BIOSCIENCE JOURNAL

AGRONOMIC PERFORMANCE OF SALAD TOMATOES GROWN IN DIFFERENT CONDUCTION SYSTEMS AND FERTILIZATION DOSES

Antônio Alves de OLIVEIRA JÚNIOR[1], Gabriel Filipe da SILVA[2], Michelle Souza VILELA[3], José Ricardo PEIXOTO[3], Jean Kleber de Abreu MATTOS[3], João Victor ÁVILA[2], Andrine De Mari CENCI[2], Carlos Oliveira CASTRO[2]

[1] Postgraduate Program in Agronomy, Faculty of Agriculture, University of Brasília, Brasília, Distrito Federal, Brazil.
[2] Graduate Program in Agronomy, University of Brasília, Brasília, Distrito Federal, Brazil.
[3] Department of Agronomy and Veterinary Medicine, University of Brasília, Brasília, Distrito Federal, Brazil.

Corresponding author:
Antônio Alves de Oliveira Júnior
agroun b.antonio@gmail.com

How to cite: OLIVEIRA JÚNIOR, A.A., et al. Agronomic performance of salad tomatoes grown in different conduction systems and fertilization doses. *Bioscience Journal*. 2022, **38**, e38041. https://doi.org/10.14393/BJ-v38n0a2022-54148

Abstract
Looking to reduce the cost and maximize tomato productivity, this study aimed to evaluate fertilizer doses and conduction systems. For this, a field experiment was carried out in randomized blocks, in a simple factorial scheme, which consists in four fertilizer doses, (50, 100, 150 and 200% dose), and four conduction systems (with one or two plants per pit, and one or two stems per plant). Plants were spaced 0.44m and 1.5m between lines. Each plot consisted of 10 plants. The evaluated characteristics were fruit mass, number of fruits, total production per plant and pit, longitudinal and transversal dimension of the fruit. Under the experiment conditions, interactions were observed between fertilization and conduction only for the transversal and longitudinal diameter. The C4 conduction system showed superior results for the estimated yield when compared to the treatments containing only one plant per pit (C1 and C2). For the fertilizer doses, the observed yield was 142.68 t ha $^{-1}$, in the 150% dose, and 114.84 t ha $^{-1}$ for the 50% dose. The highest production per pit was obtained in the 150% fertilizer dose and the C4 conduction, but this treatment showed a lower average fruit mass. The treatment with two plants per pit and two stems provided lower fruit average mass than the treatments containing a single plant. The fertilization influenced only in the longitudinal diameter, and the largest diameter was observed in the recommended fertilization dose. Aiming at cost/efficiency relation, the 100% dose and the C3 were considered the best treatments.

Keywords: Field management. Productivity. *Solanum lycopersicum*.

1. Introduction

The tomato (*Solanum lycopersicum*) originates from the Andean region of South America, being an herbaceous plant, with determinate, semi-determinate or indeterminate growth. It belongs to the Solanaceae family, Tubiflorae order, with small yellow flowers, producing climacteric, fleshy fruits, with smooth surface and round format (Alvarenga 2013; Peixoto et al. 2017).

The success in growing of the salad type tomato depends on the application of various cultural practices carried out in the fields, such as tutoring and pruning (Almeida et al. 2015). Among them, the cross fence, the vertical method (with ribbons) and the Viçosa method are the most common in Brazil (Almeida et al. 2015). Tomato cultivation can still be done by adopting one or two plants per pit, with the conduction of these plants with one or more stems (Gomes et al. 2017).

In addition to these practices, the correct nutritional management, according to Filgueira (2008), has relevance in the tomato culture, since it is a crop highly demand in nutrients, namely nitrogen, calcium, and potassium. The definition of the doses of these fertilizers depends on the analytical result of the soil as well as on factors such as irrigation method, type of conduction and productive potential of the explored tomato cultivar. Due the high demand for tomato fertilization, several farmers, in search of higher yields, adopt fertilizations doses that in some cases are up to two times higher than those recommended, thus resulting in a waste of resources, and decreasing the farmer profits. Therefore, studies involving hybrid tomato cultivation, relating different fertilization doses and conductions with different number of plants and stems per pit, are needed to further understand these interactions and define the optimal fertilization doses for the different conductions for the tomato culture.

