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Productivity and quality of melon cultivated in a protected environment under different soil managements

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ABSTRACT

The need to adapt agricultural crops to climate change and to develop more sustainable cultivation systems has been a major challenge for agriculture. In this study the effects of soil conservation practices were evaluated on production aspects of melon (*Cucumis melo*), cultivar BRS Araguaia, cultivated in a greenhouse under soil and climatic conditions of the Brazilian Cerrado. The adopted experimental design was of randomized blocks with three treatments (soil managements) and six replicates. We evaluated the following soil management systems: no-tillage (PD), minimum tillage (CM) and conventional tillage (PC) in two cycles. Increases in commercial productivity and average number of marketable fruits were observed for PD (61.5 and 61.2 t/ha; 56,000 and 44,300 fruits/ha in the first and second cycles, respectively) and CM (59.7 and 57.5 t/ha; 55,700 and 42,400 fruits/ha in the first and second cycles, respectively). No effects of management systems on fruit quality were observed. PD and CM were effective in increasing the production of melon under evaluated conditions.

Keywords: *Cucumis melo*, no-tillage, minimum tillage, conventional tillage, greenhouse.

RESUMO

Produtividade e qualidade de melão cultivado em ambiente protegido com diferentes manejos de solos

A necessidade de adaptação de cultivos agrícolas às mudanças climáticas, aliada à necessidade de desenvolvimento de cultivos mais sustentáveis constitui um grande desafio para a agricultura. O presente trabalho teve como objetivo avaliar os efeitos de sistemas de manejo de solo conservacionistas sobre aspectos produtivos de melão amarelo (*Cucumis melo*), cultivar BRS Araguaia, cultivado em ambiente protegido em condições edafoclimáticas do Cerrado brasileiro. O experimento foi conduzido em delineamento de blocos ao acaso, com três tratamentos (manejos de solo) e seis repetições. Foram avaliados os seguintes sistemas de manejo de solo: plantio direto na palha (PD), cultivo mínimo (CM) e plantio convencional (PC), em dois ciclos culturais. Foram observados incrementos na produtividade e no número médio de frutos produzidos quando do uso do PD (61,5 e 61,2 t/ha no primeiro e segundo ciclo, respectivamente) e do CM (59,7 e 57,5 t/ha no primeiro e segundo ciclo, respectivamente). Nenhum efeito dos sistemas de manejo sobre a qualidade dos frutos foi observado. O PD e o CM foram eficientes em aumentar a produção do melão amarelo nas condições avaliadas.

Palavras-chave: *Cucumis melo*, plantio direto na palha, cultivo mínimo, preparo convencional, cultivo protegido.

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Melon (*Cucumis melo*) is originated from the warm valleys of Iran and from the Northwest of India (Filgueira, 2008), that is the reason why this plant is best adapted to warm regions, with accentuated dry periods. These days, the largest producing region in Brazil is the Northeast. The northeastern melon market is not only restricted to the national market, considering that a good part of the production is destined to the exportation due to the high quality of fruits. The demand for the product, however, is not restricted to this region and the service to local markets may allow the production of this fruit in other Brazilian regions.

Climate projections for the end of the 21st century indicate a clear trend towards the increase of the average temperature of the planet, as demonstrated by the IPCC (2014). In Brazil, Hamada *et al*. (2012) report that a strong trend towards an increase in average air temperature for all the regions, considering greater climatic anomalies is expected for the Central-West region. This fact highlights a possible need, in this region, of agricultural practice management adapted to such temperature conditions, favoring species adapted to warm climate. Limiting factors, especially in spring-summer, should be the high rainfall rates commonly observed and also the possibility of concentration, at the same time, of extreme rainfall events according to Hamada *et al*. (2012). Due to this fact, productivity gains, using agricultural production in a protected environment, becomes a very good opportunity. The possibility of obtaining high productivity of melon grown in a greenhouse was demonstrated by Gualberto *et al*. (2001).

In relation to the sustainability of agricultural production systems, special attention has been given to soil quality. In this sense, management systems with low tillage system such as no-tillage or minimum tillage systems have been used in order, not only to obtain productivity gains, but also to maintain soil quality. The authors recommend special attention, since literature on the subject is scarce, to the adoption of some conservation practices in greenhouse and the effects on productivity aspects, mainly for melon crop. Previous experiments show good responses of melon grown in open fields when mulching, whether artificial or composed of vegetable residues, is maintained during the crop cycle (Silva *et al.*, 2005; Câmara *et al.*, 2007; Morais *et al.*, 2008, 2010; Lourenção *et al.*, 2013). In this study the hypothesis was tested if melon cultivation in a greenhouse can be benefited by straw left on the soil surface, or by the incorporation of straw into soil, with positive effects on productive components, capable of supplying specific market niches and adding value to the final product, key factors to compensate high costs of protected cultivation.

