FIELD AND GREENHOUSE TOMATO YIELDS AS FUNCTIONS OF NITROGEN DOSIS APPLIED BY HAND OR BY DRIP FERTIGATION SYSTEM

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Introduction

In tropical area researchers and growers always search for growing systems that maximize yield and quality of tomato fruits, specially in summer rainy season. Excess of humidity combined with high temperature favor pathogen proliferation and diseases, promotes nutrients loss, especially N and K, and imposes great challenges to operate essential cultural practices as fertilization, irrigation and agrochemical application. As a consequence decreases in fruits yield and quality and on growers profit.are very common. A technical option for assure successful growing of tomatoes during the rainy months is to grow plants inside greenhouses equipped with drip irrigation system, which allows growers to exert greater control upon some growing conditions, specially water and nutrients. But, technical recommendations as to how fertilize protected tomato crop during summer in Brazil are still poor. This way, this research was undertaken to evaluate the response of tomato plants grown in three production systems during Brazil´s rainy summer to N dosis.

Methodology

Hybrid Débora Plus tomato plants were grown following a particular production system in each experiment, which differentiated primarily on the improvement of environmental growth conditions promoted by plastic sheeting (plastic greenhouse x open field), the mode of irrigation in combination with the method of application of topdressing fertilizers (drip fertigation x furrow irrigation with traditional fertilization by hand) and number of stems per plant (one or two stems).

This way, the 3 systems were composed as follows:

System A = SA Tomato plants grown inside a plastic greenhouse with drip fertigation system and conducted with a single stem ;

System B = SB Tomato plants grown in open field with drip fertigation system and conducted with two stems;

System C = SC Tomato plants grown in open field with furrow irrigation and topdressing fertilizers applied to the soil by hand, and conducted with two stems.

Each plot was 4 m wide and 3.6 m long, occupying 14.4 m^2, and seedlings were spaced by 1.0 x 0.6 m, with 24 plants per plot (4 rows of 6 plants each). The central 8 plants were evaluated up to the 7th inflorescence.

Treatments consisted of five N dosis applied as top-dressing fertilization, as follows: SA = 0, 80, 160, 240 and 320 kg/ha: SB = 0, 100, 200, 300 and 400 kg/ha, and SC = 0, 125, 250, 375 and 500 kg/ha. Treatments were replicated four times, following a randomized block design. Fertilizers ammonium sulfate, calcium nitrate and ammonium nitrate were the nitrogen sources, and dosis were splitted in 7 applications at 13, 19, 32, 47, 61, 75 and 92 days after transplantation, being 10% in 1st and 15% in the 2nd, 3rd, 4th, 5th, 6th and 7th applications. Fertilizers KCl (550 kg/ha of K_2O), bórax (10 kg/ha), $ZnSO_4$ (10 kg/ha) and sodium molibdate (200 g/ha) were applied by drip in SA and SB, and conventionally in SC, at 13, 34, 48 and 62 days after transplantion.

On SA irrigation was performed daily, resulting on a volume of 123 L/plant, corresponding to 205 mm. On SB irrigation amounted 22 L/ plant, and were done in complementation to rains (981 mm). On SC irrigation was done when necessary, by furrows alternating to planting lines, once per week. Water was delivered at the top of furrows, and flow was closed when water front was at the end of furrow.

Cycle from transplantation to final harvest was round 120 days, from november to march. Fruits without defects were classified as to the traverse diameter, and extra production was the sum of the weights of the fruits of the first four classes and as commercial production the sum of the weights of the fruits of the first six classes. Not commercial yield corresponded to the sum of the weights of the fruits with diameter smaller than 40 mm and those disqualified due to defects. Total yield was obtained by the sum of the commercial and not commercial yields. It was also calculated the equivalent production to fruits Extra AA (EAAY), being used the factors of consideration of 1,0; 0,687; and 0,288, basing on the medium prices of the classes extra AA, extra A and extra for the tomato Santa Cruz type marketed in K box. Also, relative increment in extra AA yield (RIEAAY) was calculated seeking to establish the increment obtained in EAAY for each kg of applied N (kg of extra fruits AA/kg of applied N). For such, was used the difference among the productions to fruits extra AA with the dose of maximum physical efficiency (MEF) and with the zero dose, and the difference among those doses, through the following formula:

$$RIEAAY = \frac{\text{EAAY max - EAAY zero}}{\text{N dose MEF – N dose zero}}$$

Results

Fruit yield was increased by N rates in all systems. In SA maximum total, marketable, extra and equivalent to extra AA fruits yields were 96.7, 75.4, 72.6 and 45.1 t/ha, respectively, achieved with 241, 181, 194 and 177 kg/ha of N, respectively (Figure 1). In SB these yields were 76.9, 62.9, 59.5 and 33.5 t/ha, achieved with 150, 125, 115 and 119 kg/ha of N, respectively (Figure 2), and on SC these yields were 62.9, 48.0, 43.6 and 31.7 t/ha, all of them achieved with 500 kg/ha of N (Figure 3). The relative increment on extra AA yield resulting from N fertilization (increasing in extra AA yield as a function of optimum dose application), in experiments A, B and C were 111.6, 59.8 and 35.7 kg of extra AA fruits/kg of N applied, respectively.

Conclusions

Tomato yields achieved with drip fertigation (systems A and B) were very high for summer season.

Furrow irrigation on open field (system C) imposed adverse conditions related to pests, water and nutrients, which together, resulted in the lowest yields.

Greenhouse equiped with drip irrigation system (System A) showed to be the best system for tomato production in summer. Better control of the environment, protection from rain and less disease pressure, associated with the control of water supply and fertigation, can be some of the reasons for the excelent behaviour of tomato plants when grown under system A practices.

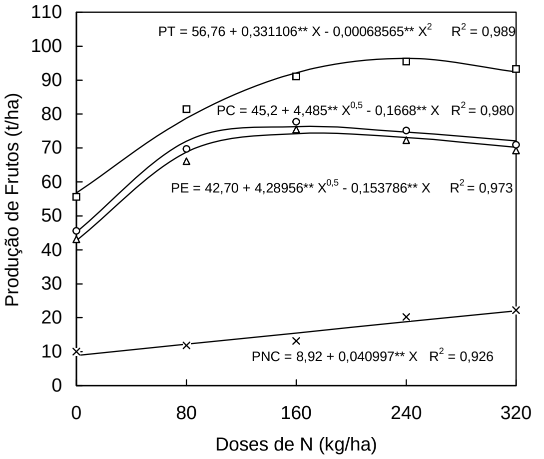

Figure 1 – Tomato fruits total (PT), comercial (PC), extra (PE) e not comercial (PNC) yields as functions of N dosis applied at system A.

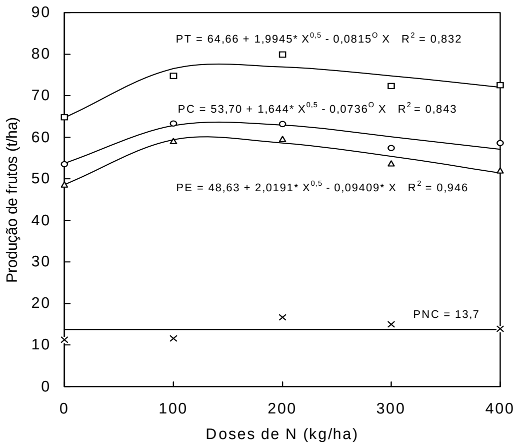

Figure 2 – Tomato fruits total (PT), comercial (PC), extra (PE) e not-comercial (PNC) yields as functions of N dosis applied at system B.

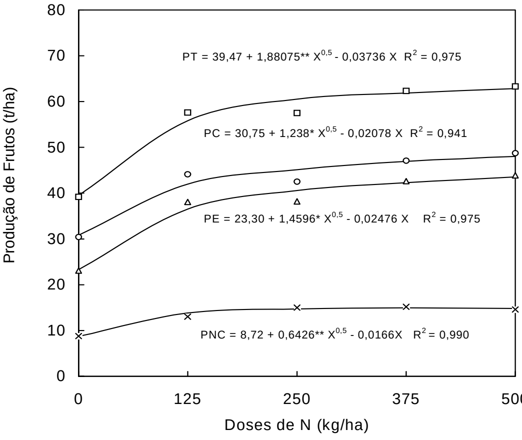

Figure 3 – Tomato fruits total (PT), comercial (PC), extra (PE) e not-comercial (PNC) yields as functions of N dosis applied at system C.