In this context, this work had as main objective evaluate the effect of four different fertilizer doses and four conduction systems of hybrid tomato, type salad, in an experimental field in the Distrito Federal region, Brazil.

2. Material and Methods

The experiment was conducted in the orchard sector of the Fazenda Água Limpa (FAL) on the University of Brasília (UnB), located in Brasília, Distrito Federal (15° 56' 55.9"S and 47° 56' 02.0" W, with 1.080 m of height). The climate on the region, according to the Köppen classification is Aw, with an annual average rainfall of 1500 mm (Cardoso et al. 2014). The climate data collected in the FAL/UNB weather station are shown below (Figure 1A, Figure 1B, Figure 1C).

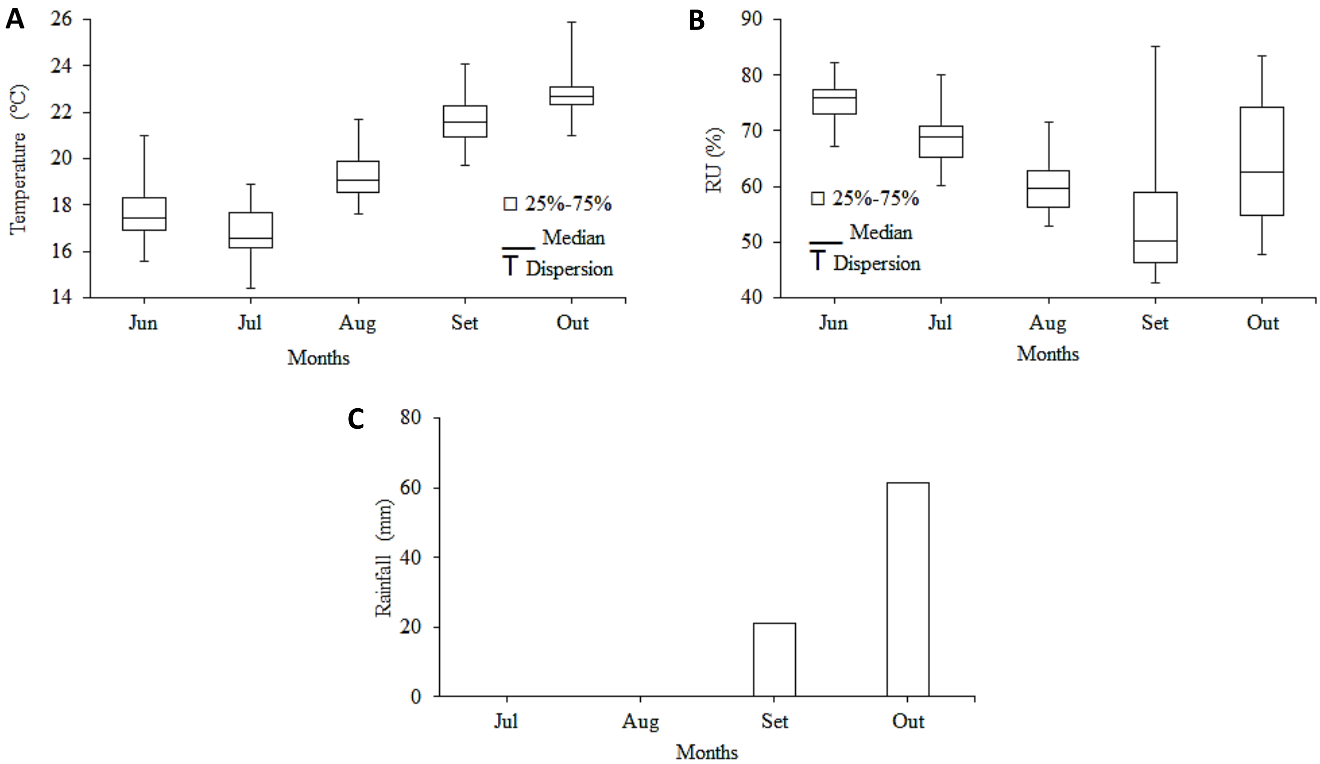

Figure 1. Climate data collected on the weather station located on the Fazenda Água Limpa, between June and October, Brasília, DF, 2019. (A) Temperature; (B) RU and (C) Rainfall.