Thus, this study aimed to evaluate the productivity and postharvest characteristics of melon, cultivar BRS Araguaia, grown in a protected environment under three different soil management systems: no tillage (PD), minimum tillage (CM) and conventional tillage (PC) under soil and climatic conditions of the Brazilian Cerrado and two distinct periods.

MATERIAL AND METHODS

The experiment was carried out in the field of Embrapa Hortaliças, in Brasilia, Brazil (15º56'S, 48º08'W, altitude 997.6 m), from October 2013 to January 2014. The authors used cultivar BRS Araguaia, a "yellow" melon hybrid (*Cucumis melo*), developed at Embrapa and Emater-GO. The soil was classified as typic distrophic Red Latosoil, very clayey texture. The soil chemical attributes can be found in Table 1. According to Köppen, the climate is Aw (tropical savanna with rainfall concentration in summer).

The experiment was carried out in a protected environment, in a greenhouse with dimensions of 7 m width x 50 m length, covered with low-density polyethylene film, 150 micron thickness and anti-aphid screen. The authors used randomized block design, with three treatments (soil management) and six replicates. The evaluated treatments were: no-tillage (T1), conventional tillage (T2); and minimum tillage (T3), spacing of 0.30 m between plants and 0.8 m between rows. Two plant lines for each experimental plot were used, being the useful area of 5.6 m^2 (7 m length x 0.8 m width). The authors used seedlings grown in styrofoam trays. Transplanting (DAT) was carried out at 15 days after sowing in previously opened pits. The plants were tutored using nylon threads, with two fruits per plant. Tutoring of plants began at 18 days after transplanting.

Two experimental cycles, during two different cultivation periods, were carried out. The first cycle was carried out between October 2013 and January 2014, so that the authors could represent a period characterized by high temperature and high rainfall occurrence (average temperature of 22.55°C and total precipitation of 1284.8 mm). The second cycle was carried out between the end of July 2014 and November 2014, in order to represent a period characterized by high temperatures and very low rainfall occurrence (average temperature of 22.61°C and total precipitation of 480.8 mm).

Millet (*Pennisetum glaucum*) was used as cover crop (mulch) for straw formation. The sowing was broadcast, with high density, in the whole greenhouse. The average development cycle of the millet was 60 days. At the end of the cycle, the cover crop and straw were managed using a crusher-disintegrator followed by the use of the desiccant glyphosate at sprouting, and a week before melon planting, the authors applied desiccant Paraquat. In T1, the straw was maintained on the surface; In T2, it was taken from the experimental plots and incorporated subsurface with semi-opened grid in T3.

No-tillage management (PD) is related to straw formation and to open pits for planting, with minimum soil disturbance. Conventional tillage management (PC) was carried out using plowing once and harrowing twice and opening of pits for planting. For minimum tillage (CM), the authors just carried out one sub-superficial harrowing, with a levelling semi-opened grid so that the straw could be incorporated up to 10 cm deep.

Spray applications were performed to control pests and diseases in both planting cycles. In the first cycle, at 17 DAT, a solution of the fungicide (2 g/L) pyraclostrobin + metiran was applied on the whole area, at concentrations of 550 and 50 g/kg, respectively, to control the powdery mildew; at 28 DAT the aphid and white fly were controlled with the insecticide solution (0.44 g/L) of thiamethoxam and cypermethrin on the whole area, at concentrations of 750 and 30 g/kg, respectively. In the second cycle, at 1 DAT and 8 DAT, a solution of the fungicide (0.75 g/L) thiophanate-methyl + chlorothalonil metiran was applied on the whole area, at concentrations of 200 and 500 g/kg, respectively.

The nutrition of the melon was carried out, exclusively, through fertigation. The authors used dripping irrigation system; the doses of fertilizers were measured using a dispenser (Venturini type). Nutrient supply was carried out according to the need observed for the cultivar, in experiments previously carried out at Embrapa Hortaliças. At the end of the cycle, an amount equivalent to 190 kg/ha of N, 120 kg/ha of P_2O_5 and 170 kg/ha of K_2O was supplied.

