APLLICATION OF CALCIUM NITRATE AND UREA BY FERTIRRIGATION ON BANANA CROP AND THEIR EFFECTS ON SOIL PH AND ELECTRICAL CONDUCTIVITY

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ABSTRACT: Fertirrigation is one effective mean of fertilizer application in irrigated agriculture since it combines water and nutrients, two necessary inputs for growth and production of crops. The objective of this work was to evaluate the effects of using two nitrogen sources by fertirrigation on variations of some soil chemical attributes (pH e CE) in a soil cultivated with banana crop during two production cycles. The experimental design followed a random block design with six treatments and five replications, with six plants per plot. Nitrate calcium and urea were the nitrogen sources that were applied as different combinations during the crop cycle. Results showed that nitrogen fertirrigation by the combination of urea and calcium nitrate did not increase soil acidity. None of urea and calcium nitrate combinations had effect on saturation electrical conductivity during the two cycles of banana crop.
KEYWORDS: Fertirrigation, pH, electrical conductivity

INTRODUCTION: The application of fertilizers by irrigation water to crops may cause desirable and undesirable effects on soil chemical properties. The positive effects is the increase of nutrients to the soil and their availability to plants. The negative effects may be related to variations on pH and on soil electrical conductivity (MALAVOLTA, 1981; MACLAREN & CAMERON, 1996). Amidic and ammoniac sources of nitrogen applied in the soil by fertirrigation release hydrogen ions during nitrification process that may induce variation on soil pH (Souza, 2006). Nitrical nitrogen sources have high solubility and move easily in the soil profile, since nitrate ions are charged negatively and are not requested by soil particles, therefore, nitrate may move as downward under excessive water application as upward by capillary water (MUCHOVEJ & RECHCIGL, 1994). Nitrate and amidic sources may be used in a same crop cycle in order to avoid pH variations in the soil. Therefore, Nitrogen sources should be used in such a way in order to maximize yields without negative impacts to the soil (DUGGAN, 2005). The objective of this work was to evaluate the effects of using two nitrogen sources by fertirrigation on variations of some soil chemical attributes (pH e CE) in a soil cultivated with banana crop during two production cycles.

MATERIAL AND METHODS: The work was carried in a experimental field of Embrapa Cassava & Tropical Fruits, at Cruz das Almas city, Bahia State (12º48`S; 39°06`W; 225m). The experiment was set in a silt clay sand soil that is classified as Dystrophic Yellow Latossol (Souza & Souza, 2001). Banana cv. Grand Naine was planted at 3,5 x 2,5 m spacing as single rows. Table 1has soil chemical characteristics at the beginning of the experiment. The experimental design followed a random block design with six treatments and five replications, with six plants per plot. Nitrate calcium and urea were the nitrogen sources that were applied as different combinations during the crop cycle, according to the following treatments: T1- urea applied during 100% of the cycle; T2 - urea applied during 80% of the cycle and calcium nitrate applied to the 20% remaining; T3= urea applied during 60% of the cycle and calcium nitrate applied to the 40% remaining; T4= urea applied during 40% of the cycle and calcium nitrate applied to the 60% remaining; T5= urea applied during 20% of the cycle and calcium nitrate applied to the 80% remaining and T6= calcium nitrate applied to 100% of the cycle.

Table 1: Mean values of soil chemical characteristics of the experimental area.

Prof.	pH	P	K	Ca	Mg	Na	S	CTC	V	M.O.
(m)	(em H_2O)	(mg dm^{-3})				(mol dm^{-3})			%	g kg^{-1}
0-0.20	5.17	4.33	0.26	1.17	1.27	0.14	2.83	5.95	47	7.54
0.20-0.40	5.27	4.33	0.33	1.30	1.07	0.15	2.85	5.85	48	7.31

The experimental area was prepared and 1600 kg.ha^{-1} of calcarium was applied to raise up basis saturation. Also, 105 g Simple Super phosphate, 50 g of FTE BR-12 and 20 L of manure were mixed to the soil for each plant. The nitrogen and potassium were applied during the cycle according to recommendations of Borges & Costa (2002). The fertirrigation frequency was twice a week by using a injection hydraulic pump (TMB 60), keeping flow rate at 60 L.h^{-1}, where treatments were differentiated with valves at the beginning of the experimental area. Soil solution electrical conductivity, saturation extract electrical conductivity and pH were the chemical attributes evaluated. Soil samples were collected by na auger and soil solution was obtained by using water samplers inslled at depths of 0.20, 0.40 m at 0..30 m from plant (pseudostem) and close to a dripper. Electrical conductivity was determined for the soil solution and for saturation extract by using a table conductivimeter. Saturation extract was obtained from soil samples according to Embrapa (1997). Also, saturation extract pH was determined in laboratory using na pH meter.

RESULTS AND DISCUSSION: Table 2 shows values of saturation extract pH as mean of data collected during two cycles of the crop. There was no relevant difference among mean values of saturation extract pH (Table 2), that varied in the range of 5.7 to 6.4. pH did not reduce with time at any treatment, even for those with larger percentage of urea application. This was not expected since the use of urea ends up with a nitrification process in the soil and as a consequence, pH is expect to reduce. Data of pH showed that the effect of fertirrigaton of the different combination of nitrogen sources on soil pH during the two crop cycles was minimum. Values of pH varied from 6.4, 6.2 and 6.0 in the beginning of the cycle to 6.2, 6.0 and 5.9 at the end of second studied cycle for depths of 0-0.20, 0.20-0.40 and 0.40-0.60 m, respectively(Figura 1). This result is in accordance to SILVA et al (2001) who did not verify relevant reduction of pH with application of urea. Those authors found variation from 5.8 to 5.6 and 5.2 to 4.8 at depths of de 0-0.20 e 0.20-0.40 m, respectively after 141 days. Also, some works verified increasing of pH under urea application in the soil (Silva & Vale, 2000); Barbosa Filho et al., 2004)

Tabela 2: Mean pH of treatments during two cycles of banana crop.

Depth (m)	T1	T2	T3	T4	T5	T6
0-0.20	6.3	6.2	6.2	6.1	6.4	6.3
0.20-0.40	6.3	5.9	5.9	6.0	5.8	5.9
0.40-0.60	5.8	5.9	6.0	6.1	5.9	5,7

The variance analysis showed that the different combinations of nitrogen sources did not affect electrical conductivity of saturation extract (ECes) by F test (P>0,05). However, soil depth had influence on ECes values that was larger at 0-0.20 m layer reducing with increasing in depth (Table 3). Dias (2004) also found larger EC at shallower depths in a soil cultivated with melon after application of six levels of initial soil salinity (S1 = 1.0; S2 = 2.0; S3 = 3.0; S4 = 4.0; S5 = 5.0 e S6 = 6.0 dS m^{-1}) and two fertirrigation managements, i.e., the conventional one and with electrical conductivity control

Table 3: Mean CEes under different combinations of nitrogen sources.

Treatment	CEes (dS m^{-1})	Depth (m)	CEes (dS m^{-1})
T1	0.384 ^{ns}	0.20	0.456 a
T2	0.385 ^{ns}	0.40	0.383 b
T3	0.345 ^{ns}	0.60	0.326 b
T4	0.402 ^{ns}		
T5	0.390 ^{ns}		
T6	0.421 ^{ns}		

CONCLUSIÕNS: Nitrogen fertirrigation by the combination of urea and calcium nitrate did not increase soil acidity. None of urea and calcium nitrate combinations had effect on saturation electrical conductivity during the two cycles of banana crop.

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