The soil was classified as Red-Yellow Latosol, clayphase, named by the Brazilian soil classification system as EUTROPHIC YELLOW RED LATOSSOLO (Dos Santos et al. 2018).

For the study, the Compack (Seminis®) Hybrid tomato was used. The tomato seedlings were acquired 30 days after the sowing. The transplant was done on July, third of 2019. The experiment was conducted in an area measuring 24 x 35 m, with a spacing between single lines of 1.5 m, and a 0.44 m spacing between plants. The vertical conduction system was adopted, in which posts of two meters high were used to support the tutors. In addition, one eucalyptus stick was used per pit to support the tomato plant, spaced 0.44 m apart of each other.

The chemical characteristic of the soil (Table 1) was obtained through 20 simple samples collected in the first 0.2 m of the soil, and them homogenized in a composite sample, which was analyzed in the soil fertility laboratory Soloquímica, on Brasília/DF. The results obtained are shown below (Table 1).

Table 1. Soil analysis results of the experimental field before the tomato planting operations, Brasília, 2019.

pH	O.M.	P $_{mehlich}^{-1}$	Al^{3+}	H +Al	K	Ca^{2+}	Mg^{2+}	SB	CEC
H_2O	g kg^{-1}	mg.$^{dm-3}$				cmol$_c$ dm^{-3}			
5,8	31,0	3,9	0,0	2,5	0,16	2,1	1,5	3,8	3,6
V	B	Cu	Fe	Mn	Zn	S			
%					mg.dm^{-3}				
61	0,04	0,6	41,1	14,1	2,5	11,8			

Organic Matter (O.M.), sum of bases (SB), and cation exchange capacity (CEC), base saturation (V%).

The soil correction (liming) was performed through the need for the base saturation, raising the saturation from 61% (Table 1) to 80%, using 1.5 t ha^{-1} of dolomitic limestone with 80% effective calcium carbonate equivalent. The limestone was incorporated in the superficial layer (0 to 0.2 m) 60 days before transplanting the seedlings.

For the fertilization process, the following fertilizer doses were used for the pre-planting and fertigation process: A1: Recommendation according to Ribeiro (1999); A2: 50% of A1; A3: 150% of A1; A4: 200% of A1.

Considering the results presented in Table 1, the phosphate fertilization for A1 was 900 kg ha^{-1} of P_2O_5, of which super phosphate was used as source in a 5 t ha^{-1} dose. For the N-fertilization, urea was used as source in an 88 kg ha^{-1} dose, and 40 kg ha^{-1} of K2O for potassium fertilization, with 66 kg ha^{-1} of potassium chloride (KCl). The remaining doses for fertilization, namely A2, A3 and A4, were based on the doses of A1. The fertilizers were distributed manually on the planting line 15 days before transplanting the seedlings and incorporated using a rotary hoe in the 0 to 0.2 m soil layer. In addition to these fertilizations, two leaf applications of Borax® were used to prevent the blossom-end rot physiological disorders in the crop.

The fertigation was carried out in a weekly basis, starting 15 days after the transplanting, and ending 120 after. In total, 15 N-fertigation (with 881.6 kg ha^{-1} of urea) and 15 K-fertigation (628 kg ha^{-1} of K_2O and 1047.5 kg ha^{-1} of potassium chloride) were conducted, totaling 30 split fertigation according to Alvarenga (2013), with adaptations. Irrigation was done as recommended for the crop, using a drip system with hoses containing emitters spaced 0.2 m apart.

