

Birdsfoot Trefoil

An Alternative Legume

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Disclaimer:

Birdsfoot trefoil is one of my favorite plants. We named our dairy goat herd “Trefoil Meadows”



Who Is Birdfoot Trefoil?



Birdsfoot Trefoil

Lotus corniculatus



Lotus Species

- 100-176 *Lotus* species worldwide, many in Mediterranean region
- 60 *Lotus* species native to North America's west coast



Lotus Species Used in Agriculture

- *Lotus corniculatus* - birdsfoot trefoil
- *Lotus uliginosus* (*L. pedunculatus*) – big trefoil
- *Lotus tenuis* – narrow-leaf birdsfoot trefoil





Birdsfoot



Trefoil – 3 leaflets at end of petiole,
also 2 at base,
a lumping with clovers/trifolium





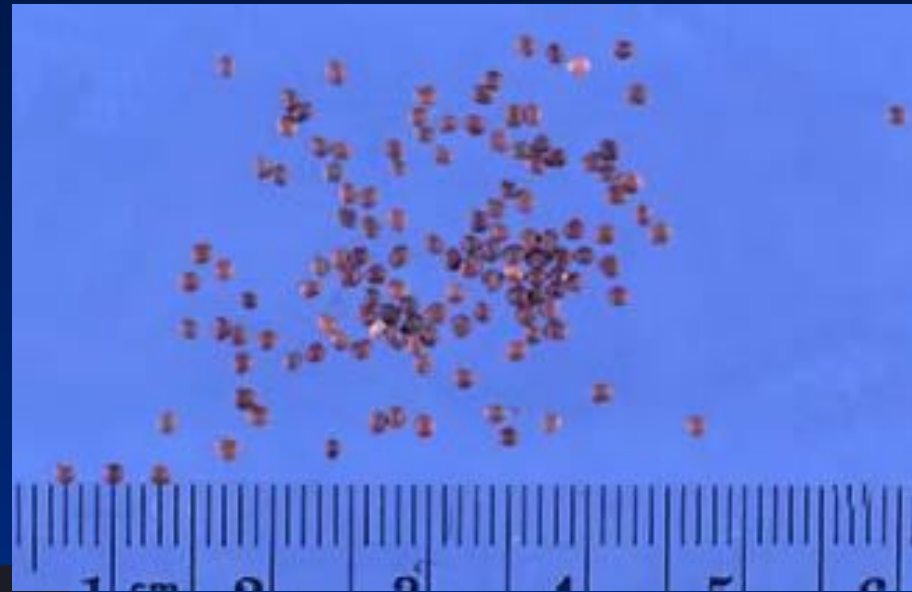
Michigan State Univ. Extension







agry.purdue.edu



extension.umn.edu



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Seed Size and Recommended Seeding Rates for Selected Legumes.

Species	Seeds/lbs	Seeds/sq.ft./ lbs/acre	Seeding rate lbs/acre
Trefoil	375,000	9	6-8
Alfalfa	200,000	5	8-12
Red clover	275,000	6	4-8
White clover	700,000	16	1-2

