Birdsfoot Trefoil: An Old Friend with a New Face

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History of BFT in Michigan

- Grown in USA since 1930s and UP since 1949
- UP historically one of the major BFT seed-growing regions of USA
- In 2-cut hay system or on marginal sites, BFT can outyield alfalfa in Michigan
- In more intensive systems, alfalfa yields more
- Typical Michigan yields, 3-4 ton/acre/yr

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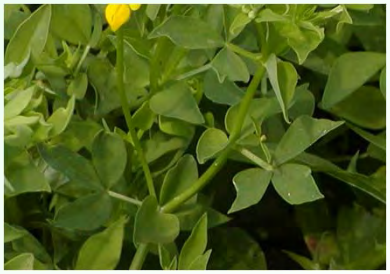
Characteristics

- Perennial legume
- Fine stems growing prostrate to erect
- Branching root system
- Indeterminant flowering and seed production
- Most regrowth from axillary buds on stems, NOT from crowns
- Readily reseeds itself, leading to long stand life
- High nutritional value
- Suitable for pasture, hay, or haylage



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Characteristics

1. Perennial legume
2. Fine stems growing prostrate to erect
3. Branching root system
4. Indeterminant flowering and seed production
5. Most regrowth from axillary buds on stems, NOT from crowns
6. Readily reseeds itself, leading to long stand life
7. Yield potential up to 6 ton/acre/yr
8. High nutritional value
9. Suitable for pasture, hay, or haylage
10. Contains condensed tannins

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What are Tannins?

- Class of secondary plant compounds
  - Hydrolyzable tannins (HT) – mostly bad
  - Condensed tannins (CT) – mostly good
- Chemical structure and activity specific to plant species
- Probable functions in plant:
  1. Defense against being eaten
  2. Protection from ultraviolet light

- "Astringency" reduces palatability and binds nutrients needed by herbivores
  - A little is good. Too much is bad.

- CT are found in many plants, but relatively few forages
  - lespedezas, sainfoin, trefoils, chicory

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Scientific papers published per year on topic of forage tannin

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BFT and Pasture Bloat

Pasture bloat occurs when stable foam forms in rumen and blocks escape of fermentation gases

How to prevent pasture bloat

- **Limit legumes to 50% or less of pasture**
- **Feed bloat preventatives (poloxalene, monensin)**
- **Feed dry hay on pasture or before turnout**
- **Avoid grazing wet pastures**
- **Avoid letting animals get too hungry**
- **Avoid grazing legumes altogether**
- **Cull bloat-prone animals**

OR… Graze birdsfoot trefoil!

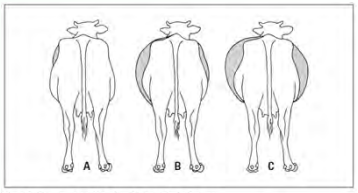

Figure 7 Three degrees of bloat: A - mild, B - moderate, C - severe

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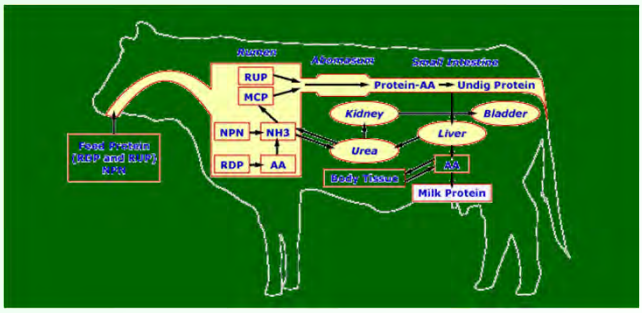
BFT and Escape Protein



1. **CT bind strongly to proteins, preventing microbial fermentation of protein in rumen**
2. **In acid abomasum, bond breaks, releasing protein for digestion**
3. **Improved protein digestion (increased milk and ADG)**
4. **Reduced ruminal ammonia**
5. **Less waste N in urine**

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BFT and Gastrointestinal Nematodes (GIN)

1. GIN are major production limitation for sheep and goats in humid regions
2. Anthelmintic resistance
3. *Haemonchus contortus* – blood feeding worm, can kill

4. Small ruminants eating CT (pasture or hay) are more tolerant of GIN loads
   - Direct interference of CT with GIN lifecycle?
   - Better protein nutrition?