In the first cultivation cycle, the harvests were carried out on January 9, 16 and 22, 2014. In the second cycle, the harvests were carried out on October 30, November 11 and 19, 2014. After each harvest, the following agronomic variables were evaluated: marketable fruits productivity, average weight per fruit, number of marketable fruits, fruit diameter, pulp thickness, pulp texture and soluble solid content (°Brix).

The evaluation of agronomic attributes followed protocols commonly used in the sector of Protected Cultivation of Embrapa Hortaliças. The mass of marketable fruits, which was used to determine the marketable fruits productivity and average weight per fruit, was determined with the aid of a scale with a maximum capacity of 60 kg.

In order to determine other postharvest traits, five marketable fruits were obtained randomly. The fruits were separated in two halves using a knife. In one of the halves, the authors determined the longitudinal length of the fruit and pulp thickness, using a graduated ruler. The pulp firmness was evaluated with the aid of a penetrometer. For this last analysis, seven random readings were carried out throughout the fruit pulp. Soluble solid content was determined using the juice of the fruit pulp, using a refractometer Atago Digital PR-1. The procedures were carried out similarly to that ones used by Terceiro Neto *et al*. (2013).

The results were submitted to the analysis of variance using the statistical program SISVAR. When ANOVA was significant, the averages were compared by the Scott-Knott test at a 5% significance level.

RESULTS AND DISCUSSION

Productivity and components

Analysis of variance shows that, at a 5% significance level, the authors noticed significant statistical differences, in both productive cycles, for the following attributes: marketable fruits productivity and average number of marketable fruits per treatment (Table 2).

Significantly higher productivity of marketable fruits was observed for PD (Table 2). The average marketable fruits productivity for this system was 61.49 t/ha. The intermediate productivity was for CM (59.71 t/ha). Significantly low productivity was observed for PC (44.18 t/ha). Similar results were found for the second cultivation cycle (Table 2), although any difference between the average of commercial productivities provided by PD and CM was noticed. In the second cycle, however, the highest commercial productivities were observed for PD, and for CM, 61.17 and 57.54 t/ha, respectively. Productivities found for all treatments were quite superior, reaching almost three times the Brazilian average productivity in 2012, which was 22.96 t/ha (Agrianual, 2013). The values obtained were similar to those obtained by Gualberto *et al.* (2001) for net melon grown in a greenhouse in the State of São Paulo.

Braga *et al.* (2010) found, in an experiment carried out in open field under Northeastern semi-arid climatic conditions and six different kinds of mulches, synthetic and natural, highest commercial productivities in relation to the ones which did not use mulches. These productivities were still similar to ones found in this study for treatments which used PD. Although the experiments were carried out in different productive systems, the results show that a tendency to maintain higher productivities can be

Table 1. Chemical attributes of typic distrophic Red Latosoil previously to experiment implementation. Brasília, Embrapa Hortaliças, 2016.

Management system	pH (H_2O)	P (mg/dm³)	K (mg/dm³)	Na (cmol$_c$/dm³)	Ca (cmol$_c$/dm³)	Mg (cmol$_c$/dm³)	Al (cmol$_c$/dm³)	H+Al (cmol$_c$/dm³)	MOS (g/kg)
First cycle									
0-10 cm									
CM	6.8±0.6	125.0±55.8	338.2±140.0	8.0±1.3	10.2±2.1	3.3±0.3	0.0	1.4±1.0	45.3±3.2
PC	6.9±0.4	125.7±31.3	332.7±186.3	8.3±0.5	11.0±2.3	2.8±0.2	0.0	1.2±1.2	44.0±2.9
PD	7.2±0.5	117.9±14.3	336.7±187.3	9.0±1.3	12.0±1.7	3.1±0.5	0.0	0.7±1.0	43.6±3.5
10-30 cm									
CM	6.6±0.6	107.7±39.9	341.0±135.9	8.7±0.8	10.4±2.2	3.1±0.5	0.0	1.9±1.2	41.3±6.2
PC	6.8±0.5	121.6±27.3	369.5±149.1	8.3±0.5	10.0±3.1	3.2±0.3	0.0	1.7±1.1	44.9±2.7
PD	7.0±0.5	145. 7±70.0	458.3±73.6	9.2±1.5	11.3±2.6	3.2±0.2	0.0	1.1±1.1	41.9±4.1
Second cycle									
0-10 cm									
CM	6.9±0.5	130.3±40.9	565.0±149.8	14.2±1.2	10.6±1.9	4.1±0.5	0.0	0.7±0.6	39.7±1.3
PC	6.7±0.4	77.0±14.8	346.5±106.9	13.5±2.1	11.4±1.5	3.6±0.3	0.0	1.0±0.5	39.4±1.0
PD	6.9±0.5	107.4±26.4	571.7±96.8	14.7±0.8	12.6±2.0	3.6±0.3	0.0	0.7±0.6	42.7±1.4
10-30 cm									
CM	6.8±0.6	108.7±27.8	623.3±243.5	13.3±1.6	11.4±2.4	3.9±0.4	0.0	0.8±0.8	35.0±1.4
PC	6.6±0.4	99.2±33.1	331.7±129.6	14.7±1.8	10.7±2.0	3.5±0.3	0.0	1.0±0.5	32.4±1.4
PD	6.8±0.5	91.2±35.6	427.5±149.2	13.8±1.6	11.3±2.6	3.6±0.2	0.0	0.7±0.6	36.9±2.1