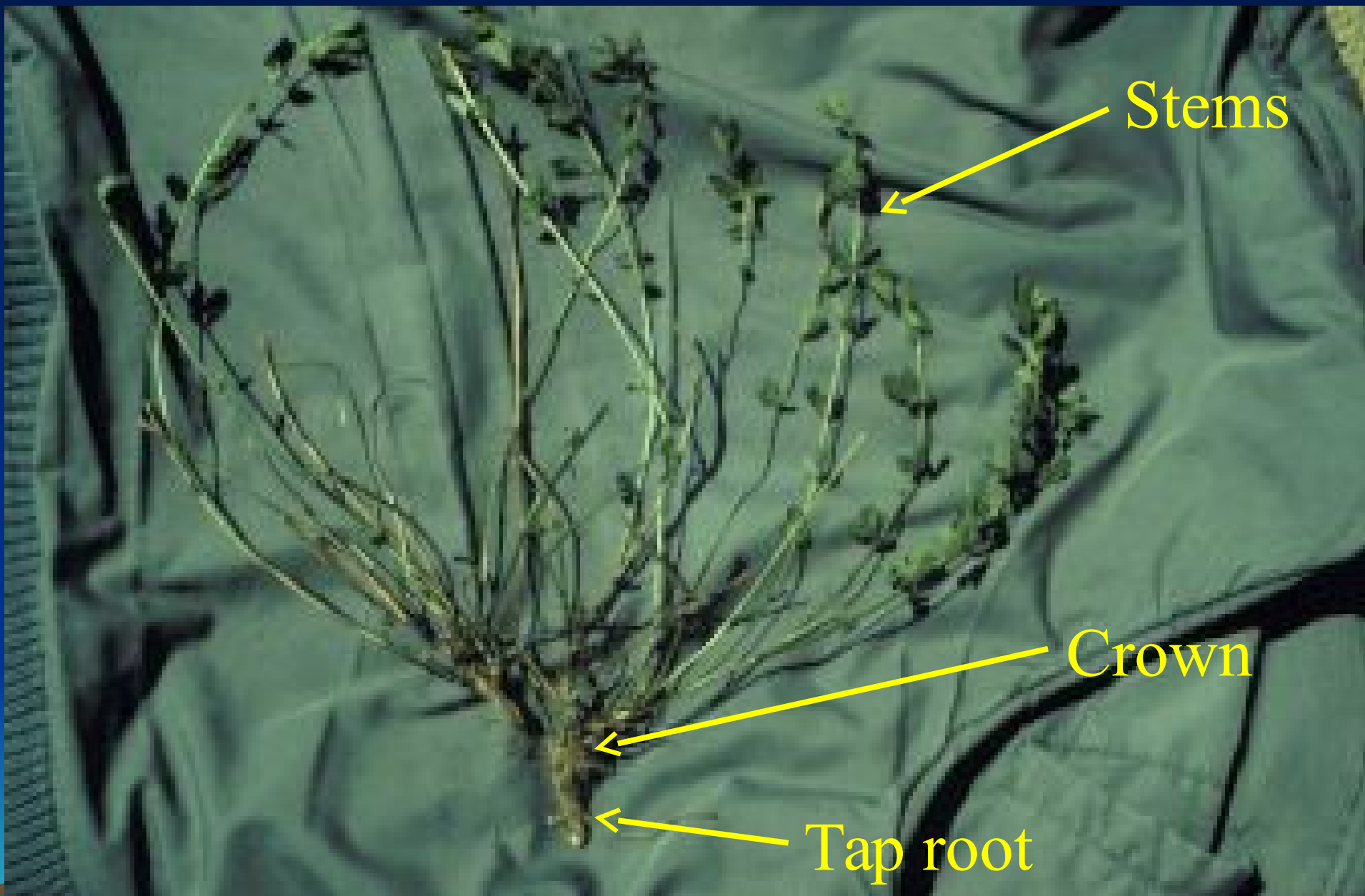


Seedling



Procumbent Plant





Stems

Crown

Tap root



Upright Growth

omafra.gov.on.ca

Procumbent Growth



Procumbent Growth on Road Side



Birdsfoot Trefoil Advantages (1)

- fix N from air (special rhizobia, *Rhizobium loti*)
- tolerates low pH
- tolerates poor soil drainage
- tolerates excessively drained soils
 - tap root
- All growth types do well under rotational grazing



Birdsfoot Trefoil Advantages (2)

- low bloat potential
- tannins in some varieties
 - by pass protein
 - parasite control/tolerance
- stands long lived through seedlings
 - thick stand can produce 400 lbs seed/acre
 - seed viable in soil for over 20 years

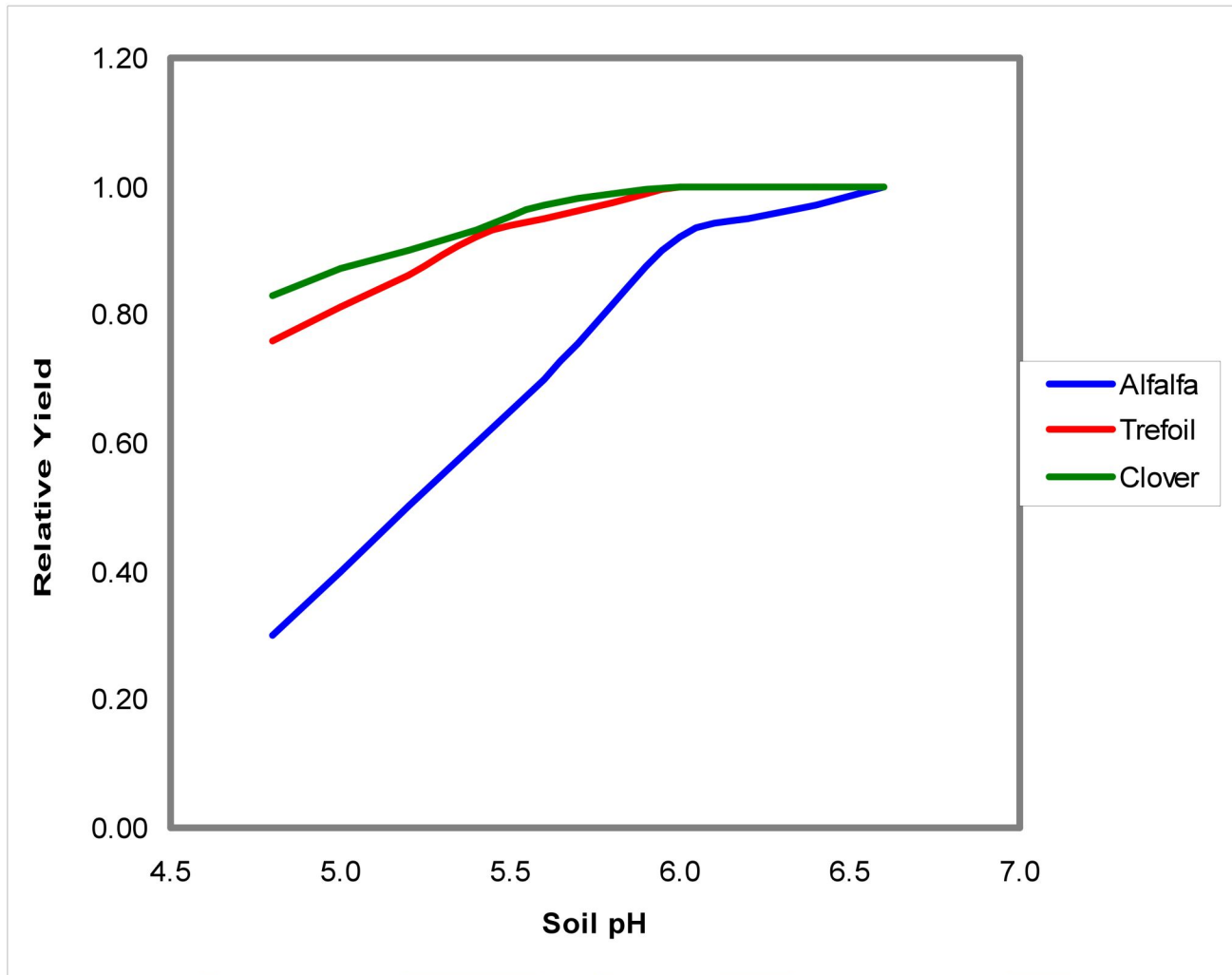


Birdsfoot Trefoil Weaknesses

- low seedling vigor
- slow establishment
- plants short lived
- needs adequate rest interval
- hay types not tolerant to set stocking
- need to allow seed to mature and set occasionally



Birdsfoot Trefoil Tolerates Low Soil pH



Birdsfoot Trefoil Tolerates Poor and Excessive Drainage.

