EVALUATING A FIELD NITRATE TEST FOR SUDANGRASS HAY TO PREVENT NITRATE POISONING

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Abstract

The objective of this study was to compare a field nitrate test using two different test strips to the hay nitrate concentrations determined at a commercial laboratory. Twelve samples of sudangrass hay collected in 2006 through 2008 were used to compare the nitrate concentration determined at a commercial laboratory using the RQflex Reflectometer method to those determined by a field nitrate test. A 1 g ground hay sample was weighed into a 250 ml Erlenmeyer flask. To the flask, 100 ml of distilled-deionized water was added and the solution shaken for 30 s. The hay was allowed to soak for 30 min, with the flask shaken every 10 min. After 30 min, the solution was tested with either Precision Nitrate Test Strips (Precision Labs, Inc., Cottonwood, Arizona 86326) or with Quick Dip Aquarium Test Strips Nitrate/Nitrite (Jungle Laboratories Corp. Cibolo, Texas 78108). Microsoft Excel was used to calculate a Paired, two-tailed T-test and the relationship (r^2) between the results of the field nitrate test using the Precision or Quick Dip test strips to the results determined at the commercial laboratory. The results determined with Quick Dip test strips had a greater relationship to the those determined by the commercial laboratory than the those using the Precision test strips (r^2 = 0.92 and 0.88, respectively). The improved precision using the Quick Dip test strips was due to the greater color change associated with increasing nitrate concentration allowing the technician to more accurately estimate the concentration.

Introduction

On 20 December of 2007, a load of sudangrass hay (*Sorghum sudanense*) was received at the San Diego Zoo's Wild Animal Park and sampled to protocol. The sample of hay for nutrient analysis was received at a commercial laboratory on 14 January 2008 with the results being reported on 18 January 2008. This particular load of sudangrass hay contained 0.93% nitrates (DM basis). Based on the recommendations provided by the commercial laboratory (Table 1), ruminant animal feeds containing greater than 0.88% nitrates (DM basis) should not be fed to pregnant animals and limited to 35 – 40% of the diet dry matter to prevent nitrate poisoning. The remaining bales of sudangrass hay from this load were discarded. During the previous 3 years (2005 – 2007), 34 loads of sudangrass hay averaged 0.25% nitrates (range = 0.03 – 0.76%, dry matter basis).

Due to late-term abortions in sable antelope (*Hippotragus niger*) in early January 2008, which may or may not have been associated with high nitrates in the sudangrass hay, a review of our hay specifications and the need to have a field nitrate analysis was prompted. Therefore, the objective of this study was to compare a field nitrate test using two different test strips to the nitrate concentrations determined at a commercial laboratory.

Materials and Methods

Twelve samples of sudangrass hay collected in 2006 through 2008 were used to compare the nitrate concentration determined at a commercial laboratory (Dairy One, Ithaca, NY 14850) using the RQflex Reflectometer method to those determined by a field nitrate test described by Vendrell.[1] Briefly, a 1 g ground-hay sample was weighed into a 250 ml Erlenmeyer flask. To the flask, 100 ml of distilled-deionized water was added and the solution shaken for 30 seconds. The hay was allowed to soak for 30 minutes, with the flask shaken every 10 minutes. After 30 minutes, the solution was tested with either Precision Nitrate Test Strips (Precision Labs, Inc., Cottonwood, Arizona 86326) as outlined by Vendrell,[1] or with Quick Dip Aquarium Test Strips Nitrate/Nitrite (Jungle Laboratories Corp. Cibolo, Texas 78108). The results were read as milligrams of nitrate (NO^-_3) per liter (mg/L) and adjusted to nitrates as a percentage of DM by dividing by 100 (step 1, calculate mg of nitrate per 100 ml; step 2, convert milligrams to grams; step 3, calculate the percent of nitrates in 1 g of dry hay). Microsoft Excel was used to calculate a Paired, two-tailed T-test and the relationship (r^2) between the results of the field nitrate test using the Precision or Quick Dip test strips to the results determined at the commercial laboratory.

Results and Discussion

The nitrate concentrations using the Quick Dip test strips were similar ($P = 0.37$) to those from the commercial laboratory compared with the nitrate concentrations determined using the Precision test strips, which were lower ($P = 0.006$) than the commercial laboratory. Additionally, the results determined with the Quick Dip test strips had a greater relationship to those determined at the commercial laboratory than the those using the Precision test strips ($r^2 = 0.92$ and 0.88, respectively) (Figure 1). The primary reason for improved precision using the Quick Dip test strips is the greater color change associated with increasing nitrate concentration allowing the technician to more accurately estimate the concentration.

Using the field nitrate test developed by Vendrell[1] and the Quick Dip test strips allows for the determination if a load of sudangrass is acceptable to feed or needs to be retained until the more accurate commercial laboratory's results are returned.