CM= minimum soil tillage system; PC= conventional soil tillage system; PD= no soil tillage system.

observed when mulch is used (Silva *et al.*, 2005; Câmara *et al.*, 2007; Morais *et al.*, 2008, 2010; Lourenção *et al.*, 2013). The increase in productivity in relation to the use of mulch has been attributed to the reduction of water evaporation, to the lower thermal amplitude, to no contact of the fruit with naked soil, greater availability and lower nutrient leaching, to less occurrence of weeds, among others (Brandenberger & Wiedenfeld, 1997; Araújo *et al.*, 2003). The authors also highlight that the use of vegetation cover resulting from the systematization and long-term conduction of no-tillage system (PD) shows even less environmental impact and provides, with an effective crop rotation, maintenance of the aggregation (Assis & Lanças, 2005, 2010) and an increase in the amount (stocks) of organic matter and its fractions (Figueiredo *et al.*, 2007; Carneiro *et al.*, 2008), an increase in nutrient contents (Neto *et al.*, 2010), among others, consequently, improving soil quality. In general, productivities obtained for all treatments are superior to ones found in other studies (Araújo *et al.*, 2003; Araújo Neto *et al.*, 2003; Silva *et al.*, 2005; Nunes *et al.,* 2005; Santos *et al.*, 2011; Lourenção *et al.*, 2013).

In the first cycle, the authors observed the following average weight per fruit: 920 g in PD, 890 g in PC, 870 g in CM. In the second cycle, these values were: 839 g in PD; 870 g in PC and 888 g in CM. These values are lower than those found in most part of literature, especially for hybrids of "yellow" melon produced in the Northeastern semi-arid region (Araújo Neto *et al.*, 2003; Araújo *et al.*, 2003; Nunes *et al.*, 2005; Santos *et al.*, 2011). The low values for average weight per fruit observed in this study may be due to the higher density of plants used in this experiment (0.8 m between rows and 0.3 m between plants). In the study carried out by Terceiro Neto *et al*. (2013), the spacing used for growing melon in open field in Northeastern semi-arid region was of 2.0 m between rows and 0.5 m between plants.

Average weight per fruit similar to those found in this study were also observed by Gualberto *et al.* (2001) and Frizzone *et al.* (2005) for net melon grown in a greenhouse in the State of São Paulo. Gualberto *et al.* (2001) verified that the increase of spacing decreased the productivity of net melon in a protected environment. Additionally, the average weight per fruit found, for the greatest spacing between lines used (70 cm) was the one which was the closest to the values observed in this study. Significant differences among treatments in relation to the average number of marketable fruits were also observed in the two production cycles. PD and CM systems resulted in higher numbers of fruits, whereas PC provided lower values for this parameter. In the first cycle, PD and CM management systems resulted in average number of fruits of 37.5 and 37.3, respectively. These numbers are statistically superior to the average number of fruits produced by PC, though, which was 28.3. Considering that the useful area per experimental plot was 5.6 m^2, the authors show NF/useful area ratio of, approximately, 5.6 fruits/m^2, 4.2 fruits/m^2 and 5.6 fruits/m^2 for PD, PC and CM, respectively. These values correspond to the average number of fruits per hectare, approximately 67,000 fruits/ha, 51,000 fruits/ha and 67,000 fruits/ha, respectively. The values obtained are superior to those found by Câmara *et al.*, (2007) for melon cultivation in open field in the

Table 2. Productivity of yellow melon cultivated in a greenhouse under different soil management systems in Brazilian Cerrado. Brasília, Embrapa Hortaliças, 2016.