Species	Tolerance to poor drainage	Tolerance to excessive drainage
Alfalfa	Low	High
Birdsfoot Trefoil	High	High
Red Clover	Medium to High	Medium to High
White Clover	High	Low
Alsike Clover	Medium to High	Medium to Low

Harvest Management Effect on Empire Birdsfoot Trefoil Yield and Stand Vigor at End of 2-Years.

Stubble Ht. In.	Frequency weeks	Last cut	Relative yield	Stand vigor
1	3	Late Aug	0.74	0.99
4	3	Late Aug	0.53	1.00
1	3	Early Oct	0.75	0.67
4	3	Early Oct	0.64	0.90
Pre-bloom	2 cuts	Late Aug	0.79	0.82
1/10 bloom	2 cuts	Late Aug	0.83	0.77
Full bloom	2 cuts	Late Aug	1.00	0.93
Mature	2 cuts	Late Aug	0.82	0.69

Harvest Interval of
6 Weeks (Full Bloom)
in Summer
Appears Best For
Optimal Yield.



Gain per day and animal days per acre for 842 lbs. steers grazing two birdsfoot trefoil varieties under two grazing managements.

Variety	Management	Gain per day	Animal days/acre
Empire	Rotational	1.16	229
	Continuous	1.02	196
Viking	Rotational	1.08	225
	Continuous	1.08	182

Van Keuren et al.

A stylized silhouette of a mountain range with several peaks, rendered in shades of brown and tan, positioned at the bottom of the slide.

Forage Yield Under Pasture and Hay Management on Multiple Sites in New York.

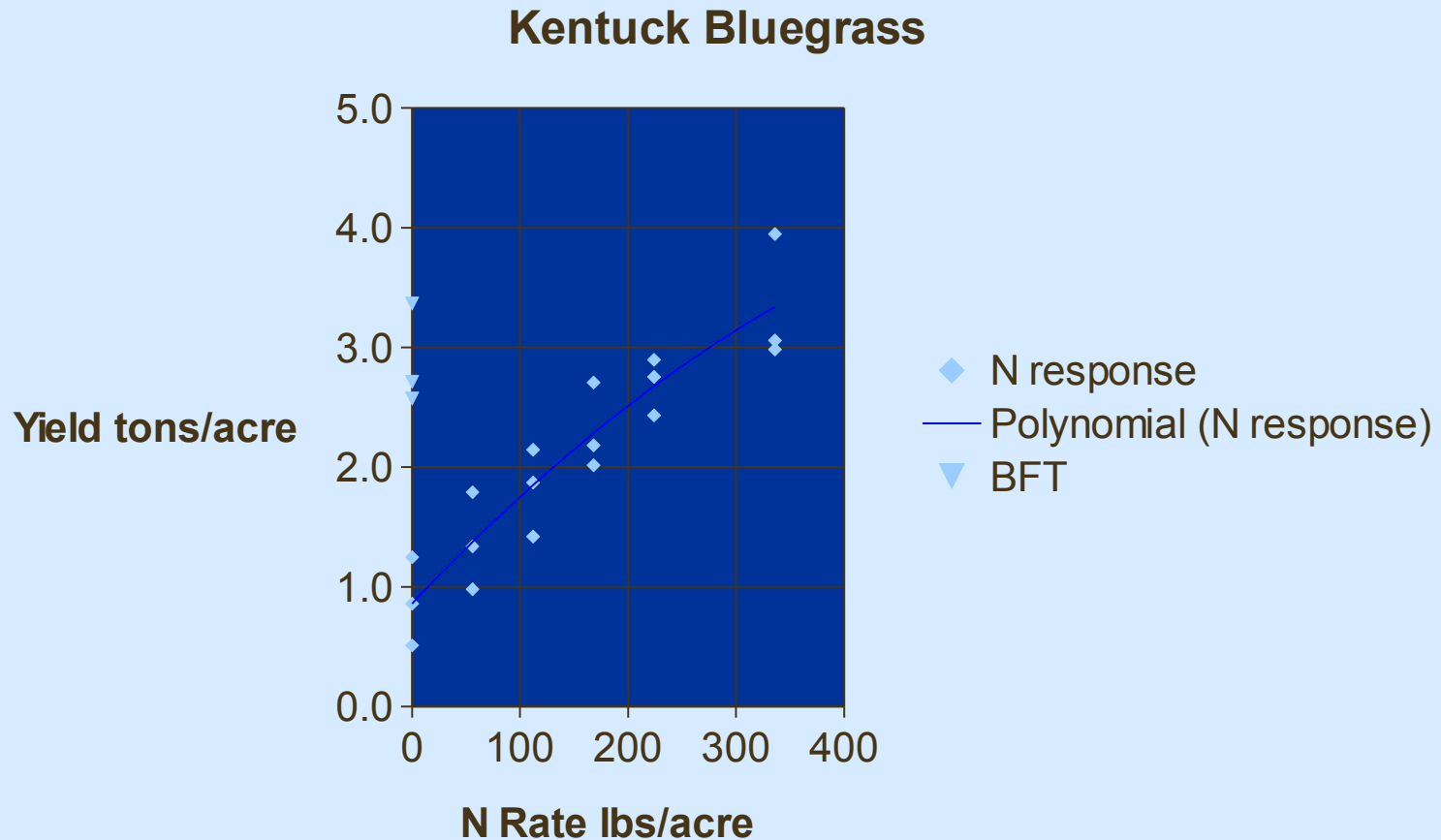
Species/ Variety	Tons/acre	SD	Site years
Pasture harvest			
Viking	3.33	0.76	23
Empire	2.81	0.66	23
Hay harvest			
Alfalfa	4.52	1.24	46
Viking	4.18	1.03	46
Empire	3.59	0.98	46