During the transplanting, four conduction treatments were developed, consisting of C1 (one plant per pit with only the main stem); C2 (One plant per pit with the main stem and one secondary stem below the first inflorescence); C3 (2 plants per pit both with only the main stem); C4 (2 plants per pit, both with the main stem and one secondary stem below the first inflorescence).

The pruning was done weekly, which consisted of removing shoots in order to configure the treatments scheduled for the conduction of the plants. In addition, part of the treatment stems was tied with white strings on the eucalyptus tutors, used to support the plants. The weeds control was done with the post emergence Sencor® (Metribuzin) herbicide, applied 10 days after the transplanting with 1L per hectare dose. Subsequently, the weeds were removed with two manual weeding controls, 25 and 40 days after transplanting. Pest control was carried out through the monitoring and application of registered insecticides for the crop according to the observed level of incidence.

The experiment was conducted in a complete randomized block design with 3 replications, in a simple factorial scheme (4X4), which consisted of four doses of formulated fertilizer N-P-K (F1: 440-900-668, F2: 220-450-334, F3: 660-1,350-1,002, F4: 880-1,800-1,336) and four conduction systems (C1, C2, C3 and C4). Each plot contained 14 plants, 10 of which were used in sampling, spaced 1.5 m between rows and 0.44 m between plants in the line. The treatments with one plant per pit (C1 and C2) had a population of approximately 15,000.00 plants per hectare, and the treatments with two plants per pit had a population of 30,000.00 plants per hectare. Between the treatment lines, tomato plants were cultivated on the border to avoid interference between the fertilizer treatments. The border plants were not evaluated in the experiment. Topping was performed on plants when the main stalk had seven racemes.

The following characteristics were evaluated: Longitudinal and transversal diameter (mm), obtained by evaluating 10 fruits for each treatment, using a pachymeter; total fruit mass (kg), determined using a scale, and number of fruits per harvest. With this data, it was possible to obtain the following characteristics: estimated yield per hectare (EY), average fruit mass (FM), number of fruits per plant (NF), number of fruits per pit (NP), total production per plant (PP) and total production per pit, in kilogram (PC), longitudinal dimension of the fruit (diameter) (ØL), transversal dimension of the fruit (height) (ØT).

The fruits were later classified according to the classification recommended by Ferreira et al. (2004), in which the fruits were classified in small (50 to 64mm), average (65-79 mm), large (80-99 mm) and giant (>100mm) categories.

The evaluations took place between August 22, 2019, and November 4, 2019. The fruits were harvested weekly when they reached the beginning of maturation. Based on the evaluated characteristics, the following statistical analysis were performed: Analysis of variance and Tukey's means comparison test at 5% probability level. The software used was Genes (Cruz 2013).

3. Results

Significant differences were observed in the EY, FM, NF, NP, PC, PP, and ØL characteristic (Table 2). Only the characteristics ØT and ØL showed significant interaction, indicating that the fertilizer doses and plant density in the field can provide differences between these two characteristics (Table 2).

Table 2. Summary of the analysis of variance for variables: Estimated Yield (EY, kg ha^{-1}), Average Fruit Mass (FM, g), Number of fruits per plant (NF), Number of fruits per pit (NP), Production per plant (PP, kg), Production per pit (PC, kg), Longitudinal fruit diameter (ØL, mm) and Transversal fruit diameter (ØT, mm) comparing fertilizer doses and conduction treatments for salad tomatoesin function of the treatments, Brasília-DF, 2019.

	EY	FM	NF	NP	PC	PP	ØT	ØL
F Fertilizer (F)	9,76**	3,38^{ns}	16,61**	16,34**	19,69**	22,33**	4,59*	8,15**
F Conduction (C)	37,82**	9,67**	108,26**	41,03**	37,73**	101,75**	2,86^{ns}	9,28**
FxC	0,54^{ns}	1,71^{ns}	0,79^{ns}	1,14^{ns}	0,54^{ns}	0,88^{ns}	4,92**	3,87**

*Significant in the F test with 5% probability, **significant in the F test with 1% probability, ^{ns}not significant in the F test.