Management system	Commercial productivity (t/ha)	Fruit weight (g)	Marketable fruits (1,000/ha)
		First cycle	
PD	61.5 a	920 a	56.0 a
PC	44.2 c	870 a	57.1 b
CM	59.7 b	890 a	55.7 a
CV (%)	15.98	6.71	8.75
		Second cycle	
PD	61.2 a	839 a	44.3 a
PC	40.1 b	870 a	33.4 b
CM	57.5 a	888 a	42.5 a
CV (%)	18.79	6.28	19.8

PD= No-tillage; PC= Conventional tillage; CM= Minimum tillage. Averages (columns) followed by the same letter do not differ by Scott-Knott test at 5%.

Table 3. Quality of yellow melon cultivated in a greenhouse under diferente soil management systems in Brazilian Cerrado. Brasília, Embrapa Hortaliças, 2016.

Cultivation system	Total soluble solids (ºBrix)	Pulp firmness (N)	Pulp thickness (cm)	Longitudinal length (cm)
		First cycle		
PD	13.15 a	49.88 a	3.22 a	12.05 a
PC	12.83 a	50.83 a	3.11 a	11.52 a
CM	12.98 a	50.50 a	3.24 a	11.81 a
CV (%)	5.68	1.95	3.39	3.12
		Second cycle		
PD	11.89 a	47.1 a	2.97 a	14.09 a
PC	12.66 a	45.2 a	3.06 a	12.85 a
CM	13.10 a	50.6 a	3.02 a	14.82 a
CV (%)	11.64	11.35	13.00	11.49

PD= No-tillage; PC= Conventional tillage; CM= Minimum tillage. Averages (columns) followed by the same letter do not differ by Scott-Knott test at 5%.

Northeastern semi-arid region. Those results are due to, mainly, plant density allowed by the cultivation in a protected environment and by the melon staking.

Technical recommendation for the cultivar used suggests that optimal productivity and quality of the fruits are obtained through cultivation carried out between May and November (Oliveira *et al.*, 2011), in the main producing regions, mainly due to the weather characteristics of this period, high temperature and low rainfall. In this study, the cultivation was carried out from October to January in the first cycle (rainy and hot) and from August to November, in the second cycle (dry and warm). However, in these two cycles, productivity, average matter of fruit and average number of marketable fruits were similar, which demonstrate a possible efficiency of cultivation in a greenhouse for maintaining stable production in the two evaluated periods.

Fruit quality

Based in the analysis of variance at 5% significance level, the authors did not notice any significant statistic differences in relation to all the variables used to measure the quality of melon, in the two crop seasons carried out (Table 3). Similar results were found by Miranda *et al.* (2003) and Braga *et al.* (2010). Câmara *et al.* (2007); however, verified the influence of different kinds of mulches on thickness and firmness of pulp, as well as soluble solid contents, contrasting with those observed in the studies of the authors previously mentioned and in the present study. Questions on the influence of mulch on qualitative aspects of melon, which should be evaluated, still remain. Anyway, such variables are known as genetic traits and, because of this, they can be more related to the hybrid used than to the soil management system (Araújo Neto *et al.*, 2003; Terceiro Neto *et al.*, 2013).

Soluble solid contents (Table 3) observed for all treatments in this study are similar to the ones obtained by Gualberto *et al.* (2001) for net melon cultivated in a protected environment in the State of São Paulo. These values are higher than the ones presented in other studies (Araújo Neto *et al.*, 2003; Miranda *et al.,* 2003; Nunes *et al.*, 2005; Câmara *et al.*, 2007; Paiva *et al.*, 2008; Braga *et al.*, 2010), reproducing different production systems of yellow melon commonly used in Northeastern semi-arid.

Pulp firmness (Table 3) measured was higher than the ones found in studies carried out by Nunes *et al.* (2005), Câmara *et al.* (2007) and, Paiva *et al.* (2008). High pulp firmness is a trait of cultivar BRS Araguaia, whose fruits showed, in previous tests, when stored for 42 days in environmental and refrigerated conditions, the same average values 41.2 N and 33.2 N, respectively (Oliveira *et al.*, 2011). Another justification for the higher values found may be the period between harvest and analysis to determine pulp firmness. In this study, this analysis was carried out right after harvesting, and always on the same day. In the study carried out by Nunes *et al.* (2004), firmness evaluation was carried out after 20 days of cold storage. Other studies, such as the one carried out by Câmara *et al.* (2007) and Paiva *et al.* (2008), did not mention this time interval.