Birdsfoot Trefoil Fixes
45 to 150 lbs. N/acre/year

(text book answer)



Birdsfoot Trefoil-Grass vs. Nitrogen Fertilized Grass Yield



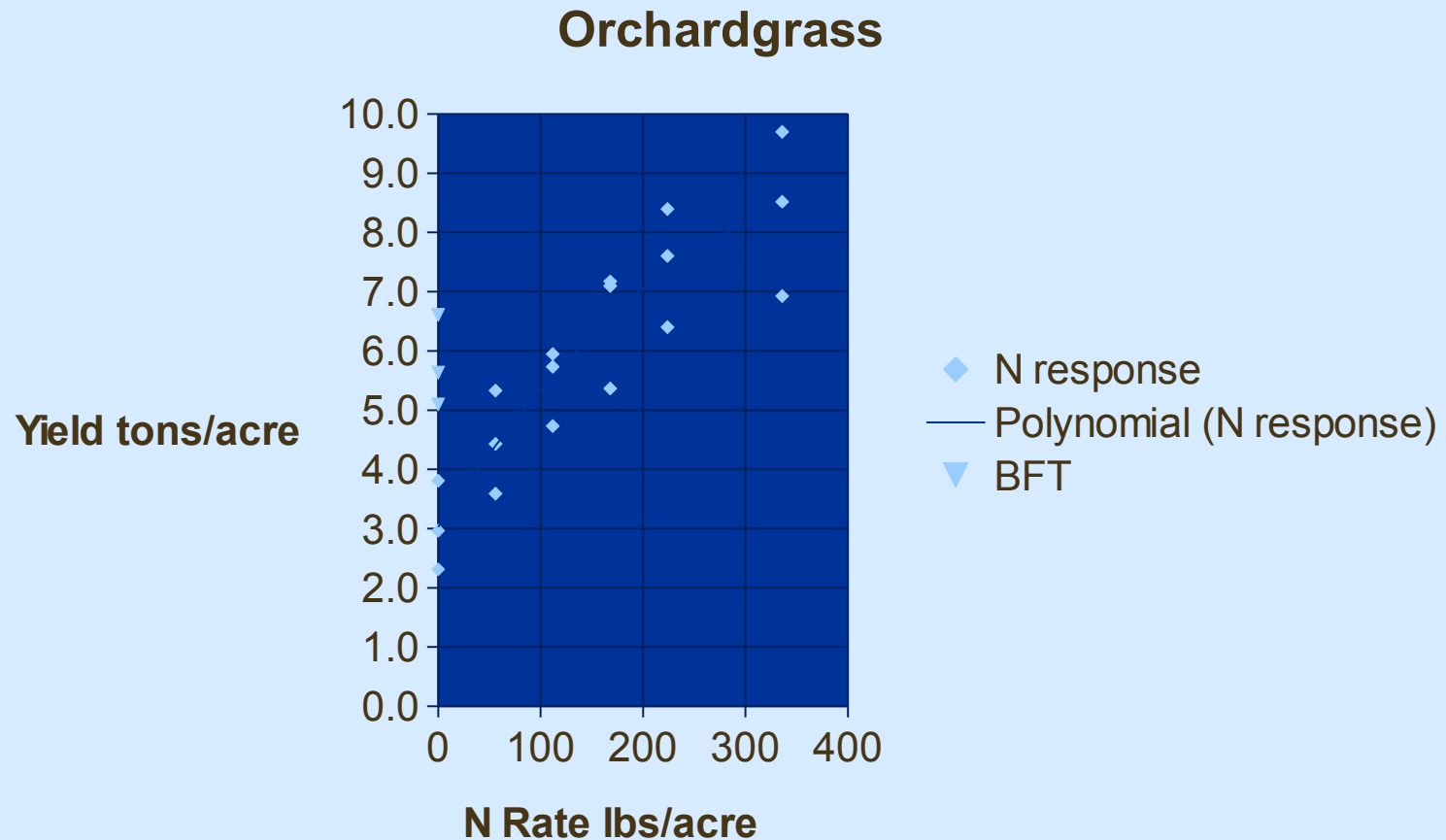
Comparing Yield of Birdsfoot Trefoil Grass Mixture

(yield potential of BFT, yield potential of grass given N fixed
by BFT, grass-legume competition within mix)

