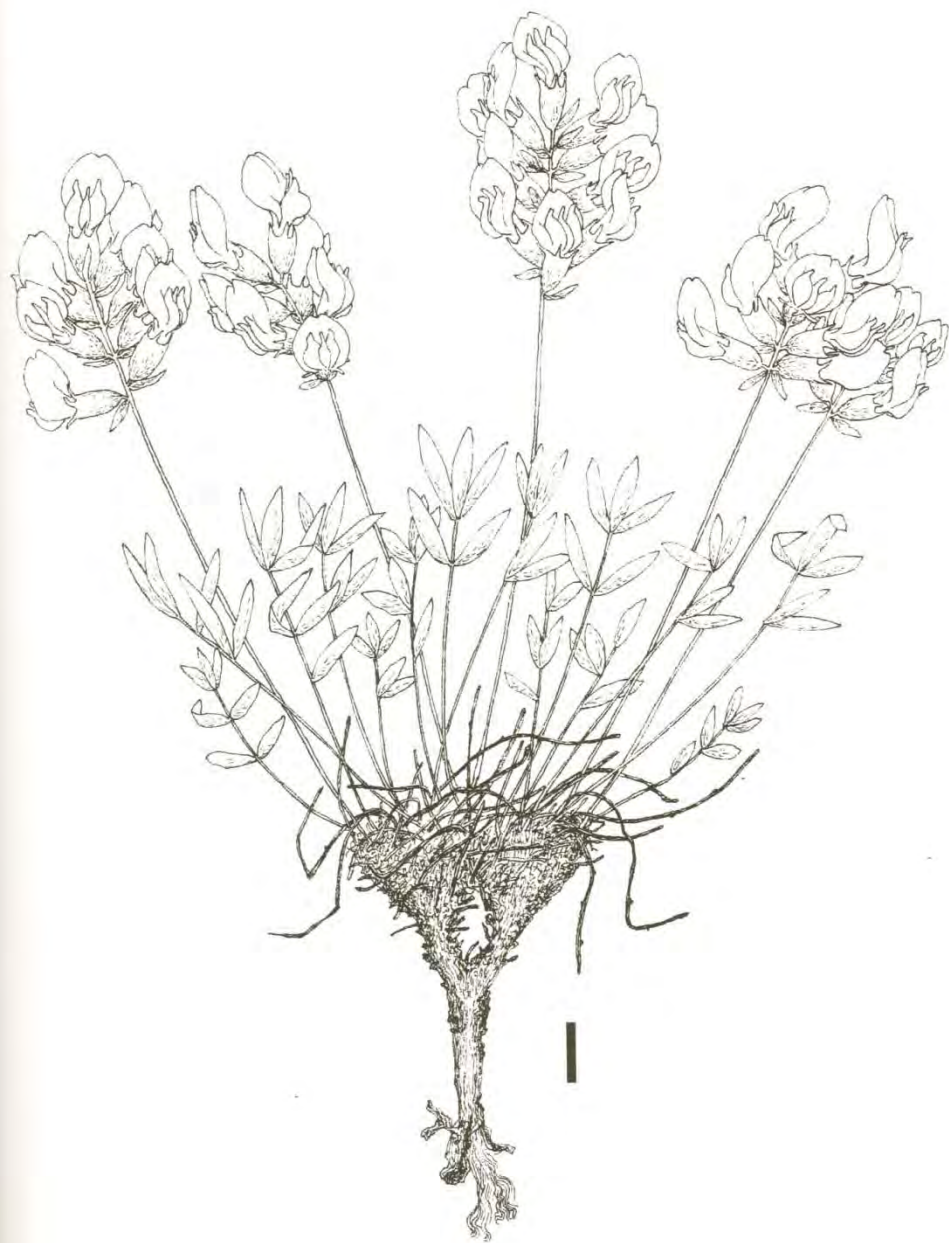


Toxic Astragalus and Oxytropis species in North America

Astragalus – 401 species, 207 varieties

Oxytropis – 22 species, 35 varieties

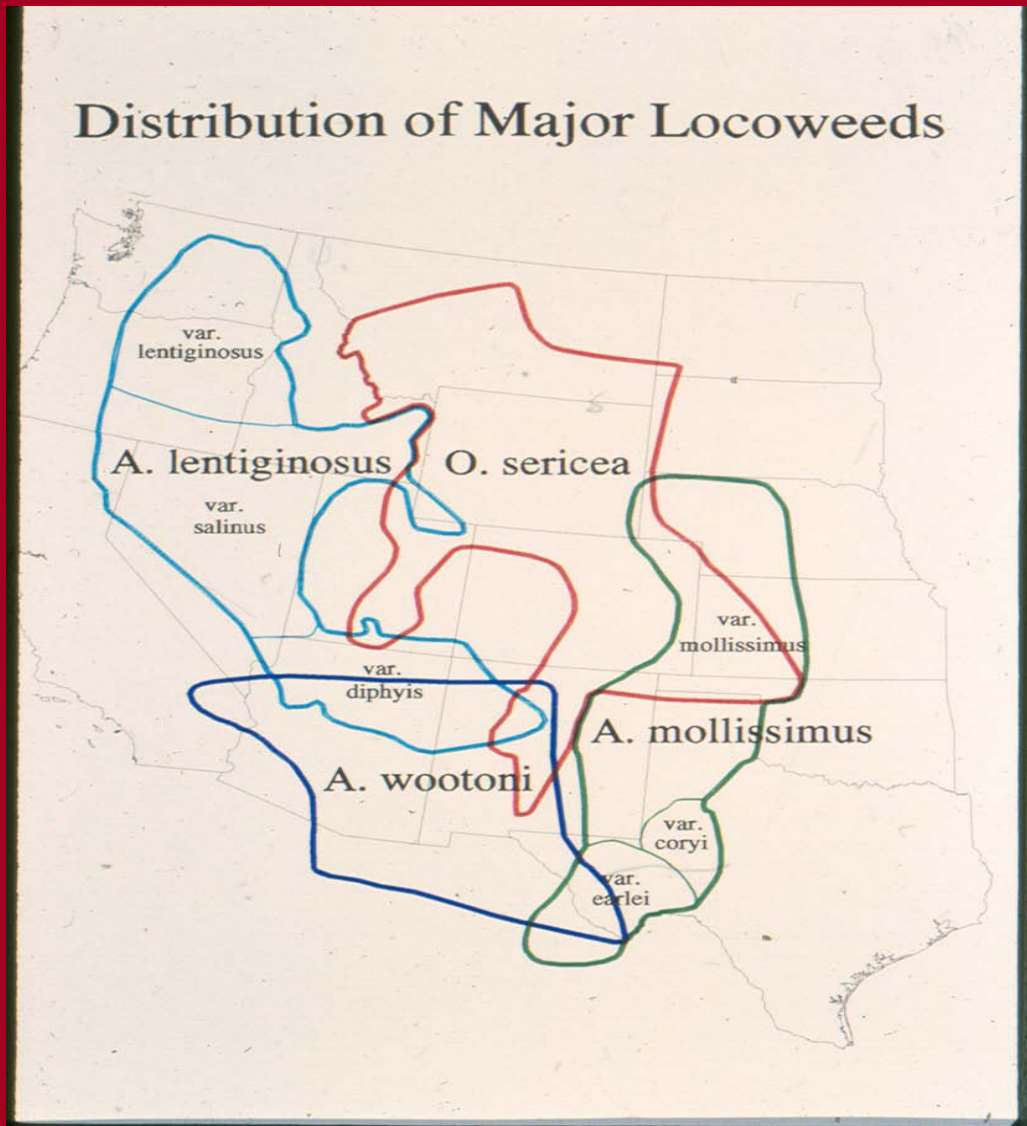
- Locoweeds (24 species)
Toxic alkaloid swainsonine
- Nitro-toxins (263 species and varieties)
3-NPOH
3-NPA
- Selenium accumulators (~20 species)





Locoweeds

Astragalus and Oxytropis spp.





