure
    - The composting process itself was uninhibited despite the presence of multiple antibiotic residues

**VT Dairy Complex – 18 months**  
*Daniels' Lab*



**VT Dairy Complex – 18 months**  
*Daniels' Lab – Rumen Development*




- Calf Trial #1
  - Goal
    - Optimize our ability to label and subsequently study rumen cell development in calves
  - Treatments
    - High-starch starter diet (maximize rumen development?)
    - High-fiber starter (delayed rumen development)

**VT Dairy Complex – 18 months**  
*Daniels' Lab – Rumen Development*




- Calf Trial #1
  - Results
    - They optimized their cell-labeling technique (main goal), and will use it in future trials with more animals
    - Test diets did not perform as planned
      - Calves performed the same on each one (unexpected)
      - Future experiments with focus on form of feed (not just on nutrients)

**VT Dairy Complex – 18 months**  
*Daniels' Lab – Rumen Development*




- Calf Trial #2
  - Goal
    - Evaluate the effect of of a probiotic (*Megasphaera elsdenii*) on fermentation profile and growth performance
  - Treatments
    - Control
    - Probiotic (50-mL oral drench at 2 weeks of age)

**VT Dairy Complex – 18 months**  
*Daniels' Lab – Rumen Development*



- Calf Trial #2
  - Results
    - No effects on neither
      - Starter feed intake
      - Weight at weaning
      - Body weight
  - Manuscript in preparation (Journal of Dairy Science)

**VT Dairy Complex – 18 months**  
*Daniels' Lab – Rumen Development*



- Calf Trial #3
  - Goal
    - Insert a rumen cannula within the first week of life and maintain it through 9 weeks of life
    - Long term → experimental procedures for future trials
      - Rumen infusion
      - Sampling
      - Washing
      - Content evacuation
  - VFA absorption

VT Dairy Complex – 18 months

Petersson's Lab



VT Dairy Complex – 18 months

Petersson's Lab – Animal Behavior



- Calf Trial
  - Goal
    - Detect behavioral changes around disease events.
  - Methods
    - Calves were housed in groups on the automatic calf feeder
    - Accelerometer (fancy pedometer) to detect
      - Changes in feeding behaviors
      - Changes in activity (steps/day) and lying behaviors.
    - Calves were health scored twice daily to determine disease status

VT Dairy Complex – 18 months

Petersson's Lab – Animal Behavior



- Calf Trial
  - Results
    - Lying behaviors may prove to be a more sensitive measure to detecting respiratory disease in pre-weaned calves than feeding behaviors



VT Dairy Complex – 18 months

Petersson's Lab – Animal Welfare



- Cow Trial
  - Goal
    - Determine if the use of non-steroidal anti-inflammatory drug (NSAID) pre-calving improves animal welfare
  - Measurements
    - milk yield and components
    - Activity and lying behaviors
    - Ketone bodies in blood (BHBA)
    - Disease incidences
    - Fertility measures (days open)

VT Dairy Complex – 18 months

Akers' Lab



VT Dairy Complex – 18 months

Akers' Lab – Mammary Gland



- Cull cow study
  - Goal
    - Determine how *Staphylococcus aureus* infections affect epithelial cell proliferation in mammary gland (MG)
    - Long term goal → mastitis and MG development in heifers
  - Treatments
    - 20 dry culled cows (involved MG) challenged with *S. aureus*
    - Cell proliferation stimulate with estradiol + progesterone
    - Tissue harvested for histology

**VT Dairy Complex – 18 months**  
*Corl's Lab*





**VT Dairy Complex – 18 months**  
*Ferreira's Lab*




**VT Dairy Complex – 18 months**  
*Ferreira's Lab – Forage Quality*

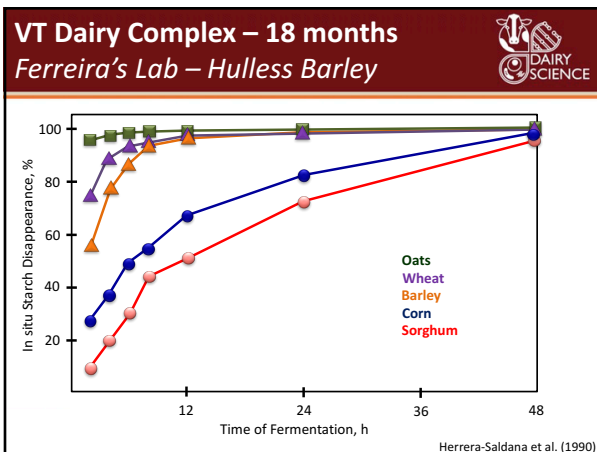


- Management practices and abiotic stresses on forage yield and quality
- In vitro studies
  - IVDMD and IVNDFD of winter crops for silage
  - IVDMD and IVNDFD of corn silage at different planting densities




**VT Dairy Complex – 18 months**  
*Ferreira's Lab – Hulless Barley*






**VT Dairy Complex – 18 months**  
*Ferreira's Lab – Hulless Barley*



- Feeding Trial #1
  - Goal
    - Determine production performance, nutrient utilization, and milk fatty acid composition when including corn or hulless barley as starch source
  - Treatments
    - 100% corn
    - 67% corn + 33% hulless barley
    - 33% corn + 67% hulless barley
    - 100% hulless barley


**VT Dairy Complex – 18 months**  
*Ferreira's Lab – Hulless Barley*



Composition of diets (DM basis).