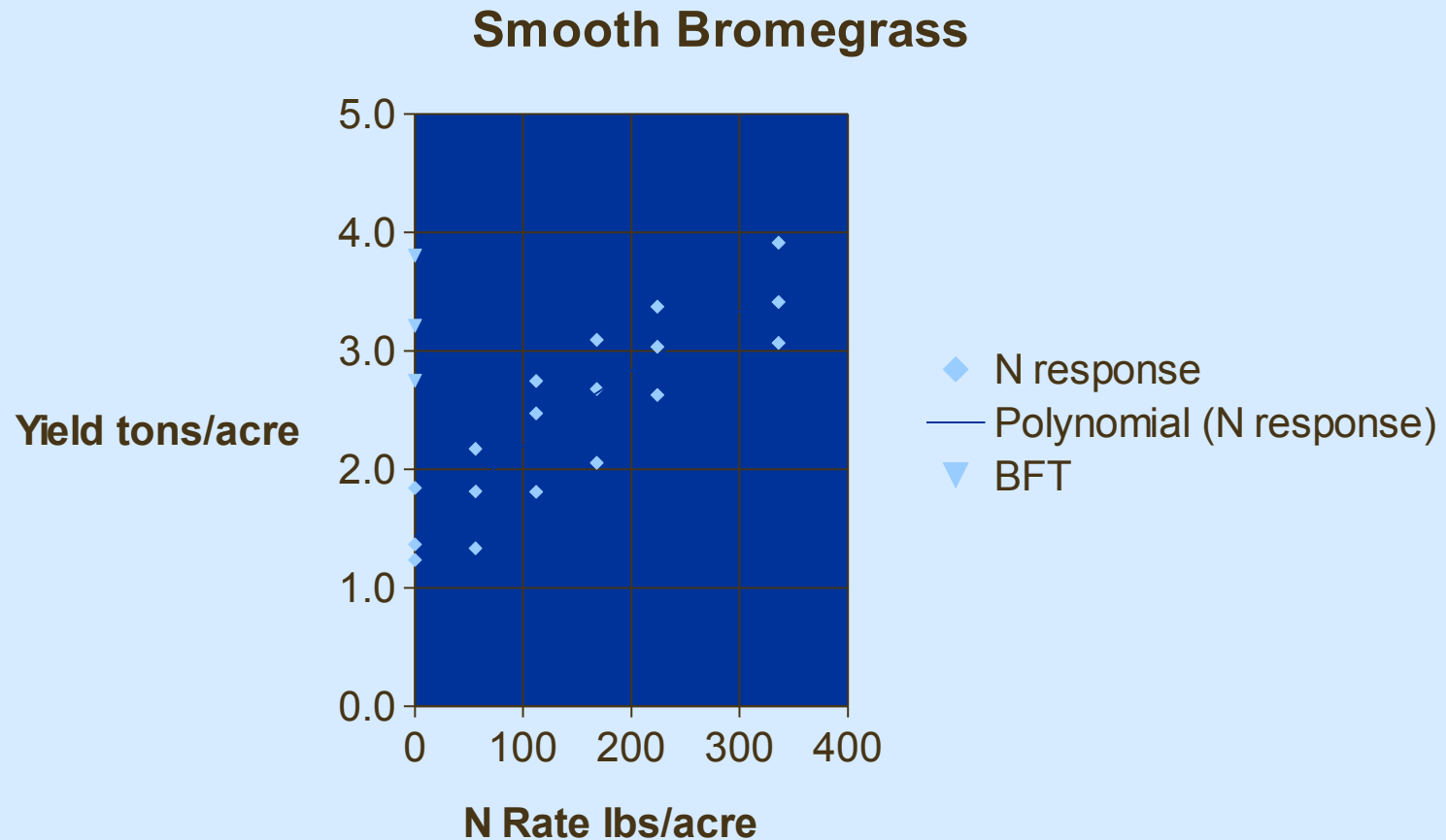
To
Yield Response of the Grass to N



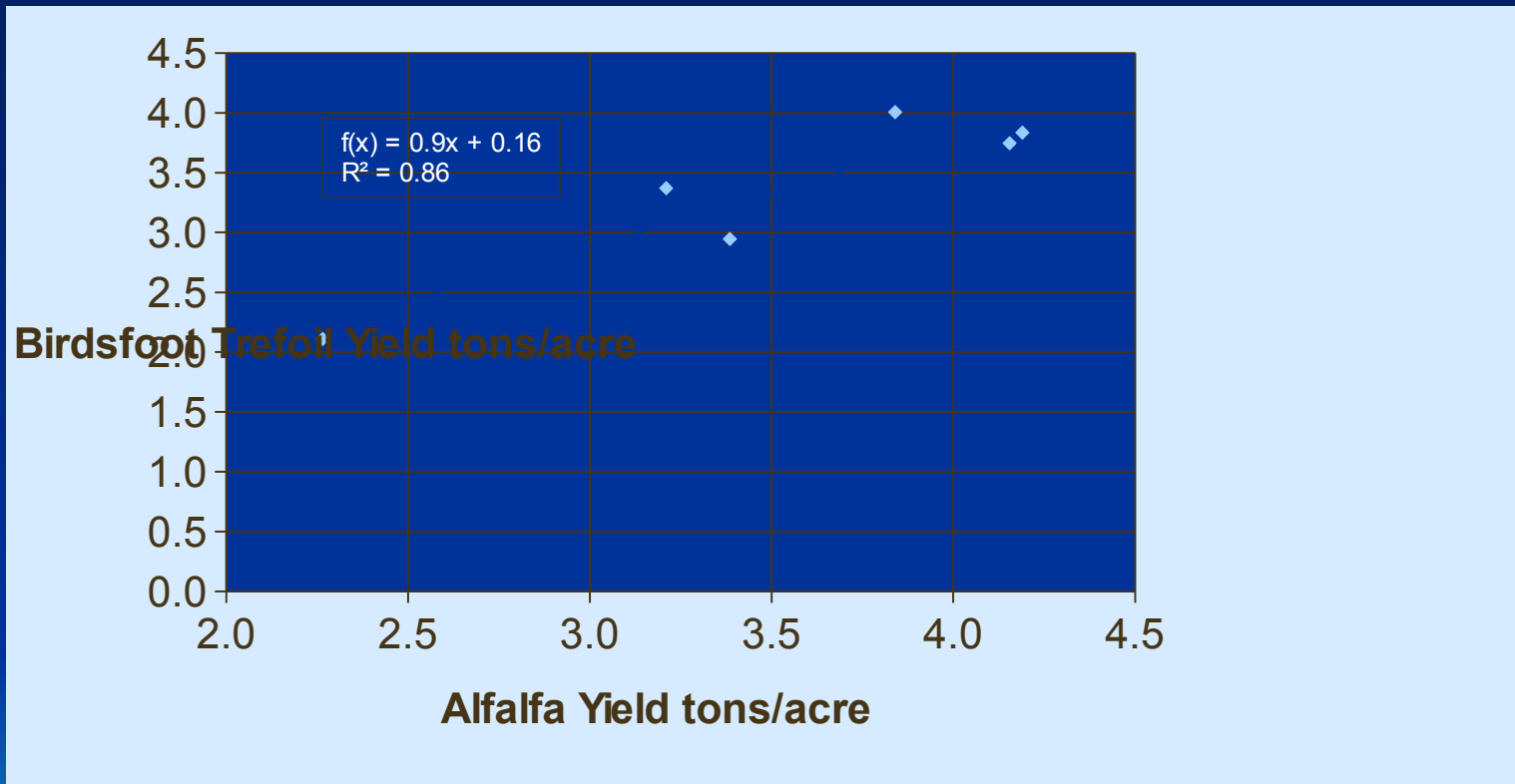
Birdsfoot Trefoil-Grass vs. Nitrogen Fertilized Grass Yield