The average estimated yield obtained for all treatments was 132.71 t ha^{-1} (Table 3). This characteristic (EY) showed significant differences in fertilization, in the means comparison test (Table 3). The 50% dose (F2) showed lower results for this characteristic (114 t ha^{-1}) when compared to the other doses. The highest observed yield was 142.68 in the 150% dose (F3). For the treatments, the highest yield, 148 t ha^{-1}, was observed in the C4 treatment (two plants per pit, with 2 stems each), while C1 had the lowest 106 t ha^{-1} (Table 4). The 150% fertilizer dose (F3) did not differ from the F1 and F3 doses (Table 3). The highest yields obtained in this study were observed in the treatment C4, with 148.39 t ha^{-1} (C4), but this treatment did not differ from the treatment C3, with 143.59 t ha^{-1} (C3).

Table 3. Result of the Tukey means comparison test (5% probability), for the estimated yield (EY), productivity per pit (PC), productivity per plant (PP), average fruit mass (FM), number of fruits per plant (NF) and number of fruits per pit (NP) considering the fertilization doses, Brasília-DF, 2019.

Fertilizer	Characteristics					
	EY	PC	PP	FM	NF	NP
F1	131.33^{a}	8.76^{a}	6.30^{a}	186.74^{a}	33.60^{ab}	47.83^{ab}
F2	114.84^{b}	7.65^{b}	5.55^{b}	179.28^{a}	30.95^{b}	42.83^{b}
F3	142.68^{a}	9.51^{a}	6.94^{a}	185.03^{a}	37.28^{a}	52.17^{a}
F4	141.97^{a}	9.46^{a}	6.87^{a}	183.26^{a}	37.22^{a}	52.18^{a}
Mean	132.71	8.85	6.41	183.58	34,76	48.76
CV (%)	10.26	10.27	10.48	5.74	9.73	9.98

Means followerd by the same letter in the horizontal don't differ between each other at 5% probability in the Tukey test.

The productivity per pit (PC) data demonstrates that, the 150% fertilizer dose (F3) was superior to the F2 dose, but staticsally similar to the F1 and F4 doses. For the conductions, C4 showed the highest production per pit, with 9.89 kg, higher than the C1 (7.12 kg) and C2 (8.79 kg) (Table 3). The production per plant (PP), showed a difference between fertilizer doses only in the F2 dose (Table 3), with 7.65 kg per plant, and the 150% dose had the highest (9.51 kg per plant). The treatments containing two plants per pit (C3 and C4) showed lower results (less than 5 kg per plant) than the treatment containing one plant with one stem (C1 – 7.12 kg), which was lower than C2, with 8.80 kg.

The results for the average fruit mass show no significant differences between fertilizations (Table 3), in which fertilizer dose F1 presented the highest average mass of 186.74 g per fruit, and the 50% dose (F2), the lowest average fruit mass, 179.28 g. The highest average fruit mass was observed in the C1 treatment (199.98 g), and the lowest was C4, with an average of 167.80 g per fruit (Table 4). The number of fruits obtained per plant (NF) was higher in the C2 conduction when compared to all of the others (Table 4).

Table 4. Result of the Tukey means comparison test (5% probability), for the estimated yield (EY), productivity per pit (PC), productivity per plant (PP), average fruit mass (FM), number of fruits per plant (NF) and number of fruits per pit (NP) taking into account the conduction treatments, Brasília-DF, 2019.

Treatments	Characteristics					
	EY	PC	PP	FM	NF	NP
C1	106.88^{c}	7.12^{c}	7.12^{b}	199.98^{a}	35.58^{b}	35.58^{c}
C2	131.96^{b}	8.79^{b}	8.80^{a}	185.23^{b}	47.21^{a}	47.51^{b}
C3	143.59^{ab}	9.57^{ab}	4.78^{c}	181.31^{b}	26.4^{c}	52.83^{b}
C4	148.39^{a}	9.89^{a}	4.85^{c}	167.80^{c}	29.56^{c}	59.12^{a}
Mean	132.71	8.85	6.41	183.58	34.76	48,76
CV (%)	10.26	10.27	10.48	5.74	9.73	9.98

Means followerd by the same letter in the horizontal don't differ between each other at 5% probability in the Tukey test.

