



Quick Nitrate Test for Hybrid Sudangrass and Pearlmillet Hays

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Hybrid sudangrass and pearlmillet have a high potential for accumulating nitrate. It is important to know the nitrate concentration before they are fed to livestock. A quick nitrate test method with a hand-held nitrate meter is easy to use and usually takes less than twenty minutes to obtain results. The results from the hand-held nitrate meter are highly correlated with those obtained by conventional laboratory procedures based on two years field and laboratory calibration studies. This methodology provides more flexibility for farmers who use warm-season annual grasses in their production systems by measuring nitrate in the field.

Equipment

1. Cardy Nitrate Meter (Spectrum Technologies, Inc., Plainfield, IL)
2. Garlic Press
3. Garden pruner or scissors
4. Nitrate calibration standards: 150 and 2000 ppm in NO_3^-

Meter Calibration

1. Turn the power **ON**;
2. Open the sensor cover, rinse the sensor with deionized water until the reading approaches zero, and then wipe it dry with a clean tissue;
3. Place a piece of sampling sheet onto the sensor pad, and drip 2 to 5 drops of the 2000 ppm standard;
4. After the readout has stabilized, adjust the **STD** dial so that the display reads 20×100 ;
5. After cleaning the sensor according to step 2, drip 2 to 5 drops of the 150 ppm standard onto the sensor pad, adjust the **Slope** dial after the readout has stabilized so that the display reads 15×10 ;
6. Check the standard STD solution again. Recalibrate it if the reading is not $(20 \pm 2) \times 100$;
7. Rinse the sensor with deionized water and then wipe it dry. The meter is ready for sample.

Extracting Plant Sap for Nitrate Analysis

First randomly select five plants and cut them with a pair of pruner at the similar height you are going to harvest from each sampling area. Cut the whole plant samples into 6-inch long pieces, cut the end of the 6-inch pieces again to shorter pieces (about one third inch long) with a pair of pruner. Thoroughly mix the fine pieces into a small pile. Transfer a portion of the fine pieces to a garlic press. Squeeze the garlic press as hard as you can and collect the sap into a small container. Make sure to express all the sap from the tissue in the press.

Analyzing Nitrate

Place a sampling sheet onto the sensor pad, and then transfer a few drops of the freshly pressed sap onto it with a dropper. Take the nitrate reading after the readout has stabilized. Record readings in table 2. Rinse the sensor before testing another sample. Recheck standard for every 10 samples tested.

If the plant sample is relatively dry and very little sap can be pressed, one may place a sampling sheet centered over the holes of the garlic press. As the press is squeezed the sap will saturate the sampling sheet. Then transfer the saturated sampling sheet directly onto the sensor with tweezers.

Finding the Equivalent Dry Weight Nitrates from Sap Reading

There is a high linear correlation between sap nitrate measured with the Cardy nitrate meter and dry-weight based nitrate obtained with the conventional laboratory procedures (Fig. 1 and 2). The correlation coefficients are 0.88 and 0.89 for hybrid sudangrass and pearl millet, respectively. To convert sap nitrate reading to dry weight based nitrate concentration use the following equations:

Hybrid Sudangrass: $\text{Nitrate}_{(\text{Dry Weight})} = 3.64 \times \text{Nitrate}_{(\text{sap})}$

Pearlmillet: $\text{Nitrate}_{(\text{Dry Weight})} = 4.4 \times \text{Nitrate}_{(\text{sap})}$

Interpreting Sap Nitrate Results

The interpretation of plant sap nitrate test for both sudangrass and pearl millet can be made from established guidelines using Table 1. There are slight differences between sudangrass and pearl millet sap readings, but one can convert the sap nitrate concentrations to dry weight based values easily using this table and follow the guidelines for feeding and hay management.

TABLE 1. Generalized interpretation for nitrate test with plant sap and dry hay*

Sudangrass Sap (ppm)#	Pearlmillet Sap (ppm)#	Dry Hay (ppm)	Interpretation
0-820	0-700	0-3000	Generally safe for all cattle
820-1380	700-1140	3000-5000	Generally safe for non-pregnant beef cattle. Low risk of reduced breeding performance and early term abortion. Total ration for dairy cattle should be <2500 ppm
1380-2750	1140-2270	5000-10000	Some risk for all cattle. May cause mid to late term abortions and weak newborn calves. May decrease growth and milk production
>2750	>2270	>10000	Potentially toxic for all cattle. Can cause abortions, acute toxicity symptoms, and death

*Interpretations for dry hay are adapted from F-2903, Nitrate Toxicity in Livestock.

