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Effects on rice plant development and soil chemical attributes from nitrogen and growth regulator

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INTRODUCTION

The "Vale do Ribeira", southeast São Paulo State, Brazil was region highly grain producing, mainly rice cultivation, which makes it possible to adopt growing techniques to revival on production of this cereal. In the XIX century, rice was the main crop having as characteristic use of slave labor and low production cost, began to be exported to markets in Europe and Latin America. The aim of this study was to evaluate the effect of growth regulator and the use of nitrogen rates in the growth vegetative and soil chemical analysis when cultivated with upland rice crop IAC 202 cultivar in 2011/12 drop year.

MATERIAL AND METHODS

The study was carried out at São Paulo State University, Campus de Registro. The experimental design was randomized blocks composed of nitrogen (0, 50, 100, 150 and 200 kg N ha^{-1}), urea font (45% N) in covering and application or non of growth regulator trinexapac ethyl (150 g active ingredient ha^{-1}) in three stages of plant development (active tillering, between active tillering and floral differentiation and floral differentiation).

Sowing was done mechanically in December 2, 2011 and featured application of 70 kg ha^{-1} rice seed cv. IAC 202. The sowing fertilization was performed by seeder and applied 600 kg ha^{-1} of 04-14-08 fertilizer. Nitrogen rates fertilization were implemented in January 29, 2012 (30 d.a.e.). The growth regulator were application in 25, 35 and 45 d.a.e.

Were evaluated height, stem diameter and number of rice plants tillers. Were also collected soil for chemical analysis on May 25, 2012 using a soil probe at depths 0.0-0.10 m. The samples were sent to the laboratory of soil fertility for the determinations of pH($CaCl_2$), P, OM, Al, K, Ca, Mg, S, (H+Al), sum of bases (SB), CEC, V% and Al-saturation (m%). The data were submitted to analysis of variance (test F), and the means were compared using the Tukey test and polynomial regression (p<0.01).

CONCLUSION

The growth regulator application provides significant reduction in plant height mainly when applied at floral differentiation stage. Increasing N rates application increased height, diameter and number of tillers, reduction of phosphorus levels, pH, Ca, Mg, SB and V% and increased on CEC, Al, m%.

RESULTS

Table 1. Height, stem diameter, number of rice plants tillers, pH, organic matter, phosphorus and sulfur from rice IAC 202 cultivar in response to nitrogen fertilizer and the use of growth regulator.

Teste F	Height	Stem diameter	Rice plants tillers	pH	OM†	P†	S†
				p>F			
Growth reg (g)†	0,0000	0,0934	0,3899	0.5751	0.4865	0.8301	0.4423
Rates (r)	0,0000	0,0000	0,0000	0.0000	0.0520	0.0201	0.0429
g*r	0,5073	0,9641	0,8818	0.9140	0.1887	0.7190	0.5943
	(cm)	(mm)	(n°)	($CaCl_2$)	(g dm^{-3})	mg dm^{-3}	
Active tillering	69,45 c	5,82	1,15	4.58	20.20	18.00	4.98
Act til-flor dif†	77,12 b	5,92	1,22	4.62	20.00	16.66	4.92
Floral different†	77,77 b	5,80	1,25	4.62	20.80	16.60	4.90
Sem	85,40 a	6,10	1,32	4.58	20.53	16.80	4.49
C.V. %	4,09	6,88	25,80	2.19	7.40	27.77	18.88
D.M.S.	2,65	0,34	0,26	0,09	1,47	4,63	0,89
				Polynomial Regression			
0	67,40	5,03	0,71	4.77	20.75	18.16	4.50
50	76,93	5,71	1,06	4.69	20.08	17.58	4.25
100	79,96	6,03	1,31	4.50	20.66	20.08	5.10
150	80,37	6,31	1,46	4.52	20.83	15.66	5.15
200	82,50	6,46	1,62	4.50	19.08	13.58	5.12
p>F (linear)	0,0000	0,0000	0,0000(3)	0.0000	0.0731	0.0542(5)	0.0134(6)
p>F (quadratic)	0,0000(1)	0,0057(2)	0,1221	0.0041(4)	0.3371	0.0595	0.7178
r2 (linear %)	79,88	92,72	96,72	79.75	45.63	69.82	65.34
r2 (quadratic %)	95,23	99,31	99,80	92.66	52.00	78.30	66.62

