

## Nitrate Measurement in Hybrid Sudangrass and Pearl Millet Hays

Determining the nitrate concentrations of sudangrass and pearl millet before feeding them to livestock prevents nitrate toxicity. Plant sap testing with LAQUAtwin B-743 nitrate ion meter offers fast and accurate nitrate in-field analysis. Generally, the maximum nitrate concentrations considered safe for all cattle are 820 ppm and 700 ppm for sudangrass sap and pearl millet sap, respectively.



### Introduction

Hybrid Sudangrass and pearl millet have high potential for accumulating nitrate. Pearl millet has been noted to accumulate significantly higher quantities of nitrate than does sudangrass. These high nitrate plants, either standing in the field or fed as hay, can cause abortion in pregnant cattle or death if consumed in great quantities. Factors that contribute to nitrate accumulation in plants are excessive use of nitrogen fertilizers and stressful environmental conditions that restrict plant growth such as drought, reduced sunlight, low growing temperatures and acidic or phosphorus-deficient soil.

The LAQUAtwin B-743 nitrate ion meter provides the easiest way to measure nitrate concentration in fresh plant sap. The sensor requires only few drops of sap, which can be quickly extracted using a garlic press. The meter analyses the sap in just few seconds and displays reading expressed as either nitrate ( $\text{NO}_3^-$ ) or nitrate-nitrogen ( $\text{NO}_3\text{-N}$ ) ppm. Nitrate results can be obtained immediately in the field with much less effort and relatively low cost. These advantages are useful for farmers and ranchers who are managing livestock and forage crops.

### Method

Calibrate the LAQUAtwin B-743 nitrate ion meter according to manufacturer's instructions using the 150ppm and 2000ppm nitrate ion standards included in the kit. Make sure that the unit of measurement set in the meter is nitrate ( $\text{NO}_3^-$ ) ppm.

#### Sample Collection and Measurement

1. Select five plants randomly from each sample and cut them with a pruner at a similar height to that of harvest.
2. Cut the plant samples into 6-inch long pieces. Then, cut again to shorter 1/3-inch pieces.
3. Mix the pieces thoroughly into a small pile.
4. Transfer a portion of the 1/3-inch pieces consisting of leaves and stems to a garlic press.
5. Squeeze the garlic press and collect the sap into a container.
6. Place drops of sap onto the nitrate ion sensor using a dropper. See Notes.
7. Record the nitrate reading once it is stable.

8. Rinse the sensor with deionized or distilled water and blot dry before testing another sample.
9. Re-check the reading of a standard after testing 10 samples.

#### Notes:

- a. If very small amount of sap is extracted from the plant sample (i.e., sap volume is not enough to cover the flat sensor), use sampling sheet in calibration as well as in sample measurement. To do this, place a sampling sheet onto the sensor and then place drops of standard solution or sap to saturate the sampling sheet.
- b. Another way to saturate the sampling sheet with sap is to place it over the holes of garlic press before loading plant sample and squeezing the press. Transfer the sap-saturated sampling sheet onto the sensor using a tweezer.
- c. Allot one sampling sheet for each standard solution type and sap sample and discard all used sheets after testing.

Refer to Technical Tip 2: LAQUAtwin Ion Sensor Maintenance Procedures

Continued at the back

for detailed information on conditioning, cleaning, and storing the nitrate ion sensor. The technical tip can be viewed and downloaded from the support section of our website [www.horiba-laqua.com](http://www.horiba-laqua.com).

## Results and Benefits

To interpret the LAQUAtwin B-743 nitrate ion meter results with sudangrass and pearl millet plants, refer to the established guidelines in Table 1.

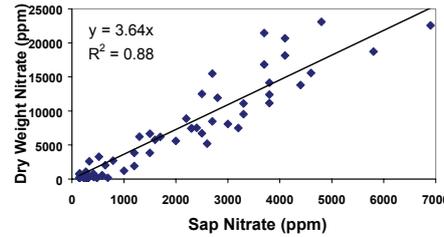
The sap nitrate results measured with LAQUAtwin B-743 nitrate ion meter are highly correlated with those dry-weight based nitrate results obtained from conventional laboratory procedures. As shown on Figures 1 and 2, the correlation coefficients for hybrid sudangrass and pearl millet are 0.88 and 0.89, respectively. To convert the sap nitrate concentration to dry-weight based concentration, use the following equations:

- Hybrid Sudangrass:  
 Nitrate(Dry Weight) = 3.64 x Nitrate(Sap)  
 Pearl millet:  
 Nitrate(Dry Weight) = 4.4 x Nitrate(Sap)

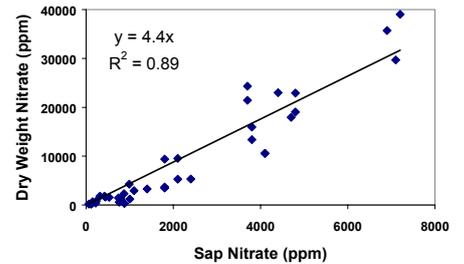
**Table 1:** Guidelines for Interpreting Nitrate Analysis Results with Plant Sap and Dry Hay

| Sudangrass Sap (ppm) | Pearl millet 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 abortions. Total ration for dairy cattle should be less than 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.  |

Source: Zhang, H., 1999. Quick Nitrate Test for Hybrid Sudangrass and Pearlmillet Hays.



**Figure 1:** Correlation between sorghum-sudangrass sap nitrate measured with LAQUAtwin B-743 nitrate ion meter and sorghum-sudangrass dry-weight based nitrate obtained from laboratory.



**Figure 2:** Correlation between pearl millet sap nitrate measured with LAQUAtwin B-743 nitrate ion meter and pearl millet dry-weight based nitrate obtained from laboratory.

References and Suggested Readings

- Zhang, H., 1999. Quick Nitrate Test for Hybrid Sudangrass and Pearlmillet Hays. Oklahoma Cooperative Extension Service [online]. Available from: [http://www.specmeters.com/assets/1/7/nitrate\\_sorghum3.pdf](http://www.specmeters.com/assets/1/7/nitrate_sorghum3.pdf) [Accessed on 18 October 2016].
- Selk, G., Step, DL., Strickland, G., Zhang, H., 1999. Nitrate Toxicity in Livestock. Oklahoma Cooperative Extension Service [online]. Available from: <http://extension.oregonstate.edu/douglas/sites/default/files/documents/ll/laql/pss2903.pdf> [Accessed on 18 October 2016].

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### B-743 Nitrate Ion Meter

## B-743 Nitrate Ion NO3

- WATER PROOF
- MICRO VOLUME
- 2 PT CAL

### Features

IP67 Rated pocket meter with flat nitrate ion sensor capable of 2-point calibration and temperature compensation for quick and direct measurement of micro volume samples

### Applications include

Soil Testing, Crop Growth and Fertilization Management, Food Quality Control



### LAQUAtwin Pocket Ion Meters Lineup



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