

A Rapid Field Diagnosis for High Nitrate Levels in Forages

S. D. Cash^{*1}, G. Snyder², T. Lane³, D. Phillips⁴, and J. Hager¹

¹ Animal & Range Sciences Department, Montana State University, Bozeman, MT 59717 Montana State University Extension Service
County Agricultural Agents, Roosevelt County², Culbertson, MT 59218;
Toole County³, Shelby, MT 59474; Fergus County⁴, Lewistown, MT 59457



Abstract

Cereal forage crops have gained rapid acceptance for livestock producers in Montana and the northern Great Plains. In dryland farming systems, several varieties of cool-season cereals such as wheat, barley, oat, triticale and spelt are excellent hay crops. Currently, there are several hundred thousand acres of cereals harvested as hay, and these are displacing traditional alfalfa or alfalfa-grass mixes on dryland. Unfortunately, when these crops are grown under droughty conditions, cereals can accumulate levels of nitrate (NO_3) that are toxic to livestock. High forage nitrate levels can cause many chronic symptoms, but in extreme cases result in abortions and death. Several laboratory or field tests are used to test forage nitrate levels. In Montana, a qualitative nitrate “spot” test has been used since the 1960’s. In 2000, we formalized the MSU Extension Service “Nitrate QuikTest”, and this program requires annual training and certification similar to that for pesticide applicator licensing. All training materials and examinations are available both on-line and hard copy. Since 2000, we have certified 54 people in 31 counties to use the QuikTest, and over 4300 field tests have been conducted for producers. The Nitrate QuikTest has had an immediate impact in Montana counties where livestock producers have avoided animal losses of several million dollars annually due to feeding high-nitrate hay.



Introduction

- **Cereal forages are widely adapted for dryland, short growing seasons in northern Great Plains.**
- **300,000 acres in Montana (2000-2002).**
- **Barley, wheat, oat, triticale, spelt.**
- **Well-balanced roughage.**

Problem

Nitrate accumulation can occur in stress conditions (drought, frost, overcast, etc.)

Nitrate (*Nitrite*) Toxicity

Abortion, reduced milk production, weight loss, muscle tremors, cyanosis, DEATH

Diphenylamine Blue “Spot” Test

Qualitative Test*:

- Diphenylamine (0.5g) in 20 ml H₂O.
- Concentrated 98% sulfuric acid (to 100 ml).
- Test used in Montana since 1960's, but discontinued in 2000 due to liability and budget concerns.

Rapid blue staining of stem nodes indicates potentially high nitrate.

**Helwig, D.M. and B.P. Setchell (1960). Observations on the diagnosis of nitrate poisoning in sheep. Aust. Vet. J. 36:14.*

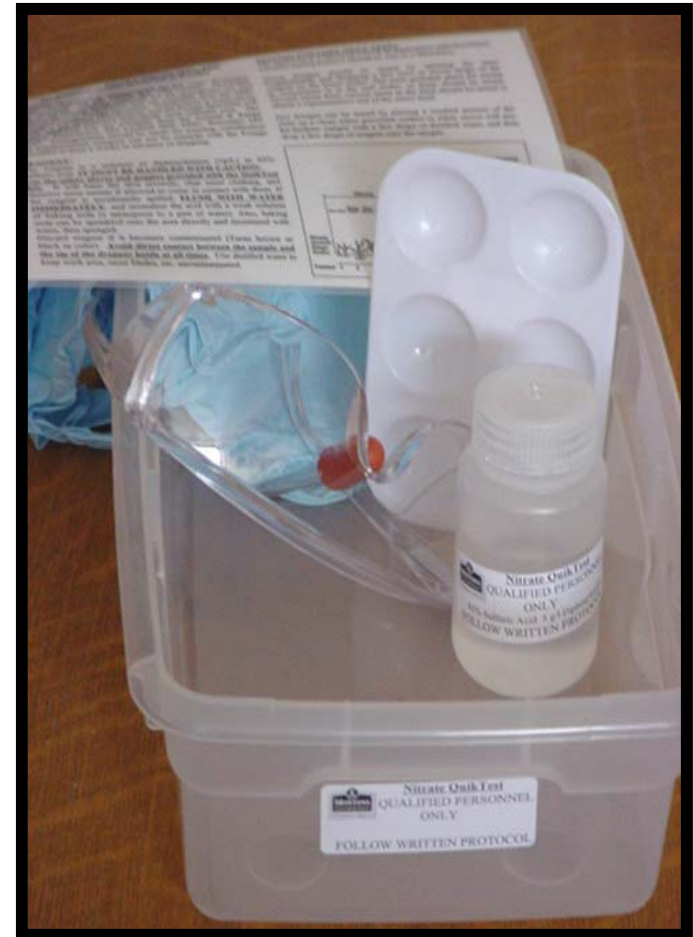
www.noble.org/pressrelease/poisonForage



Solution

Nitrate “QuikTest” Program

- Formal MSU-ES training and certification program for agents, crop advisors and producers
- Similar to pesticide applicator licensing



QuikTest Kit

Educational Methods

1. Specialist developed and tested Nitrate “QuikTest” protocol.
2. Training materials and kits distributed to certified agricultural agents.
3. Samples evaluated on-site or in county offices by trained personnel prior to harvest.

“Agent Intranet Page”: 

<http://animalrangeextension>

Montana State University
Extension Service

[Animal & Range Sciences](#)



Nitrate QuikTest

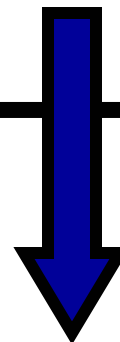


- This program was compiled to provide online training for the Nitrate QuikTest.
- The Nitrate QuikTest is administered by the MSU Extension Service. **IT MUST BE USED BY CERTIFIED, TRAINED INDIVIDUALS.** Training materials for the appropriate use and safety of the Nitrate QuikTest kits are available from the MSU Extension Service Forage Specialist. Certification is achieved by annual proficiency examination, and the Forage Specialist will maintain a list of certified individuals each calendar year.

Results

Nitrate “QuikTest” Program

Counties and <u>Trainees</u>	Samples Evaluated (2000 – 2002)			
	Total N	Safe	“Marginal”	“Hot”
46 of 56 Montana counties <u>91 trainees</u>	6615	2115 (32%)	1821 (28%)	2679 (40%)



Lab test before feeding: hay blended down or replaced.

Impacts

Potential Economic Benefits

Calf loss avoidance:

Grain hay 300,000 A = 435,000 tons x
0.40 = 174,000 tons “hot” hay @ 2
tons/AU = feed for 87,000 head.

Potential loss in calves =

\$39,150,000

“Hot”

2679

(40%)

Impacts

Potential Economic Benefits

Replacement of “hot” hay:

“Hot”
2679
(40%)

Grain hay 435,000 tons x **0.40**
= 174,000 tons “hot” hay @
\$75/ton hay. Replacement
cost of hay =

\$13,050,000

Summary

- **Increased awareness of nitrate accumulation in cereal forages** (concurrent new research efforts).
- **Timely program development** (during three consecutive years of drought, cereal forage acreage increased, and nitrate problem was significant).



- **Training and certification of users** (in-service training for 91 trainees, including agents, producers and office personnel).
- **Immediate and effective producer interaction** (outreach).
- **Considerable economic impact** (service).