Polynomial Equations

(1) $Y=68,2214+0,1668x-0,0004x^2$ (2) $Y=5,0625+0,0131x-0,00003x^2$ (3) $Y=0,7937+0,0044x$
(4) $Y=4.7892-0.0033x+0.00001x^2$ (5) $Y=19.2333-0.0221x$ (6) $Y=4.3950+0.0043x$

† OM = organic matter; P = phosphorus (resin); S = sulfur; Growth regulator; Active tillering-floral differentiation; Floral differentiation.
Means followed by the same letters in the columns do not differ by Tukey test (*p<0.05*).

Table 2. Available exchangeable cations (K^+, Ca^{2+} and Mg^{2+}), aluminum, potential acidity, sum of bases, cation exchenge capacity, base saturation and alumunum-saturation in the soil under rice IAC 202 cultivar in response to nitrogen fertilizer and the use of growth regulator.

Teste F	K†	Ca†	Mg†	Al†	H+Al†	SB†	CEC†	V†	m†
					p>F				
Growth reg. (g)†	0.0778	0.3797	0.0490	0.0125	0.0594	0.2820	0.8406	0.0157	0.2151
Rates (r)	0.0585	0.0428	0.0438	0.0170	0.4959	0.0036	0.0000	0.0409	0.0345
g*r	0.9968	0.5463	0.8113	0.1917	0.4356	0.5274	0.8159	0.9926	0.9934
				$mmol_c$ dm^{-3}					%
Active tillering	1.29	24.33	22.13b	3.13	38.20	32.00	71.95	39.20b	7.71
Act til-flor dif†	1.45	24.73	24.66a	2.00	35.73	33.17	71.54	44.00a	7.40
Floral different†	1.50	23.80	22.93ab	1.80	35.46	33.72	72.16	43.80a	7.62
With out	1.46	24.73	23.53ab	2.20	35.73	33.24	70.97	43.20ab	7.60
C.V. %	16.10	6.84	10.46	27.08	13.65	7.46	5.35	10.39	29.88
D.M.S.	0,22	1,63	2,39	0,60	4,93	2,41	3,76	4,33	4,57
					Polynomial Regression				
0	1.58	25.58	24.58	2.08	36.08	35.17	67.93	45.00	7.41
50	1.36	24.66	23.83	2.16	36.58	32.52	68.18	43.16	8.41
100	1.35	24.00	24.00	2.02	35.91	33.30	74.69	43.25	9.66
150	1.49	24.08	22.00	2.33	36.25	33.25	74.39	41.50	10.16
200	1.35	23.66	22.16	2.83	39.16	30.91	73.09	39.83	11.08
p>F (linear)	0.1120	0.0062(1)	0.0048(2)	0.0054(3)	0.2111	0.0013(4)	0.0000	0.0051(6)	0.0394(7)
p>F (quadratic)	0.2222	0.3375	0.9000	0.0531	0.2891	0.9429	0.0219(5)	0.7552	0.8566
r2 (linear %)	26.46	85.95	82.39	63.29	46.97	64.29	61.12	93.78	98.45
r2 (quadrátic %)	41.86	95.59	82.54	92.22	80.52	64.32	76.82	94.82	99.17

Polynomial Equations

(1) $Y=25.2833-0.0088x$ (2) $Y=24.6500-0.013333x$ (3) $Y=1.9500+0.0033x$ (4) $Y=34.5916-0.0155x$
(5) $Y=66.9378+0.0896x-0.0002x^2$ (6) $Y=44.9500-0.0155x$ (7) $Y=7.53333+0.0181x$

† K^+ = potassium; Ca^{2+} = calcium; Mg^{2+} = magnesium; Al^{3+} = aluminum; H+Al = potential acidity; SB = sum of bases; CEC = cation exchange capacity; V = base saturation; m = Al-saturation; Growth regulator; Active tillering-floral differentiation; Floral differentiation.
Means followed by the same letters in the columns do not differ by Tukey test (*p<0.05*).