The fertilization influenced the number of fruits per pit (NP), where the 150% and 200% (F3 and F4) presented the highest number of fruits (Table 3), approximately 52, and the 50% dose the lowest, 42.83. Considering all the tested treatments, the C1, had the lowest number of fruits, 35.58, C2 and C3 had similar number of fruits, with 47.51 and 52.83 respectively, and C4 had the highest, with 59.12 (Table 4).

For the F1 fertilization, the conduction systems influenced the longitudinal fruit diameters (ØL), and the C1 had a larger fruit diameter than the other treatments for the recommended fertilizer dose (F1). For the F3 and F4 fertilizer doses, the diameter of C4 was lower than C1. The smallest average fruit longitudinal diameter (ØL) observed was 71.39 mm and the largest 77.34 mm (Table 5).

Table 5. Result of the Tukey means comparison test (5% probability), for the Longitudinal and transversal diameters, taking into account the interaction between Fertilization x Conduction systems, Brasília-DF, 2019.

Longitudinal diameter (ØL - mm)				
Conduction/Fertilizer	F1 recommended dose	F2 50% dose	F3 150% dose	F4 200% dose
C1	77.34^{Aa}	72.79^{Ca}	76.53^{ABa}	74.45^{BCa}
C2	71.82^{Bb}	72.98^{ABa}	74.48^{Aab}	74.87^{Aa}
C3	73.19^{Ab}	74.80^{Aa}	74.16^{Aab}	72.24^{Aab}
C4	71.9^{Ab}	72.72^{Aa}	73.07^{Ab}	71.39^{Ab}
Mean	73.55	73.32	74.56	73.31
CV (%)	2.34	1.09	1.51	0.80
Transversal diameter (ØT - mm)				
C1	60.37^{Aa}	57.76^{Ba}	58.35^{Ba}	58.40^{Ba}
C2	57.26^{Ab}	57.52^{Aa}	57.66^{Aa}	57.30^{Aab}
C3	57.43^{Ab}	57.97^{Aa}	58.05^{Aa}	57.57^{Aab}
C4	56.19^{Ab}	56.17^{Ab}	55.86^{Ab}	56.63^{Ab}
Mean	57.81	57.36	57.48	57.45
CV (%)	0.76	1.08	1.20	1.06

Means followed by the upper-case letter in the horizontal and lower case in the vertical don't differ between each other at 5% probability in the Tukey test. C1 (one plant per pit with only the main stem); C2 (One plant per pit with the main stem and one secondary stem below the first inflorescence); C3 (2 plants per pit both with only the main stem); C4 (2 plants per pit, both with the main stem and one secondary stem below the first inflorescence).

Regarding transversal diameter (ØT), the fertilizer doses influenced in the treatments, with the recommended dose (F1) showing a higher significant average for this characteristic than the other doses in the conduction C1 (Table 4). For the recommended dose (F1), the treatment with one plant with one stem per pit had the higher transversal diameter (60.37 mm). For the fertilization F2 and F3, the fruits obtained from the treatment T4 showed lower diameter values than the other treatments. Considering the fertilization dose of 200% (F4), the conduction with less stems (C1) was statistically superior to the T4 treatment.

4. Discussion

The average yield obtained for all treatments was 132.71 t ha^{-1} (Table 3), which was higher than the Brazilian average yield in 2018, which was 70 t ha^{-1}(IBGE 2019). The difference in yields, comparing the Distrito Federal regions with other Brazilian regions, could be related to the tomato cultivation during the winter, in addition to different types of plant conduction systems (Melo and Vilela 2005).