Acknowledgements

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LITERATURE CITED

1. Vendrell, P.F. Forage Nitrate Test Kit Instructions. University of Georgia Agricultural and environmental Services Labs. Athens GA. Available at http://aesl.ces.uga.edu/publications/ForageNitrate.htm. Accessed 27-June-2009.

Table 1. Feeding recommendations based on concentration of forage nitrates.[1]

Forage nitrate, % of DM	Recommended action
< 0.44	Safe to feed
0.44 – 0.66	Safe for nonpregnant animals. Limit to 50% of diet dry matter intake. Animals may go off feed, experience a slow drop in milk production or abort in some cases.
0.88 – 1.54	Limit to 50% of diet dry matter. Same symptoms as above, some deaths may occur.
0.88 – 1.54	Limit to 35 – 40% of diet dry matter. Do not feed to pregnant animals
1.54 – 1.76	Limit to 25% of diet dry matter. Do not feed to pregnant animals
> 1.76	Toxic, do not feed.

[1]Recommendations provided by Dairy One (Ithaca, NY 14850) as part of their Forage Testing Laboratory's analysis results.

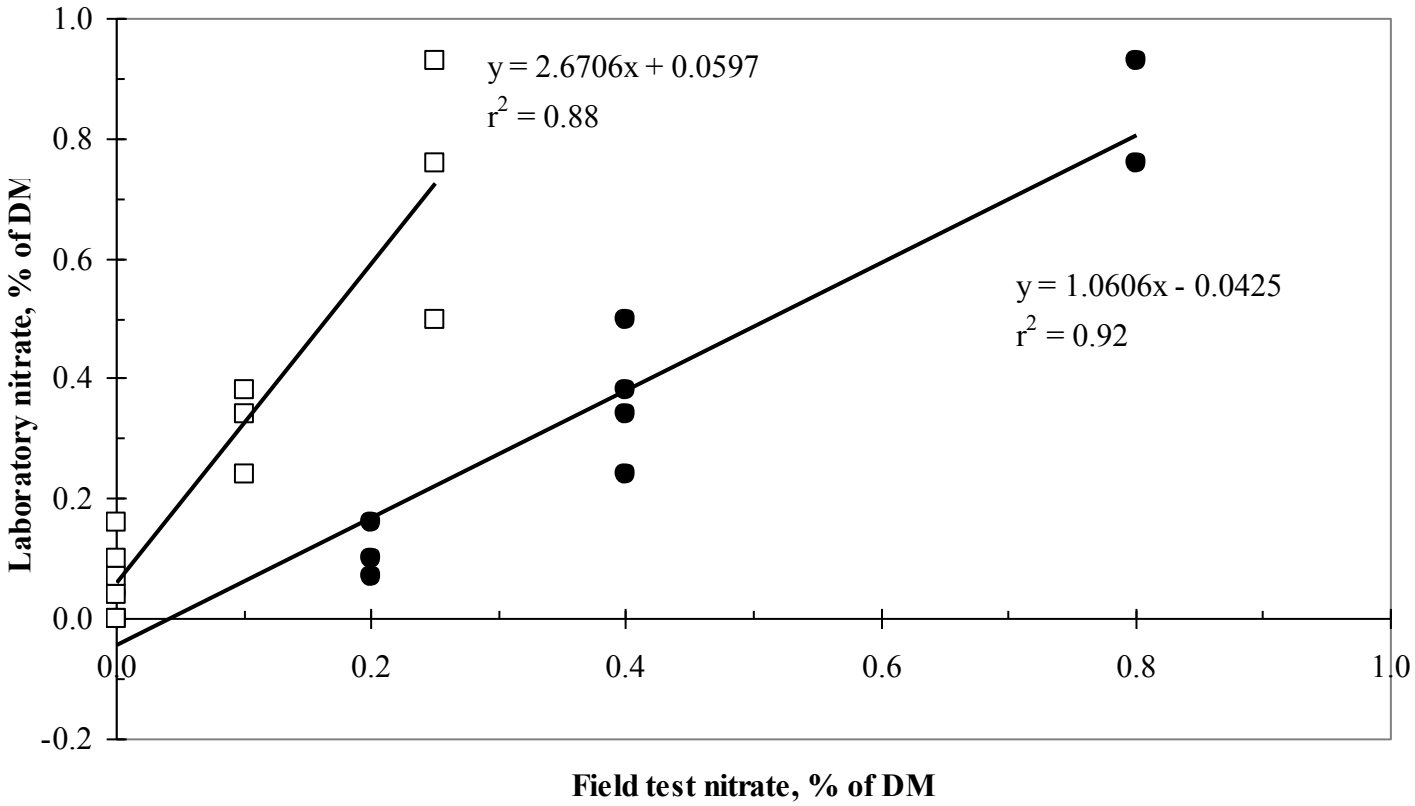

Figure 1. The relationship between sudangrass nitrate concentrations determined with a field test using Quick Dip (●) or Precision (□) test trips compared to nitrate concentrations from a commercial laboratory using the RQflex Reflectometer method.