Winter annual

Drought avoidance strategy

Germinate and grows in wet winter

Garbancillo (*Astragalus wootoni*)

Hot deserts of South West



Short - lived perennials

Opportunistic survival strategy

Boom and bust population cycles

Spotted loco (*A. lentiginosus*)

Woolly loco (*A. mollissimus*)

Green river milkvetch (*A. pubentissimus*)



Long – lived perennials

Stress tolerant survival strategy

White loco (*Oxytropis. sericea*)

Lambert loco (*O. lambertii*)

Locoweed Population Cycles

Spotted Loco (*A. lentiginosus* var. *diphysus*) n AZ, s UT

Outbreaks

1983-85

1991-93

1998

2008 ?

Requires 2 successive wet years

1st year seeds germinate –

plants not very apparent

2nd year grow into large robust

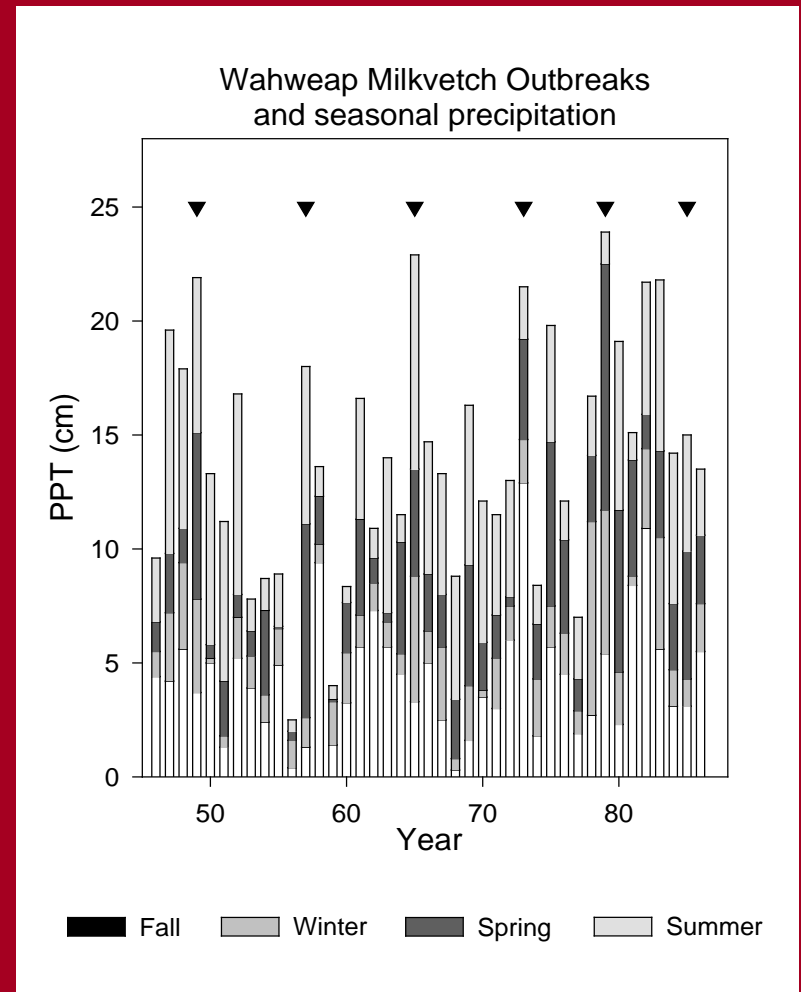
plants that dominate community



Wahweap milkvetch

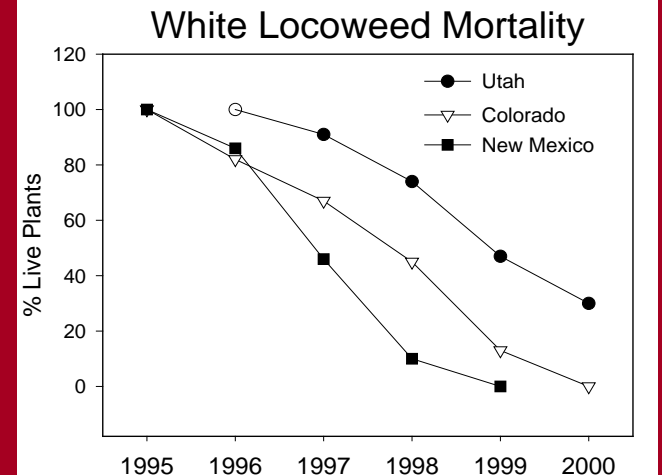
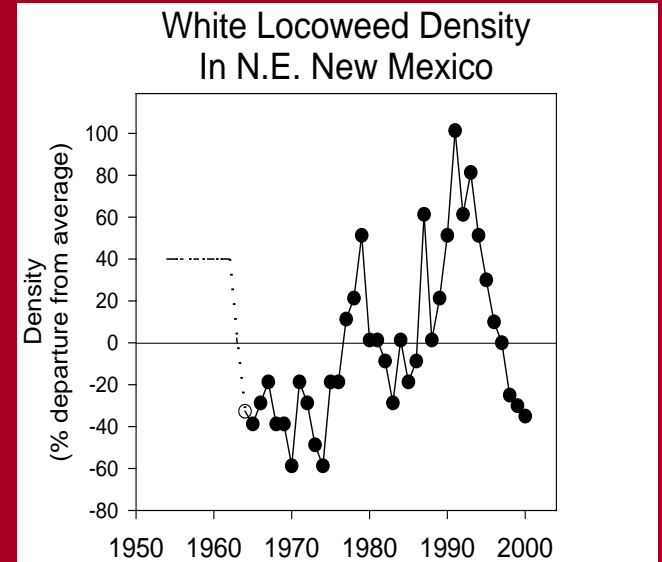
(*A. lentiginosus* var *wahweapensis*)

Henry Mt and Grand Staircase



White Locoweed

(*Oxytropis sericea*)



Locoweed Seed Ecology

Seed bank in soil

<u>Species</u>	<u>Location</u>	<u>Seed/m2</u>	<u>Viability</u>
O. sericea	Raft River UT	1500	93%