Almeida et al. (2015), analyzing agronomic characteristics in the cultivation of hybrid tomatoes, in different conduction systems, obtained an estimated yield of 74.65 t ha^{-1} for tomato plants grown with just one stem. In this study, tomato plants grown with only one stem showed a higher estimated yield, 106 t ha^{-1} (Table 3). Similarly, Heine et al. (2015), evaluating the effect of different spacing and conductions systems with a different number of stems per plant, obtained an estimated average yield of 78.48 and 87.91 t ha^{-1} for the conductions with one and two stems respectively. The estimated yield (EY) results obtained in this study varied between 106.88 (C1) and 131.96 t ha^{-1} (C2) (Table 3), superior results when comparing to those obtained by Heine et al. (2015).

Genuncio et al. (2006), evaluating agronomic characteristics in tomato cultivars with one stem, submitted to different fertilizations, obtained yields ranging from 47 t ha^{-1} for the 50% fertilizer dose, 101.3 t ha^{-1} (75%) and 94.22 t ha^{-1} for the 100% dose. Similar results were obtained in this work, in which the data demonstrated that plants submitted to higher fertilizer doses do not necessarily present greater productivity.

For production per plant, Heine et al. (2015) obtained a significantly higher tomato production in plants conducted with two stems (4.31 kg) when compared to plants with one stem (3.83 kg). Similarly, Charlo et al. (2009), obtained higher productivity in tomato plants conducted with two stems per plant (5.71 kg), in contrast, plants with one stem had a productivity of 4.92 kg. Also, according to this author, the production per plant was higher in treatments conducted with only one plant per pit. These results, obtained by both authors, are similar to those obtained in this study, in which the systems containing only one plant per pit had superior production when compared to the treatments with two plants.

The average fruit mass (FM) results show that, the recommended dose had tomatoes of similar mass when compared to higher fertilizations, this being an important result, because the cost of chemical fertilizers can reach 18% of the total production cost in the Distrito Federal region (EMATER 2018), showing that the relation between costs and the gains in fruit mass don't increase in higher fertilizer doses.

The average fruit mass results are similar to those obtained by Charlo et al. (2009), who also obtained higher results for fruit mass in plants conducted with just one stem. When considering the treatments with two plants per pit, the results are alike those obtained by Charlo et al. (2009), in which, treatments with higher number of stems presented lower average fruit mass. According to Genuncio et al. (2006), there is a relation between the correct fertilizer doses, with the tomato's formation and their average mass during the harvest.

It is certain that, in addition to fertilization, the correct doses of water also influence this characteristic (Santana and Vieira 2010). These authors, seeking to determinate the optimal dose of water reposition to the soil, tested the doses of 70, 100, 130, 160 and 190%, obtaining the highest yield and the largest number of fruits at the 100% irrigation dose. Thus, for the conduction of tomato fields, understanding the best water levels, ideal fertilizer doses, in addition to edaphoclimatic and field management characteristics, may provide a better average fruit mass. The fruit mass is also relevant in the commercialization, since there is a difference in the resale prices based on the CEASAs classification.

According to market prices in Brazilian CEASAs, the average tomato prices (20 kg box), in the period between August and November 2019, ranged from R$ 38.80 (DF) and R$ 49.50 (CEAGESP-SP).

The lower number of fruits in conductions with just one plant and one stem can be explained due to the greater number of bunches present in plants grown with a higher number of stems (Charlo et al. 2009, Gomes et al. 2017). These results are similar to those obtained by Genuncio et al. (2006), who, testing different fertilizer doses on hydroponic cultivation of different tomato cultivars, did not obtain a higher number of fruits per plant in higher fertilization doses. The results obtained in this study, show that the number of fruits per plant was lower only in the F2 dose, where the other fertilizations had similar results.

The 100% fertilization dose can provide a number of fruits similar to higher doses (Table 3), similarly, in conduction systems with just one plant per pit (C1 and C2) the number of fruits were lower than the C4 treatment.

The results presented in Tables 3 and 4 are relevant in the tomato production fields, especially when observing the economic characteristics of the crop. According to EMATER (2018) data, the average costs of producing tomato is R$72,842.53 per hectare. Approximately 10% of these costs are related to expenses with seeds, and 18% is related to the fertilization. Thus, understanding what the ideal management and the fertilizer doses would be can promote higher yields and reduce costs in the field.