5. Sheep grazing BFT in the UP had lower fecal egg counts (Dr. Richard Ehrhardt)

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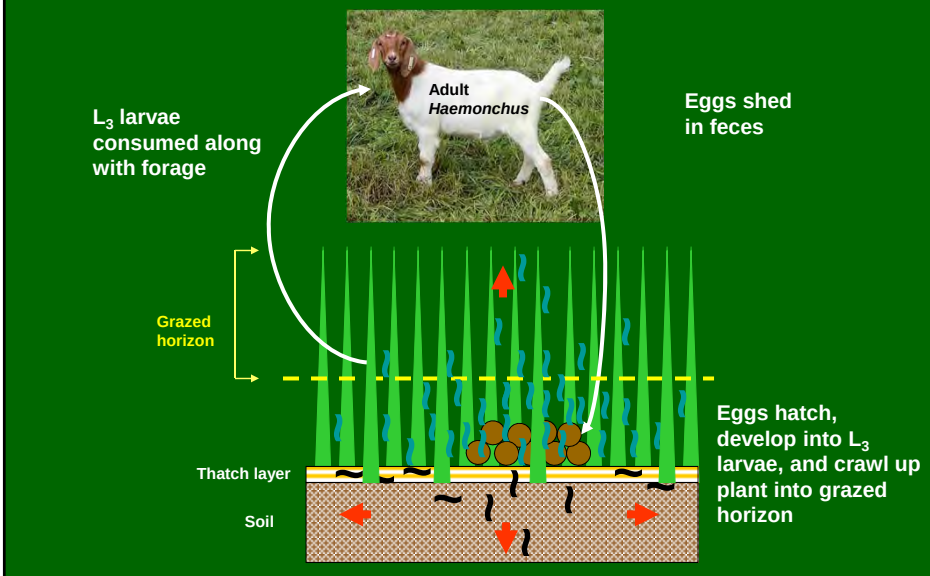

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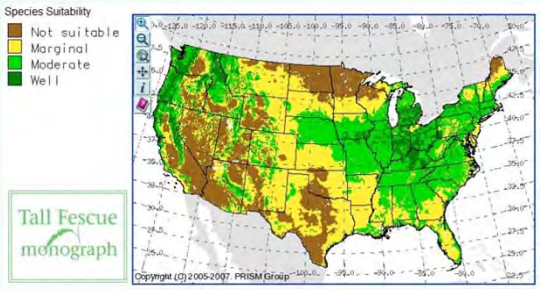
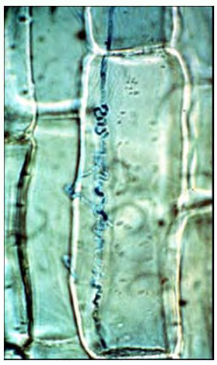
BFT and Plant Toxins

1. Tall Fescue endophytic fungus helps plant tolerate stress but produces alkaloid toxic to livestock
2. If offered BFT or CT forages first, livestock will eat more fescue alkaloid
3. Does CT bind and neutralize alkaloids?





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BFT and Greenhouse Gases

Enteric methane

1. Methane produced as waste product of fermentation in ruminant gut, estimated at ~25% of total CH_4 emissions
2. Cattle eating CT emit less enteric methane
   - Influences microbial population?
   - Reduced fiber fermentation?
   - Increased propionic acid production → More milk, increased ADG

Soil GHG Emissions

1. CT in forest soils reduce soil methane production
2. CT in dung reduces soil denitrification around dung pats
3. Reduced urine N excretion reduces NO_2 emissions and NO_3 leaching

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BFT and Meat/Milk Quality

1. Including BFT in Australian pastures reduced off-flavors in grass-fed lamb
2. BFT reduces saturated fats and increases omega-3 fatty acids in milk

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High-tannin Birdsfoot Trefoil Breeding Project

- Multi-state collaboration (AL, MI, UT, KY, MO, WV, WY), 2014 to 2017
- 3 objectives:
  1. Selection for persistence, flowering date, and condensed tannin content of accessions from national germplasm collection
  2. Selection for compatibility with tall fescue
  3. Effect of CT on soil N cycling in BFT/grass mixtures

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Genetic variability exists for flowering date and CT content
North American varieties tend to be low CT, especially Norcen

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How to Grow Birdsfoot Trefoil

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Managing BFT – Site Selection

- BFT is more tolerant of low pH, poor fertility, and poorly drained soils than alfalfa
- Alfalfa is more tolerant of droughty, sandy soils, and heat

- This does NOT mean BFT prefers marginal soils! It just means it can outperform many other legumes on marginal sites.

- A good site for alfalfa is often also a good site for birdsfoot trefoil
- BFT is poor choice for sandy, droughty soils, and muck

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Managing BFT – Choosing a Variety

1. Upright "European" varieties better for hay
   - 'Viking' (Cornell, 1930s)
   - 'Pardee' - Fusarium resistance, early maturity (Cornell, 1999)

2. Semi-upright, dual purpose
   - 'Norcen' – wide adaptation, good vigor in NORth CENtral region (1981), low CT
   - 'Leo' – improved seedling vigor (Canada)
   - 'Bull'
   - 'AC Bruce' - good cold tolerance & seedling vigor (Nova Scotia, 2006)

3. Prostrate varieties better for grazing
   - 'Empire' (Cornell, 1930s)

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Managing BFT - Establishment

- Seed may germinate unevenly over time (lots of hard seed)
- Seedlings are weak and competition MUST be controlled by cutting or well-timed grazing
- May not know if stand is "success" until second year if planted in mixture. BE PATIENT!
- Well-cared-for stands tend to thicken with time
- Have a back-up plan for what you will be feeding while BFT stand establishes