	Wheatland WY	700	89%
O. lambertii	Wagon Mound NM	1000	96%
A. lentiginosus var. salinus	Rosebud UT	400	97%
A. lentiginosus	Henry Mt UT	1800-4000	

White locoweed seed ecology

Raft River Mountain, NW Utah

- 8 plants/m²
- 87 seed/plant
- 700 seed/m²
- Seed bank in soil – 1500/m²
- 93% viable
- Longevity 50% remain viable after 6 yr
- Germination 1-21% (hard seed coat)

- Seed bank support population cycle
 - Germinate and establish when environmental conditions favorable
- Reduce long-term effectiveness of herbicide control

Catastrophic Loss to Locoweed

<u>Year</u>	<u>Species</u>	<u>Location</u>	<u>Loss</u>
1893	Woolly loco	Kansas	25,000 cattle
1918	Green river milkvetch	UT, WY	extensive loss
1958	“	UT	\$45,000 1 ranch
1964	“	UT	\$125,000 1 ranch
1996	“	UT	300 ewes died, 340 aborted
1964	Spotted loco	UT, NV	70 cows 12 horses

Ranch level loss to white locoweed

<u>Category</u>	<u>WY</u>	<u>UT</u>	<u>NM</u>
Ranch size (cows)	500	400	2500
Death loss (%)		+4	+5
Calf gains (lb)	-50	-20	
Calf crop (%)	-5	-15	-10
Cow wt (lb)		-300	-300
Replace heifer (%)	<u>+4</u>	<u>+5</u>	<u>+5-8</u>
Annual Total	\$36,339	\$30,698	\$220,000
Acres sprayed	7000	400	10,000