The average pulp thickness observed for the evaluated melon are in accordance with the ones found in other studies with hybrids of yellow

Table 4. Pearson's correlation coefficients between fertility attributes of the soil prior to the cultivation and marketable fruit productivity and average number of marketable fruits. Brasília, Embrapa Hortaliças, 2016.

Attributes	2013		2014	
	PFC	NMF	PFC	NMF
CM				
pH	-0.01^{ns}	0.05^{ns}	0.06^{ns}	0.32^{ns}
P	0.48^{ns}	0.59^{ns}	0.43^{ns}	0.17^{ns}
K	-0.09^{ns}	0.08^{ns}	0.54^{ns}	-0.04^{ns}
Ca	-0.24^{ns}	-0.24^{ns}	0.25^{ns}	0.52^{ns}
Mg	-0.43^{ns}	-0.23^{ns}	-0.08^{ns}	0.42^{ns}
H+Al	0.06^{ns}	0.05^{ns}	-0.05^{ns}	-0.20^{ns}
MOS	-0.32^{ns}	-0.54^{ns}	0.75^{ns}	0.40^{ns}
CTC	-0.26^{ns}	-0.22^{ns}	0.32^{ns}	0.57^{ns}
PC				
pH	-0.70^{ns}	-0.64^{ns}	-0.24^{ns}	0.11^{ns}
P	-0.04^{ns}	-0.06^{ns}	-0.12^{ns}	-0.22^{ns}
K	0.27^{ns}	0.12^{ns}	0.56^{ns}	0.69^{ns}
Ca	-0.20^{ns}	-0.18^{ns}	0.73^{ns}	0.89*
Mg	-0.30^{ns}	-0.22^{ns}	0.55^{ns}	0.77^{ns}
H+Al	0.81^{ns}	0.74^{ns}	0.26^{ns}	-0.06^{ns}
MOS	0.06^{ns}	0.14^{ns}	0.55^{ns}	0.47^{ns}
CTC	-0.12^{ns}	-0.12^{ns}	0.82*	0.92*
PD				
pH	-0.78^{ns}	-0.64^{ns}	-0.62^{ns}	-0.18^{ns}
P	0.51^{ns}	-0.05^{ns}	0.07^{ns}	-0.16^{ns}
K	0.58^{ns}	0.05^{ns}	-0.23^{ns}	0.06^{ns}
Ca	-0.38^{ns}	-0.72^{ns}	0.40^{ns}	0.62^{ns}
Mg	0.43^{ns}	-0.22^{ns}	-0.02^{ns}	0.14^{ns}
H+Al	0.74^{ns}	0.49^{ns}	0.53^{ns}	0.15^{ns}
MOS	0.34^{ns}	-0.23^{ns}	-0.05^{ns}	0.45^{ns}
CTC	-0.09^{ns}	-0.09^{ns}	0.45^{ns}	0.48^{ns}

melon cultivated in different planting systems (Paiva *et al.*, 2008; Santos *et al.*, 2011). Nevertheless, Nunes *et al.* (2005) verified for edaphoclimatic conditions of the Northeastern semi-arid and open field cultivation average pulp thickness approximately one centimeter higher than the one observed in this study.

The average longitudinal length of the fruit showed, as well as the average weight, the reduced fruit size, when comparing to the results obtained from Paiva *et al.* (2008). Gualberto *et al.* (2001) observed for net melon cultivated in the State of São Paulo, in a protected environment, using the productive system with tutoring of plants and spacing of 0.7 m among rows, similar values to the observed in this study. This fact, as mentioned above, reinforces the idea that the density of the plants may be the factor responsible for the smaller size of the fruits produced.

Productivity and quality of melon in this study were similar in the two cycles and the results reported by Gualberto *et al.* (2001) for net melon, using similar productive systems and weather conditions. Despite the small size of fruits produced, the traits presented show differentiated fruits, evidenced, for example, by the high content of soluble solids. This may add value to the final product.