	OHB	33HB	67HB	100HB
Corn silage	36.0	35.9	35.9	35.9
Alfalfa hay	15.3	15.2	15.2	15.2
Corn grain	20.2	13.6	6.7	-
Hulless barley grain	-	6.8	13.9	20.6
Others	28.5	28.5	28.3	28.3
CP, %	17.5	17.8	18.2	18.6
NDF, %	30.1	30.2	30.4	30.5
Forage NDF, %	18.4	18.3	18.3	18.2
Starch, %	30.7	29.9	29.0	28.2


**VT Dairy Complex – 18 months**  
*Ferreira's Lab – Hulless Barley*



Production performance


	OHB	33HB	67HB	100HB	SEM	L	Q	C
DMI, lb/d	59.2	54.6	51.5	57.0	1.94	0.08	0.01	-
MY, lb/d	90.9	91.1	91.3	90.6	3.63	-	-	-
Milk fat, %	3.43	3.45	3.91	3.52	0.18	-	-	0.03
Milk protein, %	2.98	3.07	3.05	2.99	0.06	-	-	-
Milk lactose, %	4.81	4.84	4.82	4.80	0.04	-	-	-
Efficiency, lb FCM/lb DMI	1.53	1.70	1.81	1.58	0.07	-	0.01	-

**VT Dairy Complex – 18 months**  
*Ferreira's Lab – Hulless Barley*




Nutrient total tract apparent digestibility (%).

	OHB	33HB	67HB	100HB	SEM	L	Q	C
DM	62.1	61.3	61.1	61.4	1.80	-	-	-
CP	60.3	60.5	61.0	62.4	1.89	-	-	-
NDF	38.7	36.6	35.6	38.3	3.71	-	-	-
Starch	97.3	97.7	97.9	97.7	0.17	0.01	0.02	-

- VT Dairy Complex – 18 months**  
*Ferreira's Lab – Hulless Barley*
- 
- Feeding Trial #2
    - Goal
      - Determine production performance, nutrient utilization, and milk fatty acid composition when including corn or hulless barley as starch source
    - Treatments
      - Low forage (40%) + hulled barley (LFD)
      - High forage (60%) + hulled barley (HFD)
      - Low forage (40%) + hulless barley (LFS)
      - High forage (60%) + hulless barley (HFS)


**VT Dairy Complex – 18 months**  
*Ferreira's Lab – Hulless Barley*



Composition of diets (DM basis).

	LFD	HFD	LFS	HFS
Corn silage	31.9	45.7	30.9	46.7
Alfalfa hay	12.0	17.6	12.9	16.6
Hulled barley grain	27.7	16.0	-	-
Hulless barley grain	-	-	27.7	16.0
Others	28.4	20.7	28.5	20.7
CP, %	16.3	15.9	15.6	15.3
NDF, %	33.3	30.5	31.1	30.7
Forage NDF, %	14.6	21.1	14.7	21.1
Starch, %	23.7	26.4	26.3	26.5

**VT Dairy Complex – 18 months**  
*Ferreira's Lab – Hulless Barley*



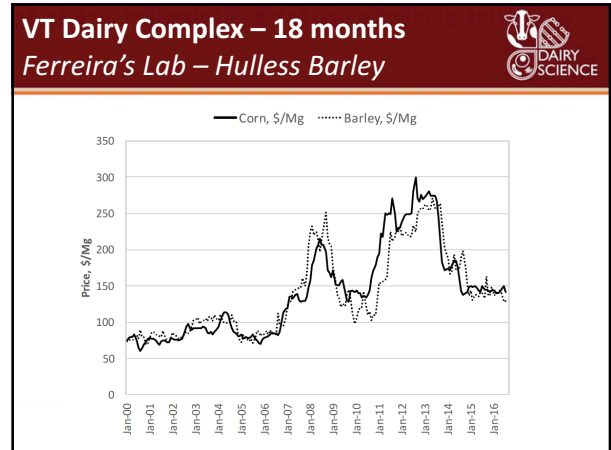
Production performance

	LFD	HFD	LFS	HFS	SEM	Forage	Grain	F × G
DMI, lb/d	59.7	53.8	58.2	57.8	2.57	-	-	-
MY, lb/d	93.1	90.9	91.8	91.0	2.84	-	-	-
Milk fat, %	3.60	3.92	3.40	3.89	0.20	0.01	-	-
Milk protein, %	3.11	3.07	3.14	3.07	0.12	0.01	-	-
Milk lactose, %	4.85	4.85	4.85	4.82	0.02	-	-	-
MUN, mg/dL	15.1	16.0	13.1	14.8	1.05	0.01	0.01	-
Efficiency, lb FCM/lb DMI	1.63	1.83	1.66	1.66	0.08	-	-	-

**VT Dairy Complex – 18 months**  
*Ferreira's Lab – Hulless Barley*



- Partial conclusions
  - Good performance with hulless barley
  - No indications of ruminal upsets
    - Milk components
    - De novo fatty acid synthesis



**VT Dairy Complex – 18 months**  
*VT Dairy Complex – Research Summary*



- 3 intensive metabolic trials
- 4 feeding trials
- 2 in vitro digestibility trials
- 3 rumen development trials
- 2 animal behavior and welfare trials
- 2 antibiotic resistance trials
- 1 mammary gland physiology trial

**VT Dairy Complex – 18 months**  
*Not As Simple As It Sounds*



- We cannot just “go ahead and do research”
  - Herd and Farm Committee (departmental) approves requests for animal and facilities use
  - Institutional Animal Care and Use Committee (IACUC) approves protocols for animal care and use
    - Compliance with regulations
    - Regular inspections





