**IPNI PROJECT BRAZIL-62**

Source, rate, and time of nitrogen fertilization for sugarcane

**REPORT #1**

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## Introduction

The requirement for worldwide abundant food, feed, fiber, and more recently biofuel, leads to higher amounts of fertilizer utilized in agriculture in diverse parts of the globe. Nitrogen (N) is, most generally, the first nutrient in terms of plant demand. Nitrogen promotes rapid growth, increases leaf size and quality, hastens crop maturity, and promotes fruit and seed development. Because nitrogen is a constituent of amino acids, which are required to synthesize proteins and other related compounds, it plays a role in almost all plant metabolic processes. Nitrogen is an integral part of chlorophyll manufacture through photosynthesis. Carbohydrates (sugars) provide energy required for growth and development Nitrogen application may be interfered by chemical reactions generating losses by leaching or volatilization, therefore the use of distinct sources is strategic to overcome such problems. In many areas farmers are testing different sources to increase N use efficiency.

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## Objectives

The main objective of the study will be to evaluate the agronomic effectiveness of different N sources for sugar cane. Also, it will be possible to study other important factors which affect the N fertilizer effectiveness in tropical soils.

## Materials & Methods

*Location*
Project is located at the APTA experimental station in Piracicaba, São Paulo, Brazil.

*Soil conditions*
Soil test results of the experimental area are presented at Table 1.

**Table 1.** Soil conditions of the experimental area.

| Soil parameters | Deapth (cm) | | |
|---|---|---|---|
| | 0-20 | 20-40 | 80-100 |
| Organic Matter. (g/dm$^3$) | 28 | 22 | 14 |
| Soil pH ($CaCl_2$) | 5,5 | 4,4 | 4,4 |
| Available P-resin (mg/md$^{3)}$ | 23 | 8 | 3 |
| Available K (mmolc/dm$^3$) | 1,88 | 1,34 | 0,81 |
| Available Ca (mmolc/dm$^3$) | 44,72 | 23,02 | 21,18 |
| Available Mg (mmolc/dm$^3$) | 32,94 | 15,15 | 9,51 |
| Al concentration (mmolc/dm$^3$) | 0,54 | 8,98 | 9,56 |
| H + Al (mmolc/dm$^3$) | 30 | 58 | 50 |
| Available S (mg/md$^{3)}$ | 23 | 37 | 63 |
| Sum of bases (mmolc/dm$^3$) | 79,54 | 39,51 | 31,50 |
| CEC (mmolc/dm$^3$) | 109,54 | 97,51 | 81,50 |
| Bases saturation (%) | 72,61 | 40,52 | 38,65 |
| Al saturation (%) | 0,67 | 18,52 | 23,28 |

*Experimental design*
Trial was installed using a complete randomized block design with 4 replicates in a factorial 3x3x2 and 2 controls, as such: 3 N sources (UAN, Urea, and Ammonium Nitrate), 3 N rates (60, 120, and 180 kg/ha), and 2 times of application (after emergence of plants and at 60 cm plant height). Controls are: no N application and 120 kg N/ha via Ammonium Sulphate. Plots were composed by 9 meters width (6 sugarcane rows) by 20 meters long. Treatments are presented at Table 2 below and field trial layout at the appendix along with more recent images of the trial. All sources were applied on the top surface over the sugarcane harvest residue. Urea, Ammonium Nitrate, and Ammonium Sulphate were applied manually, while UAN was applied using a tractor mounted sprayer.

**Table 2.** Treatments under evaluation on this project.

| # | Source | Rate, kg N/ha | Application[1] |
|---|---|---|---|
| 1 | UAN | 60 | Single |
| 2 | UAN | 120 | Single |
| 3 | UAN | 180 | Single |
| 4 | UAN | 60 | Split |
| 5 | UAN | 120 | Split |
| 6 | UAN | 180 | Split |
| 7 | Urea | 60 | Single |
| 8 | Urea | 120 | Single |
| 9 | Urea | 180 | Single |
| 10 | Urea | 60 | Split |
| 11 | Urea | 120 | Split |
| 12 | Urea | 180 | Split |
| 13 | Ammonium Nitrate | 60 | Single |
| 14 | Ammonium Nitrate | 120 | Single |
| 15 | Ammonium Nitrate | 180 | Single |
| 16 | Ammonium Nitrate | 60 | Split |
| 17 | Ammonium Nitrate | 120 | Split |
| 18 | Ammonium Nitrate | 180 | Split |
| 19 | Control | 0 | Control |
| 20 | Ammonium Sulphate | 120 | Single |

[1] Application of fertilizers: single, 100% rate applied at emergence of plants; and split, 50% rate applied at emergence of plants and 50% applied when plants reach 60cm.

*Set up information*

The experimental area used is a one year old sugarcane field (variety CTC7) that was harvested on October 19th, 2013, within APTA's experimental station. Treatments were initially applied on October 31st, 2013, and second application occurred on December, 3rd, 2013, in accordance to Table2. Figure 1 presents images of the trial during treatments application, and Figure 2 shows the equipment used for UAN application. Potassium as KCl was applied to all plots at the rate of 140 kg $K_2O$/ha on Nov 1st, 2013.

1st application - Oct.31st

2nd application - Dec, 3rd

**Figure 1.** Field trial images during treatments application.

**Figure 2.** Tractor mounted sprayer used to apply UAN.

## Appendix

**Figure 1.** Images of trial taken on December 19th, 2013, during Dr. Prochnow's visit to the site.

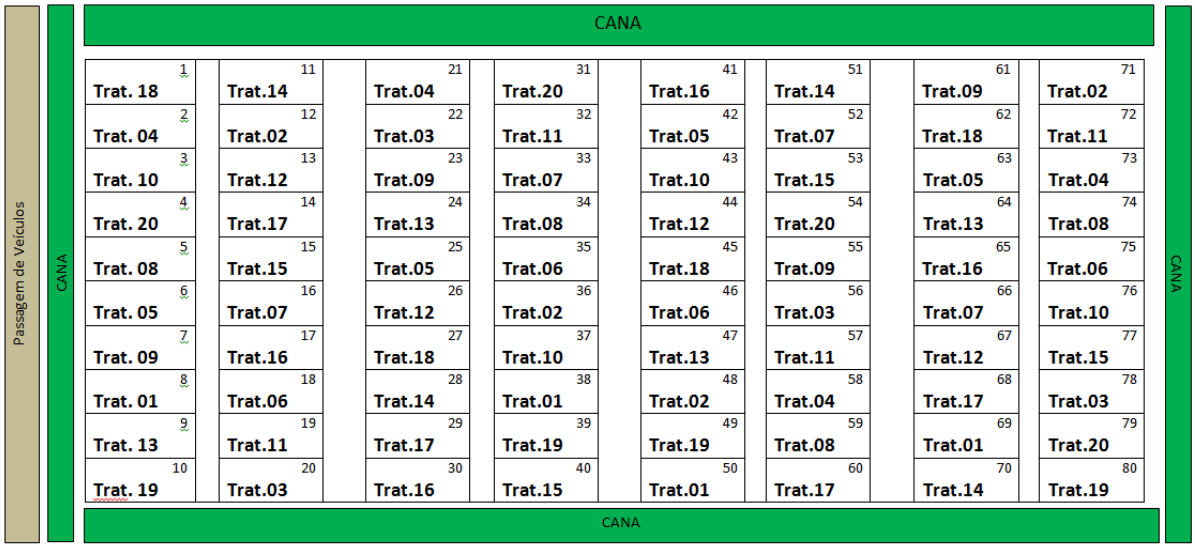


**Figure 2**. Field trial layout of the project.