Effects of soil management systems

The use of PD increased significantly the productivity of marketable fruits in the first cycle and, with CM, in the second cultivation cycle (Table 2). Productivity levels evaluated in two first systems were superior to PC and to the national average in the two evaluated cultivation cycles. Also, the use of PD and CM led to the production of a higher average number of marketable fruits when compared to PC. Thus, the joint use of cultivation in a protected environment and of more conservation practices as PD and CM potentiated the production of yellow melon under the evaluated edaphoclimatic conditions.

The authors did not find significant correlations between fertility attributes measured previously to implement the experiment (Table 4), in the first cultivation cycle, and the results for PFC and NMF. In the second cultivation cycle, the authors found significant correlation coefficients only for PC and between: PFC and CTC; NMF and CTC and; NMF and Ca^{2+} contents. These results reinforce the possibility of the increase of these two productive components being linked to the management system.

The authors concluded that the use of PD and CM in a greenhouse result in higher productivity being more efficient in order to increase the average number of fruits produced, when compared to PC.

REFERENCES

AGRIANUAL. 2013. Agrianual: Anuário da agricultura brasileira. São Paulo. 482p.

ARAÚJO, AP; NEGREIROS, MZ; LEITÃO, MMVBR; PEDROSA, JF; BEZERRA NETO, F; ESPÍNOLA SOBRINHO, J; FERREIRA, RLF; NOGUEIRA, ICC. 2003. Rendimento do melão amarelo cultivado em diferentes tipos de cobertura do solo e métodos de plantio. *Horticultura Brasileira* 21: 123-126.

ARAÚJO NETO, SEV; GURGEL, FL; PEDROSA, JF; FERREIRA, RLF; ARAÚJO, AP. 2003. Produtividade e qualidade de genótipos de melão-amarelo em quatro ambientes. *Revista Brasileira de Fruticultura* 25: 104-107.

ASSIS, RL; LANÇAS, KP. 2005. Avaliação dos atributos físicos de um Nitossolo Vermelho Distroférrico sob sistema de plantio direto, preparo convencional e mata nativa. *Revista Brasileira de Ciência do Solo* 29: 515-522.

ASSIS, RL; LANÇAS, KP. 2010. Agregação de um Nitossolo Vermelho Distroférrico sob sistemas de plantio direto, preparo convencional e mata nativa. *Engenharia Agrícola* 30: 58-66.

BRAGA, MB; RESENDE, GM; MOURA, MSB; DIAS, RCS; COSTA, ND; CALGARO, M; CORREIA, JS; SILVA, FZ. 2010. Produtividade e qualidade do melão submetido a diferentes tipos de cobertura do solo. *Irriga* 15: 422-430.

BRANDENBERGER, L; WIEDENFELD, B. 1997. Physical characteristics of mulches and their impact on crop response and profitability in muskmelon production. *HortTechnology* 7: 165-168.

CÂMARA, MJT; NEGREIROS, MZ; MEDEIROS, JF; BEZERRA NETO, F; BARROS, JÚNIOR, AP. 2007. Produção e qualidade de melão amarelo influenciado por coberturas do solo e lâminas de irrigação no período chuvoso. *Ciência Rural* 37: 58-63.

CARNEIRO, MAC; SOUZA, ED; REIS, EF; PEREIRA, HS; AZEVEDO, WR. 2008. Atributos físicos, químicos e biológicos de solo de cerrado sob diferentes sistemas de uso e manejo. *Revista Brasileira de Ciência do Solo* 33: 147-157.

FIGUEIREDO, CC; RESCK, DVS; GOMES, AC; FERREIRA, EAB; RAMOS, MLG. 2007. Carbono e nitrogênio da biomassa microbiana em resposta a diferentes sistemas de manejo de um latossolo vermelho no cerrado. *Revista Brasileira de Ciência do Solo* 31: 551-562.

FILGUEIRA, FAR. 2008. *Novo manual de olericultura: agrotecnologia moderna na produção e comercialização de hortaliças*. Viçosa: UFV. 421p.

FRIZZONE, JA; CARDOSO, SS; REZENDE, R. 2005. Produtividade e qualidade de frutos de meloeiro cultivado em ambiente protegido com aplicação de dióxido de carbono e de potássio via água de irrigação. *Acta Scientiarum* 27: 707-717.

GUALBERTO, R; RESENDE, FV; LOSASSO, PHL. 2001. Produtividade e qualidade do melão rendilhado em ambiente protegido em função do espaçamento e sistema de condução. *Horticultura Brasileira* 19: 240-243.