Considering this economic factor, the farmers usually adopt the conduction system with just one plant with two stems per pit (C2) when the seedling used is a hybrid, this can be explained because the cost related to the seedlings acquisition is much higher than the cost of open pollination cultivars. In this case, the most common conduction system is with two plants per pit with one stem each (C3), providing higher yields with lower costs.

Silva et al. (2013), evaluating the fertigation of tomatoes in a protected environment, observed that the excessive fertilization caused a reduction in the number of fruits obtained per plant. Likewise, Almeida et al. (2015), evaluating conduction systems, observed a yield ranging from 48.22 t ha^{-1} (10,000 plants per hectare) and 109.58 t ha^{-1} (25,000 plants per hectare), thus demonstrating that there is a great variation in yields between different cultivation systems for the tomato culture.

According to Ferreira et al. (2004) classification, the fruits evaluated in all treatments, in the present study, were classified as “average”. Considering the CEAGESP (2003) classification, the fruits evaluated in all fertilizations doses and conduction treatments were classified as “70 Class”. The fruit mass (FM), and diameters (ØL and ØT) reduction behavior observed in conduction systems with two stems, can be explained by the increase in the number of drains (fruits) per plant. Heine et al. (2015), obtained similar results, noting that the increase in the number of stems per plant reduced the average fruit mass.

The tomato plant is highly demanding in fertilization, and for the initial stages it mostly demands nitrogen and phosphorus (Silva et al. 2018), but in the fruiting phase, the plant is highly demanding in potassium, needed for the flowering and fruit production (Alvarenga 2013). Thus, the correct fertilization dose is extremely important in systems with a greater number of plants with two or more stems, as there is a greater competition between plants when growing in a denser system (Heine et al. 2015).

5. Conclusions

The results showed significant interactions between fertilizer doses and conduction systems, specifically in the fruit transversal and longitudinal diameters (ØT and ØL).

For the fertilizer doses, the yield ranged from 142.68 t ha^{-1}, in the 150% dose, and 114.84 t ha^{-1} for the 50% dose. The conduction influenced the yield, with the C4 treatment showing the highest production, with 148.39 t ha^{-1}, and the C1 had the lowest, 106.88 t ha^{-1}.

The highest production per pit (9.89 kg) was obtained in the conduction with two plants with two stems each and C1 had the lowest (7.12 kg). For the production per plant, the C2 treatment showed the highest value, with 8.80 kg per plant, and the C3 the lowest (4.78 kg).

For the longitudinal diameter, the fertilizer influenced this characteristic only when the conduction was done with one plant with one stem per pit, in which the recommended dose showed the higher value for this characteristic. As for the treatments, for all fertilizations, the systems with two plants per pit with two stems showed a smaller longitudinal diameter.

The 50% fertilizer dose provided a lower number of fruits per pit and per plant, when compared to the 150% and 200% doses. The C3 conduction presented the lowest number of fruits per plant (26.4), and C2 the highest (47.21).

The treatment with only one plant per pit with one stem (C1) provided higher average fruit mass (199.98 g) than the other treatments.

Authors' Contributions: OLIVEIRA JUNIOR, A.A.: conception and design, acquisition of data, analysis and interpretation of data, drafting the article; SILVA, G.F.: conception and design, acquisition of data, drafting the article; VILELA, M.S.: acquisition of data, drafting the article, analysis and interpretation of data; PEIXOTO, J.R.: acquisition of data, drafting the article; MATTOS, J. K. A.: analysis and interpretation of data, drafting the article; ÁVILA, J.V.: acquisition of data, drafting the article; CENCI, A. M.: acquisition of data, drafting the article; CASTRO, C.O.: acquisition of data, analysis and interpretation of data. All authors have read and approved the final version of the manuscript.

Conflicts of Interest: The authors declare no conflicts of interest.

Ethics Approval: Not applicable.

Acknowledgments: The authors are grateful to the University of Brasília (UnB) for the infrastructure support.

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Received: 25 April 2020 | **Accepted:** 21 June 2021 | **Published:** 5 August 2022