Birdsfoot Trefoil-Grass vs. Nitrogen Fertilized Grass Yield

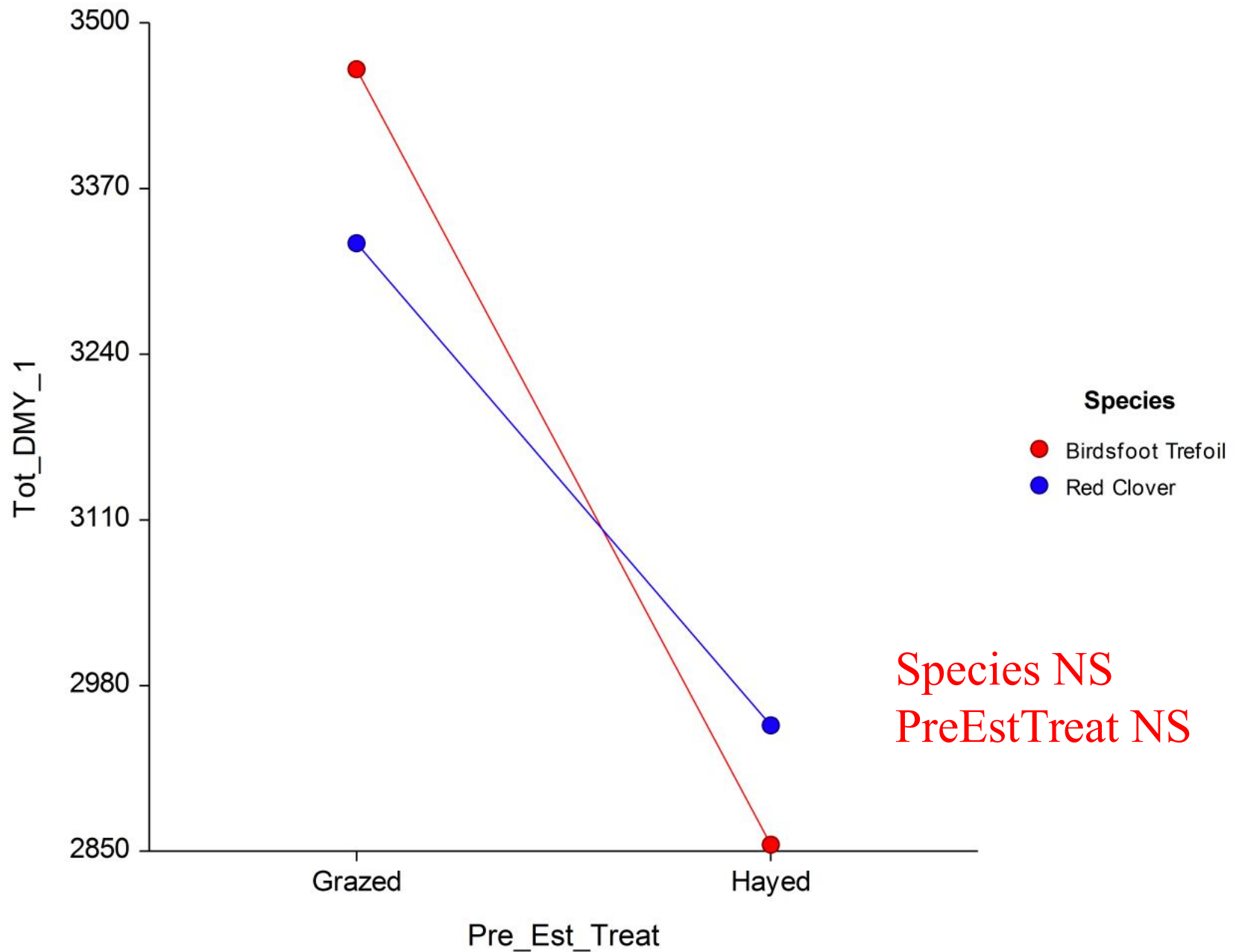


Birdsfoot Trefoil-Timothy Yield Compared to Alfalfa-Orchardgrass Yield.