Seeding rate 4-10 lb/acre

1. Conventional seedbed
2. No-till (after chemical burndown)
3. Frost-seeding possible

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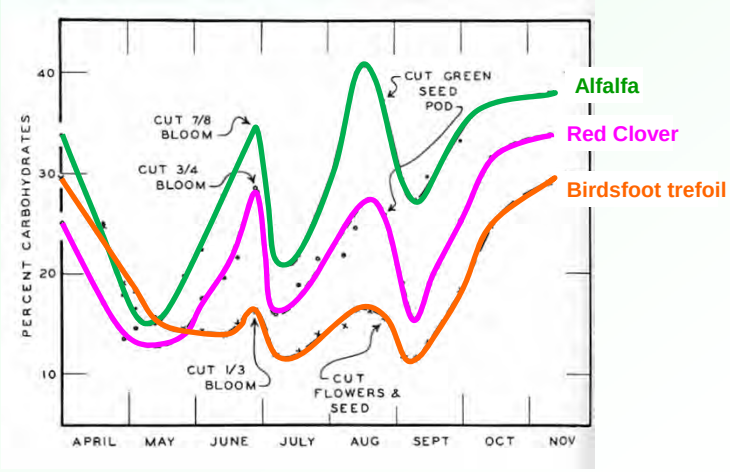
Managing BFT Harvest – Root Reserves



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Managing BFT – Hay and Haylage

- Two to three cuttings per year
- Leave at least 3 inch stubble to allow enough side buds to support regrowth
- Grass companion helps prevent lodging
  1. Orchardgrass
  2. Tall & meadow fescue
  3. Timothy
  4. Smooth brome

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Managing BFT Pastures

1. Rotational grazing is essential
2. BFT needs long rest period between grazings
3. Suitable pasture for dairy and beef cattle, sheep, and goats
4. Use "Take Half, leave half" grazing residual

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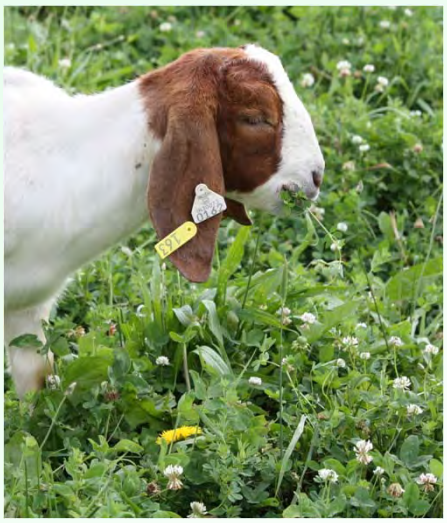

Goats like trefoil! ADG comparable to red clover and alfalfa (Cassida & Turner)

BFT mixed with orchardgrass or timothy was preferred by dairy heifers over comparable alfalfa mixtures (Berry, 2006)

BFT haylage produced more milk than alfalfa haylage (Hymes-Fecht et al., 2013)

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Great Lakes Forage & Grazing Conference

March 12, 2015
East Lansing, Michigan
"Improving Soil with Forages"
Keynote Speaker: Doug Peterson, NRCS

Other speakers:
Dr. Lisa Tiemann
Ben Bartlett
Dr. Kim Cassida
Jerry Lindquist
Phil Kaatz

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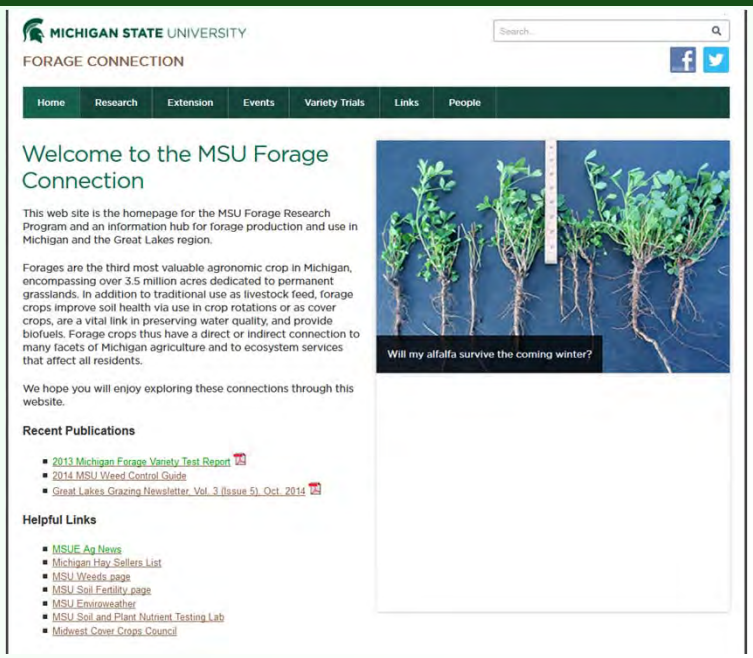

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