#Average value of two years.

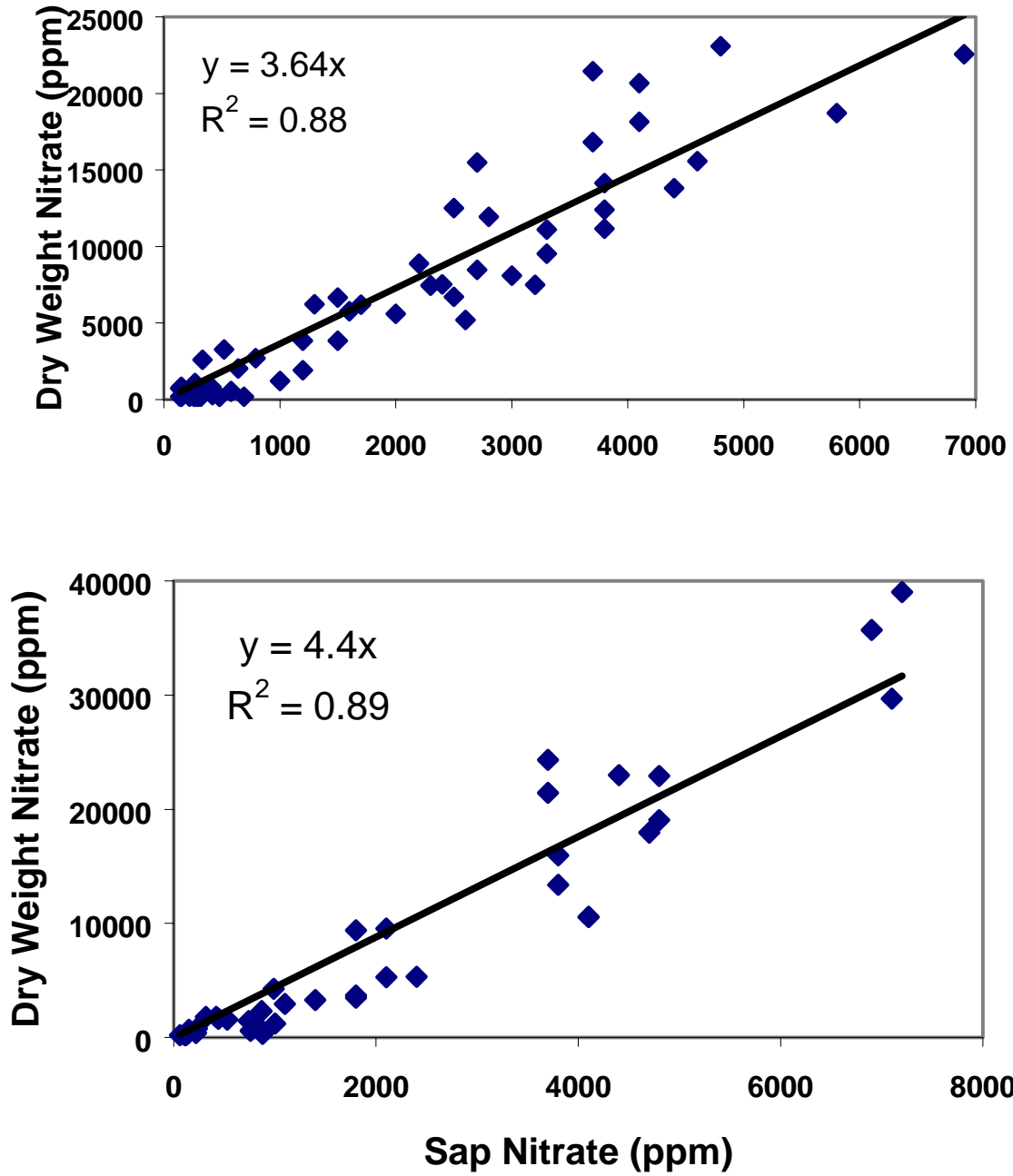


Figure 1. Correlation between sap nitrate measured with the Cardy Nitrate Meter and dry-weight based nitrate obtained from laboratory (Top: sorghum-sudangrass; bottom: pearl millet).

Table 2. Sap Nitrate Recording Sheet

Field Name	Test No. 1	Test No. 1	Test No. 1	Average