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# N Determination in Soil

## according to the Dumas combustion method

Reference: **AOAC 993.13** Nitrogen (Total) in Fertilizers

**ISO 13878:1998** Soil quality -- Determination of total nitrogen content by dry combustion ("elemental analysis")

Tested with **VELP Scientifica NDA 701 Dumas Nitrogen Analyzer** (Code F30800070)



## Introduction

The nitrogen in plants is a part of numerous compounds, including proteins, enzymes, nucleic acids, chlorophyll and vitamins essential for all biological functions. For this reason the nitrogen fertilization is one of the most important factors of agricultural production.

Normally, the application of nitrogen fertilizers causes a marked increase in plant growth, a more intense green color of leaves and stems, and a considerable boost in biomass production. However, an excessive use of nitrogen fertilizers can cause a significant rise in costs of cultivation and a severe damage to the environment (water pollution by nitrates). It is therefore essential to keep under control the quantity of nitrogen in the soil.

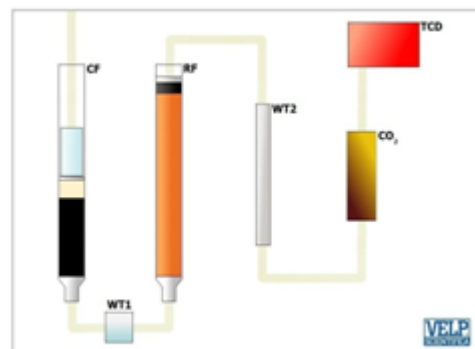
## Nitrogen Determination in Soil

The Dumas method starts with a combustion furnace (CF) to burn the sample, obtaining elemental compounds.

Water is removed by a first physical trap (WT1 - **DriStep™**), placed after the combustion, and a second chemical one (WT2). Between the two, the elemental substances passed through a reduction furnace (RF).

The auto-regenerative CO<sub>2</sub> adsorbers (CO<sub>2</sub>) let pass only the elemental nitrogen that is detected by the **LoGas™** innovative Thermal Conductivity Detector (TCD) with no requirement for a reference gas.

The NDA 701 is controlled via PC through the intuitive **DUMASoft™**.



## NDA 701 Preliminary Operations (daily)

Follow the operating manual to start the NDA 701 and check that the following parameters are set:

**Temperature Combustion reactor** (Code A00000158): 1030 °C

**Temperature Reduction reactor** (Code A00000226): 650 °C

**Flow rate MFC1 He**: 190 ml/min

**Flow rate MFC2 He**: 220 ml/min

Condition the system by testing 2 EDTA standard (Code A00000149) and 3 to 5 empty tin foils (Code A00000153) as Check up.

Verify the calibration curve with one or more tests as Standard by testing the same standard used for the curve creation.

## Sample Preparation

Using a sieve in order to remove any coarse parts; then, homogenize the sample and dry it in a desiccator in order to eliminate every trace of humidity.

Weigh around 200 mg of soil with an accuracy of 0.01 mg directly in the tin foil placed on the plate of the balance.

Close the tin foil, obtaining a capsule.

Load the capsule into the autosampler.

## Analysis Procedure

Fill the following fields in the database: **Sample name, Weight, Method, Sample type, Calibration number**

The SOIL method shows the following parameters.

**Protein factor**: none

**O<sub>2</sub> flow rate**: 400 ml/min

**O<sub>2</sub> factor**: 0.7 ml/mg

Press  to start the analysis.

Analysis time: from 3 minutes for one run.

### Typical Results on Soil

Soil N° 1 (high nitrogen content)		Soil N° 2 (low nitrogen content)	
Sample quantity (mg)	Nitrogen %	Sample quantity (mg)	Nitrogen %
207.90	1.735	218.90	0.152
202.90	1.737	218.30	0.152
203.00	1.706	207.10	0.152
213.40	1.691	200.90	0.150
210.30	1.701	219.80	0.153
206.30	1.704	191.90	0.154
203.50	1.700	206.30	0.154
206.10	1.697	201.00	0.150
210.00	1.735	205.90	0.153
210.30	1.699	199.40	0.151
<b>Average ± SD%</b>	<b>1.711 ± 0.018</b>		<b>0.152 ± 0.001</b>
<b>RSD% *</b>	<b>1.042</b>		<b>0.953</b>

(\*) RSD% = (Standard Deviation \* 100) / Average

### Conclusion

The obtained results are reliable and in accordance with the value found in literature.

The first sample is richer in nitrogen than the second one.

Results have been obtained with the following calibration curve: in a range of 0 – 4.1 mg N with 5 measurements (from 10 mg to 300 mg) of rice flour standard (%N = 1.38 ± 0.05) (Code A00000235).

Benefits of Dumas combustion method are:

- High productivity, non-stop performance
- Time saving, few minutes required
- Moderate running costs
- Totally unsupervised, fully automated
- Omission of harsh and toxic chemicals
- Eco-friendly, low amount of residues and wastes