HAMADA, E; GHINI, R; MARENGO, JA; THOMAZ ,MC. 2012. Projeções de mudanças climáticas para o Brasil no final do século XXI. In: GHINI, R.; HAMADA, E; BERTIOL, W (eds). *Impactos das mudanças climáticas sobre as doenças de importantes culturas do Brasil*. Jaguariúna: Embrapa Meio Ambiente. p. 43-74.

IPCC. 2013. Summary for Policymakers. 2014. Disponível em <http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf> Acessado em 20 de março de 2014.

LOURENÇÃO, WAP; JÚNIOR, SS; NEVES, JF; DIAS, LDE; NODARI, IDE. 2013. Produção de melão amarelo sob coberturas e cultivo convencional em Cáceres-MT. In: CONGRESSO DE INICIAÇÃO CIENTÍFICA, 5. Anais...Cáceres: UNEMAT. Disponível em http://siec.unemat.br/anais/conic/impressao-resumo_expandido.php?fxev=MA==HYPERLINK=I. Acessado em 20 de março de 2014.

MIRANDA, NO; MEDEIROS, JF; NASCIMENTO, IB; ALVES, LP. 2003. Produtividade e qualidade de frutos de melão em resposta à cobertura do solo com plástico preto e ao preparo do solo. *Horticultura Brasileira* 21: 490-493.

MORAIS, ERC; MAIA, CE; NEGREIROS, MZ. ARAÚJO JÚNIOR, BB. 2010. Crescimento e produtividade do meloeiro Torreon influenciado pela cobertura do solo. *Acta Scientiarum Agronomy* 32: 301-308.

MORAIS, ERC.; NEGREIROS, MZ; ARAÚJO JÚNIOR, BB; MEDEIROS, JF. 2008. Crescimento e produtividade do meloeiro Goldex influenciado pela cobertura do solo. *Scientia Agraria* 9: 129-137.

NETO, MS; PICCOLO, MC; VEZKE, SP; FEIGL, BJ; CERRI, CC. 2010. Mineralização e desnitrificação do nitrogênio no solo sob sistema de plantio direto. *Bragantia* 4: 923-936.

NUNES, GHS; SANTOS JÚNIOR, JJ; ANDRADE, FV; BEZERRA NETO, F; ALMEIDA, AHB; MEDEIROS, DC. 2004. Aspectos produtivos de qualidade de híbridos de melão cultivado no agropolo de Mossoró-

Assu. *Horticultura Brasileira* 22:744-747.

NUNES, GHS; SANTOS JÚNIOR, JJ; ANDRADE, FV; BEZERRA NETO, F; MENEZES, JB; PEREIRA, EWL. 2005. Desempenho de híbridos de melão do grupo inodorus em Mossoró. *Horticultura Brasileira* 23: 90-93.

OLIVEIRA, VR; BOITEUX, LS; COSTA, ND; BUSO, JA; ARAGÃO, FAZ; CARVALHO, ADF; COELHO, M; BUSO, GSC; ASSIS, JS; DIAS, RCS; PAIVA, WO; REIS, A; DUSI, NA; LOPES, CA; MORETTI, CL; GUEDES, IMR; PINHEIRO, JB; MATTOS, LM; LIMA, MF; SOUZA, RB; MELO, WF. 2011. BRS Araguaia: cultivar híbrida de melão amarelo. *Horticultura Brasileira* 29: S3219-S3226.

PAIVA, WO; MARQUES, GV; MESQUITA, JBR; DANTAS, RS; FREITAS, FWA. 2008. Qualidade e conservação de frutos de melão Amarelo em dois pontos de colheita. *Revista Ciência Agronômica* 39: 70-76.

SANTOS, MF; COSTA, CC; OLIVEIRA, EM; BARBOSA, JWS. 2011. Avaliação de genótipos de melão amarelo em Paulista, PB. *Tecnologia e Ciência Agropecuária* 5: 1-6.

SILVA, MCC; MEDEIROS, JF; NEGREIROS, MZ; SOUZA, VF. 2005. Produtividade de frutos de meloeiro sob diferentes níveis de salinidade de água de irrigação com e sem cobertura do solo. *Horticultura Brasileira* 23: 202-205.

TERCEIRO NETO, CPC; GHEYI, HR; MEDEIROS, JF; DIAS, NS; CAMPOS, MS. 2013. Produtividade e qualidade de melão sob manejo com água de salinidade crescente. *Pesquisa Agropecuária Tropical* 43: 354-362.