Economic Loss

Calf Crop

Grazing study, 1991

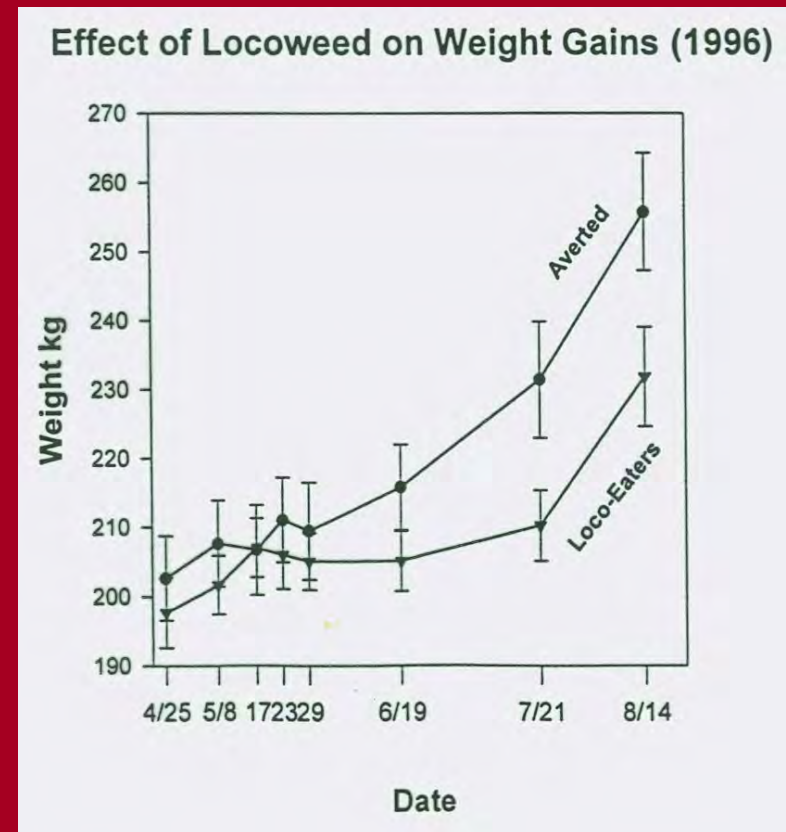
- 16 bred cows
- 4 calves died at birth
- 4 calves required assistance
- 1 cow died – premature birth
- 1 cow aborted
- Swainsonine passed in milk. All calves poisoned.

Weaning weight 380 lb

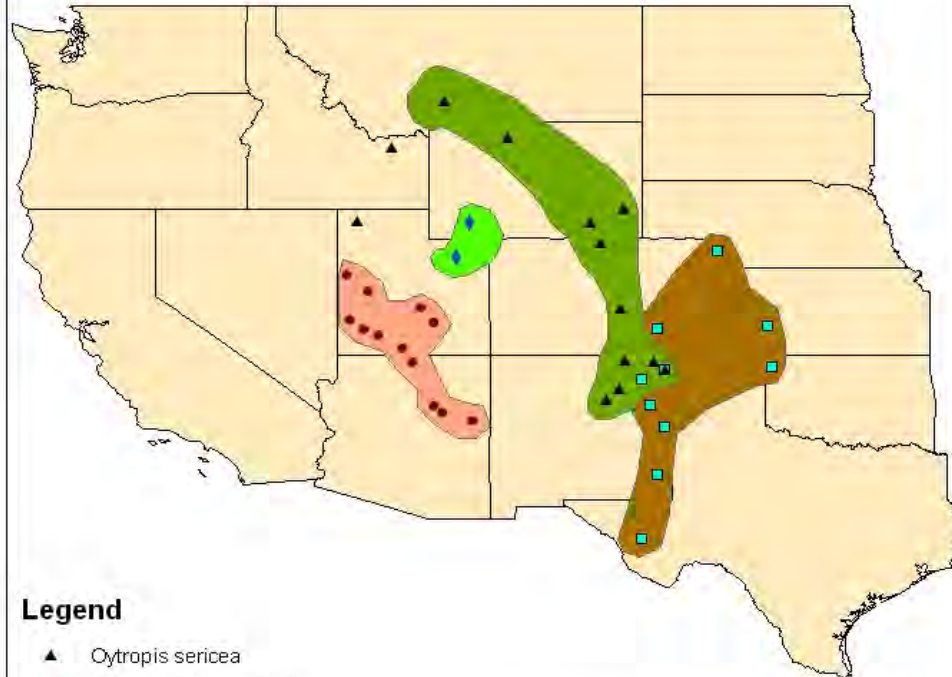
Average 480 lb

Weight Gains

Stocker grazing study 1996



Incidence of Locoweed Poisoning in the Western United States



Legend

- ▲ *Oxytropis sericea*
- *Astragalus lentiginosus*
- ◆ *Astragalus pubentissimus*
- *Astragalus mollissimus*
- *Oxytropis sericea* belt
- *Astragalus lentiginosus* belt
- *Astragalus pubentissimus* belt
- *Astragalus mollissimus* belt

