
INTERPRETING RESULTS OF NITRATES TESTS OF FORAGES

Warren Gill and James B. Neel
Professors
Department of Animal Science

“What do all of these numbers mean?” “How can I tell if my hay is safe to feed?” “I can’t figure out what this means.” These are frequent comments and questions from lots of beef cattle producers when they receive the results of a test to determine the nitrate levels in forages.

Interpreting results of the nitrate test is important. Higher levels of nitrate can kill cattle.

In situations where high nitrate levels are suspected in forages, producers should conduct a simple test that will indicate the presence of nitrates. If the test reveals the presence of nitrates, then a representative sample of the forages should be submitted to a laboratory for quantitative analysis.

The first step is simple to conduct. A reagent of diphenylamine in sulfuric acid is dropped on the plant tissue. This is generally placed on a split stem near the base of the plant. If there is a rapid appearance of blue or purple-blue color, nitrate is present. This is a qualitative test and does not provide any indication of the level of nitrate in the forage.

If the test indicates presence of nitrate, forage samples should be submitted to a laboratory for quantitative nitrate analysis. Forage samples submitted for the analysis should be gathered from several sources, i.e. bales of hay and pasture.

How do producers use the results of the quantitative test? Table 1 illustrates suggestions

on how forages containing various levels of nitrate should be used by producers. It should be emphasized that risks associated with nitrate are very “real.” Nitrate toxicity is often a leading cause of death, abortions and production losses to ruminating species in Tennessee. One Tennessee producer lost more than 30 head of cattle as result of feeding sorgham-sudan hay high in nitrates.

Table 1. Recommendation Feeding Levels With Various Nitrate Levels in Forages (Dry Matter Basis)

%	ppm	Comments ¹
0-0.25	0-2,500	Generally considered SAFE .
0.25-0.50	2,500-5,000	Caution Advised. Generally safe when fed with a balanced ration. For pregnant animals limit to one-half of total dry ration. Make certain water for livestock is low in nitrates. Prolonged feeding may result in Vitamin A deficiency. Do not feed with liquid feed or other non-protein nitrogen supplements. Be cautious with pregnant and young animals.
0.50-1.5	5,000-15,000	Danger. Limit to one-fourth of ration. Should be well fortified with energy, minerals, and Vitamin A. May experience milk production loss in 4 to 5 days, possible occurrence of reproduction problems.
Over 1.5	Over 15,000	Toxic. Strongly consider <u>not using</u> . Do not use in free-choice feeding program. Feed containing such levels may be ground and mixed if high nitrate feed is limited to 15% of total ration.

¹These recommendations are general and actual results in cattle response can vary according to age, stress, health production and sources of other feeds consumed.

Results may be reported as either nitrate, nitrate nitrogen or potassium nitrate. To make feeding decisions about the forage, the results should be in either percent nitrate or parts per million (ppm).

Table 2. illustrates the various methods of reporting nitrates as well as mathematical conversions between the methods. Results are almost always reported on a dry matter basis.

Table 2. Methods of Converting Various Forms of Nitrate

Methods of expression	Chemical designation	To convert to nitrate multiply by	To convert to nitrate nitrogen multiply by	To convert to potassium nitrate multiply by
Nitrate	NO ₃	1.00	0.23	1.63
Nitrate Nitrogen	NO ₃ -N	4.40	1.00	7.20
Potassium nitrate	KNO ₃	0.61	0.14	1.00

Following are some examples of converting two different methods of reporting to percent nitrate nitrogen.

1. Reported in nitrate and convert to percent nitrate nitrogen.
 - a.a 1.0% nitrate x 0.23 = 0.23% nitrate nitrogen. A review of the data presented in Table 1 shows that this level generally should be safe to feed.
2. Reported in potassium nitrate and convert to percent nitrate nitrogen.
 - b.a 1.0% potassium nitrate x 0.14 = 0.14% nitrate nitrogen. This level should also be safe to feed.
3. To convert ppm to percent nitrate nitrogen, move the decimal point four places to the left.
 - c.a 4,400.00 ppm = 0.44% nitrate nitrogen. This level would be in the “caution advised” category.
 - c.b 5,500.00 ppm = 0.55% nitrate nitrogen. This level would be in the “danger” category.

The data presented in this information are general guidelines which can be helpful in

determining the nitrate toxicity potential of forages. However, the likelihood of toxicity can be affected by several factors including species and class of animal, degree of animal stress, animal health, extent of previous exposure to nitrates and feeding management. In addition, sampling errors can result in misleading results. Considerable variation exists among state-to-state guidelines with regard to nitrate levels which may cause animal feeding problems.

Source: Materials compiled from several sources including: D. Miksch and G.D. Lacefield. 1988. Kentucky Agric. Ext. Service Herd Health Memo and B.G. Ruffin, D.M. Ball, and H.A. Kjar. 1979. Alabama Agric. Ext. Ser. Cir. ANR 112. (As cited in *Southern Forages*, 2nd Edition, by D.M. Ball, C. S. Hoveland and G. D. Lacefield, 1996)