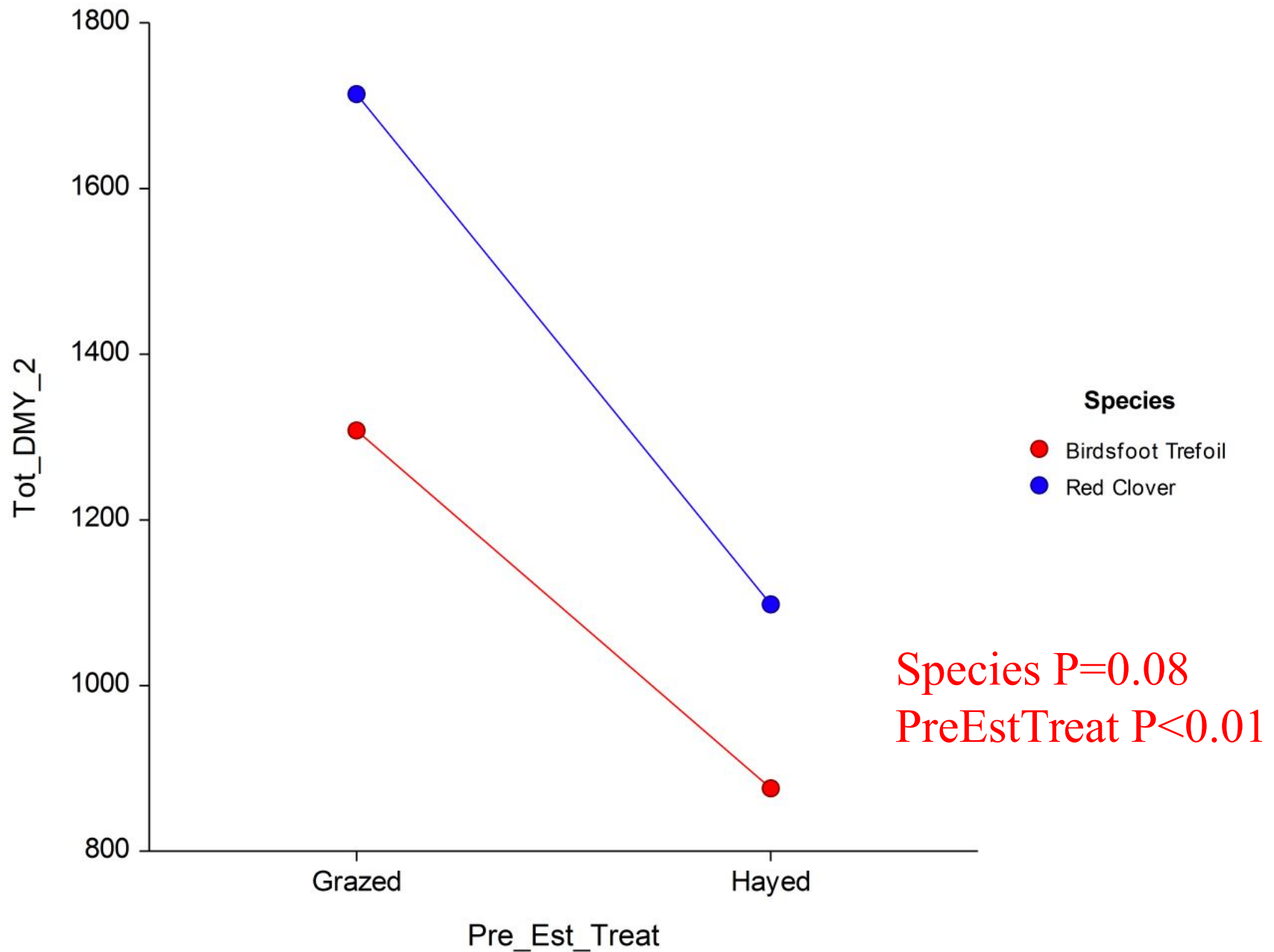


Koch and Estes Agron. J. 78:567

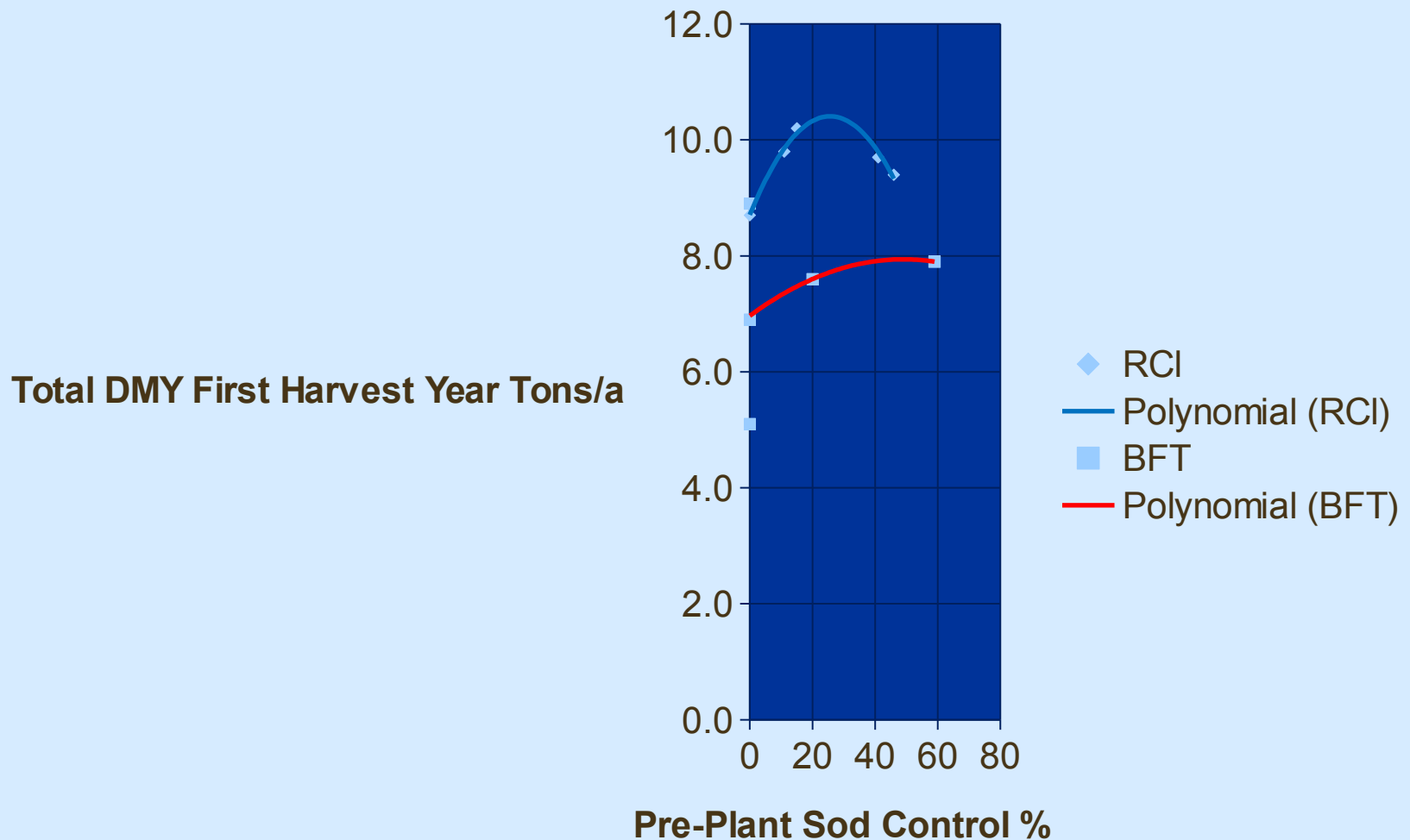
Means Plot of Tot_DMY_1 by Species



Means Plot of Tot_DMY_2 by Species



Competitive Advantage of Red Clover Over Birdsfoot Trefoil



Pasture Pharmacology & Birdsfoot Trefoil

- None Bloating
- Bypass Protein
- Anti Parasitic Value



Trefoil Produces Condensed Tannins (CT)