Created for USDA-ARS-PPRL
February 2007



0 250 500 1,000 1,500
Kilometers

Conditions of Grazing and Poisoning

- Early reports confused loco poisoning with starvation.
Late winter / early spring, overgrazed ranges.
Locoweeds are increaser species.
- Chronic poisoning
- Locoweed is not addictive.
Relatively more palatable than associated species at times.

Conditions of Grazing and Poisoning

O. Sericea - Shortgrass prairies
Spring / fall, warm-season grass dormant



O. Sericea - Mountain summer ranges
Pod stage of growth



A. Lentiginosus - Desert winter range
Dead stalks as palatable as dry grass



A. Mollissimus – shortgrass prairie
Fall, remains green as grass dries



Locoweed Management Recommendations

- **Restrict Access during critical periods**
When loco is more palatable than associated forages.
- **Eat and Pull – remove animals that start eating loco.**
Prevent further intoxication.
Prevent social facilitation of others starting to eat loco.
- **Don't overstock loco-infested ranges.**
Grazing pressure can force animals to start grazing loco.
- **Conditioned food aversion.**
Train animals to avoid eating loco.
- **Fence loco infestations.**
Graze during summer when green grass is abundant.
- **Herbicide Control**

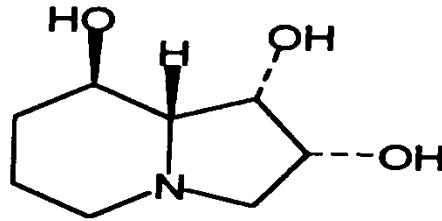
Locoweed Herbicide Control

Apply when soil temp. > 55F, moist, high humidity

<u>Trade Name</u>	<u>Chemical</u>	<u>Rate a.i.</u>
Tordon 22K	Picloram	.42 kg/ha
Stinger	Clopyralid	.14 -.28 kg/ha
Escort	Metsulfuron	.012 kg/ha
Grazon P+D	Pic + 2,4-D	.70 kg/ha

