Poisonous Plants That Contaminate Hay and Forage in the Western United States

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Dec 13, 2013
Lupine spp.
Over 500 species of annual or perennial in North America
Over 150 quinolizidine/piperidine alkaloids have been identified
Agriculture

Weed causes epidemic of mutant calves

WASHTUCNA, Wash. (AP) — Spring calving season is off to a troubled start in Adams County, where an epidemic of deformities in newborns has left ranchers desperate.

About one of every five calves born in recent weeks has been put to death with a bullet to the head.

Ranchers say it’s the best way to end the misery of animals born with crooked calf syndrome. The malady leaves calves facing almost certain death from starvation or being eaten by...
Teratology

Cleft Palate (40–50 days)

Scoliosis

Arthrogryposis

Torticollis

Kyphosis

40–70 days
Lupine

Anagyrine (7.2)

Ammodendrine (134.4)
Mechanism of Action

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Neck flexure
Coronal histology views
Surgical Goat Model

- Utilizes *Nicotiana glauca* (anabasine)
- Cleft palate induced during days 32–41 of gestation
Cleft Palate in Humans

- 1 out of every 1000 live births
- 4 and 16 surgeries to repair
In utero Cleft Palate Repair

- Day 85 of gestation
- Privileged period of scarless healing
- Secondary tissue layers repair also

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VPI is characterized by absence of eloopharyngeal closure. Normal closure accomplished by the levator veli palatini (LVP) muscle.  

Hanes et al., 2006
Levator Veli Palatini Muscle Fiber Type

Normal palate: 100% Type I (slow) fibers

Cleft palate: 14% Type I (slow) fibers
86% Type II (fast) fibers
“They’re eatin’ mostly cactus, Doc. Is there a toxic principle in cactus that could account for their poor condition?”
Tremetone (1)

Dehydrotremetone (2)

3-Oxyangeloyl-tremetone (3)

A

B
What the most toxic plant in hay or prepared forages?
Rumen tympany (bloat)

- Truly remarkable pressure
- Soluble proteins, carbohydrates, tannins, plant stage (lush immature early in day), saponins
- Alfalfa (*Medicago sativa*), Red clover (*Trifolium pratense*), White clover (*T. repens*), Rarely Subterranean clover (*T. subterraneum*)
Nitrate Accumulating Plants
- Species
- Heavy fertilization
- Drought, rainy season after drought, cloudy weather, early in the morning, decreased temperatures, herbicides
- Nitrates in water, silage juices, manure pits
- Retained and even higher in hay

Forages toxic >10,000 ppm (1%) dry weight basis
Pyrrolizidine Alkaloid Containing Plants
6000 Plants with 660 Alkaloids

- **Boraginaceae**
  - Amsinckia intermedia (tarweed)
  - Borago officinalis (borage)
  - Cynoglossum officinale (hound’s tongue)
  - Echium plantagineum (echium)
  - Heliotropium europaeum (heliotrope)
  - Symphytum officinale (comfrey)

- **Compositae**
  - Senecio (1200 species)
  - S. jacobaea (tansy ragwort)
  - S. vulgaris (common groundsel)
  - S. longilobus (threadleaf groundsel)
  - S. riddellii (Riddell groundsel)

- **Liguminosae**
  - Crotalaria (600 species)
  - C. sagittalis (rattlebox)
  - C. spectabilis (showy crotalaria)
  - C. retusa (wedge-leaf rattlebox)
  - C. pallida (smooth crotalaria)
  - C. juncea (sun hemp)
Food and Feed Quality Risk Assessment
AN OUTBREAK OF HEPATIC VENO-OCCCLUSIVE DISEASE IN NORTH-WESTERN AFGHANISTAN

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Summary  Following a 2-year period of severe drought a very large number of patients with massive ascites and emaciation were observed in north-western Afghanistan. Clinicopathological study

Afghanistan: “Charmak” disease kills people and livestock

16 December 2008 – Over 270 people have been diagnosed with a hepatic veno-occlusive disease (VOD), locally known as “camel belly” or “charmak” disease
Conium maculata

Poison Hemlock
Solanum spp.
Datura spp. (Jimsonweed or thornapple)
Hyoscyamus niger

Henbane
**Asclepias subverticillata** (western whorled milkweed)

- Neurotoxic cardenolides
- Unpalatable, but horses eat them in hay
- Central stimulation, convulsions and rapid death
- Lethal dose 0.05% BW dm in hay
Centauria spp.

Centauria repens
(Russian knapweed)
Centauria solstitialis
(Yellowstar thistle)
Chewing Disease
Cyanogenic Plants

- *Sorghum* spp. (Sudan, Johnson grass, sorghum and hybrids)
- *Triglochin* spp. (arrowgrass)
- *Prunus* spp. (Plums, cherries, chokecherries, wild black cherry, plum thickets)
Acknowledgements

- Kip Panter
- Dale Gardner
- Steve Colegate
- Stephen Lee
- Kevin Welch
- Zane Davis
- Ben Green
- Daniel Cook
- Mike Ralphs
- Jim Pfister
Resource List

- USDA/ARS Poisonous Plant Research Laboratory – 435-752-2941
  http://www.pprl.ars.usda.gov/


- State Animal Disease Diagnostic Laboratory – Contact your local or state veterinarian
  http://www.usu.edu/uvdl (Utah State Diagnostic Laboratory) or
  http://www.aavld.org/mc/page.do?sitePageId=33930&orgId=aavld
  (laboratories accredited by American Association of Veterinary Diagnostic Laboratories)

- Local Herbarium – Contact your local county agent or your Land Grant College or University
  http://herba.msu.ru/mirrors/www.helsinki.fi/kmus/botmus.html (lists of public herbaria throughout the world)

- Microscopic analysis of feces and ingesta – Texas Veterinary Medical Diagnostic Laboratories 1-888-646-5623
  http://tvmdlweb.tamu.edu