- CT complex with soluble protein in the rumen (reduces protein/bloat foam)
- This reduces protein digestion in the rumen
- Which allows protein digestion in the lower GI tract
- Providing high quality amino acids directly to the animal.



Condensed Tannins (CT)

- CT are polymers of flavanol units
- CT accumulate in the vacuole of the epidermal and subepidermal layers of the leaves (also fruits, bark, seeds, roots)
- CT are produced by dicotyledonous plants
 - i.e. grasses do not make them



Condensed Tannins (CT)

- CT are a chemical defense mechanism in plants
- CT concentration in plants is affected by
 - Genotype
 - Plant development
 - Environment/season
 - Herbivory



Condensed Tannins (CT)

- CT can affect the development of infective helminth larvae in the feces host animals
- CT may enable livestock to resist helminth parasites by providing bypass protein



Birdsfoot Trefoil Summary

- tolerates low pH
- tolerates poor soil drainage
- tolerates excessively drained soils
- requires special rhizobia, *Rhizobium loti*
- grows best under rotational grazing
- tannins provide low bloat, bypass protein, parasite inhibition/tolerance
- slow stand establishment



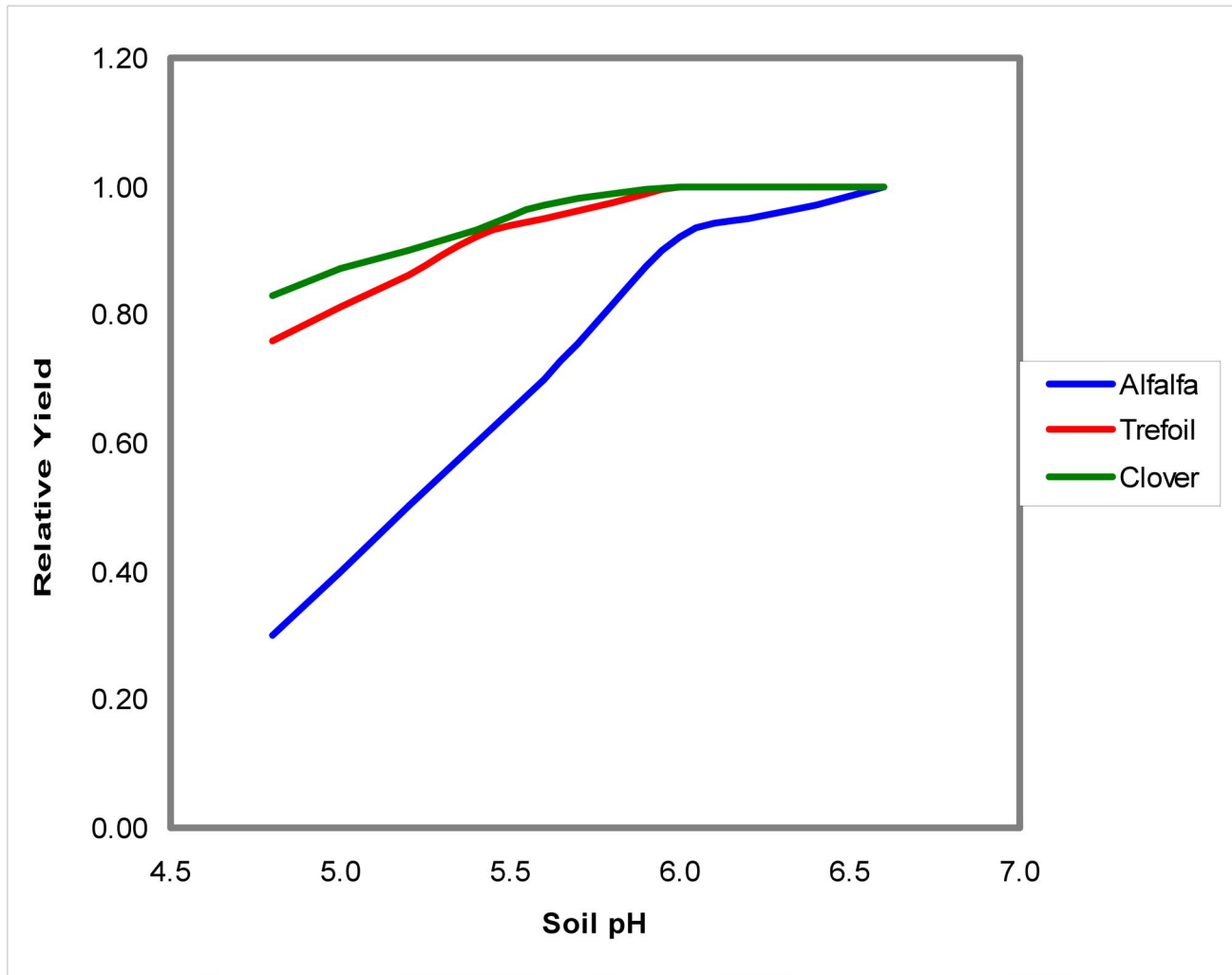




Lime for the Legume.



Soil pH Affects Legume Yield.











Alfalfa



Red Clover