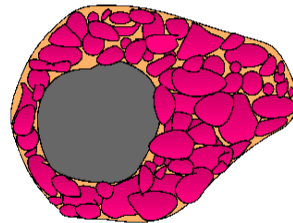


Locoweed Toxicosis



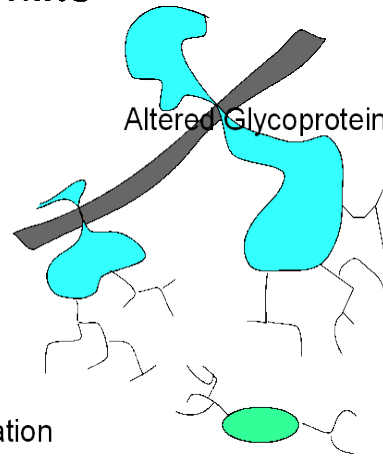
Swainsonine

α -Mannosidase Inhibition



Cellular Constipation

Altered Glycoproteins



Mannosidase II Inhibition

Reduced cell function and death

Affects all body systems

Neurological disturbance

Emaciation

Infertility

Brisket Disease

Impaired enzyme and hormone synthesis

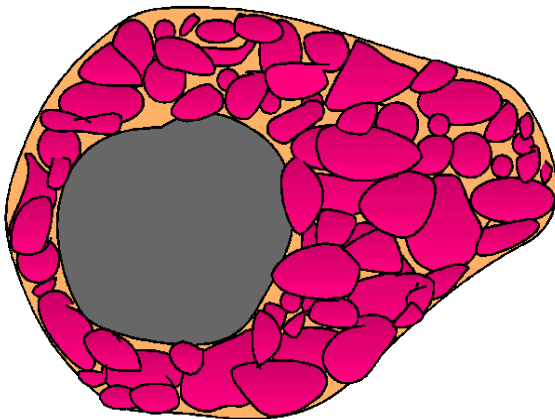
Cell-to-cell communication and movement

Immune dysfunction

Tumor metastasis

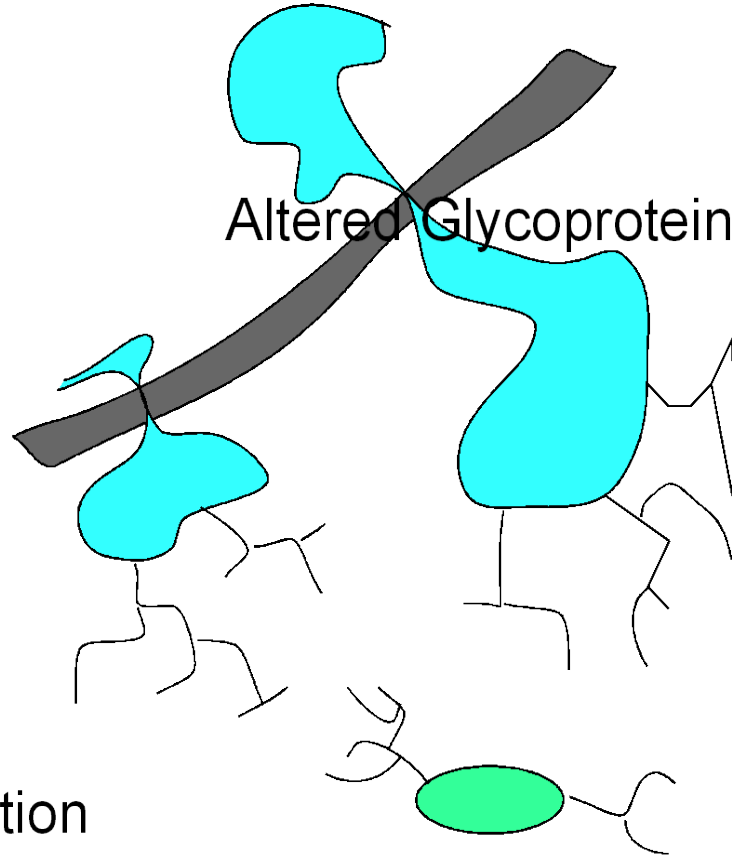
Action of Swainsonine

α -Mannosidase Inhibition



Cellular Constipation

Altered Glycoproteins



Mannosidase II Inhibition

Clinical Signs of Poisoning



Neurological disturbances

Depression / Belligerency

Impaired vision

Loss of motor control

Emaciation,

Wasting – die of starvation



Infertility

Male – reduced spermatogenesis and libido

Female – disrupt estrus, water belly, mothering instinct

Fetus – Abortion

Calf – swainsonine passed through mothers milk



Brisket Disease

Congestive right-heart failure



Astragalus spp. Containing Nitro Toxins

Toxin

3-nitro proponal (3-NPOH)

3-nitro propionic acid (3-NPA)

Mechanism

Oxidation of hemoglobin to methemoglobin – blood can't transport oxygen (chocolate brown blood)

Respiratory distress – roaring disease

Demyelination of spinal cord in lower back – weakness in hind quarters

Management

Avoid grazing in early growth when toxin is high

Summer rains can increase toxin level

Induction of rumen microbes to detoxify

Timber milkvetch
(*A. miser*)



Selenium accumulators

1. Primary accumulators 1000-7000ppm Se
Astragalus spp, Princes Plume (*Stanleya pinnata*)
Grow only on high Se soils
Take up elemental Se, convert to organic Se
2. Secondary accumulators 50-100ppm Se
Atriplex, *Aster*, *Gutierrezia*
Take up organic Se from primary accumulators
3. Forages and small grains (20-50ppm Se)

Selenium Toxicosis

- Se essential element in low doses
poor performance, reduced reproduction, white muscle disease
- Acute poisoning — from Primary accumulators
Abdominal pain, watery diarrhea, labored breathing, death
- Chronic poisoning (Alkali disease)
Lameness, sloughing of hoof, hair loss, impaired reproduction

