Use of Organic Compounds in Melon Cropping

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Abstract

An experiment was set up in Bebedouro Experimental Station in Petrolina-PE, Brazil, to evaluate the effect of different organic compounds and bio-fertilizers through fertigation on melon cropping. The treatments consisted of five types of compounds formed by a combination of Napier grass, coconut bagasse, castor bean cake, goat manure, potassium super-phosphate and thermo-phosphate. The total and commercial fruit yields, fruit chemical characteristics (soluble solids content, total acidity and pH) and fruit physic characteristics (mass loss and pulp firmness) were assessed. The highest commercial fruit yields of 27.13, 26.58 and 26.45 t ha^{-1} were obtained, respectively, by 77% coconut bagasse + 20% goat manure + 3% thermo-phosphate, by 50% Napier grass + 40% goat manure + 10% castor bean cake and by 50% Napier grass + 40% goat manure + 10% castor bean cake, at 10 L m^{-1} combinations. There were no significant effects of the organic compounds on the melon fruit chemical characteristics (pH, TTA), but the organic management caused mass loss and reduced pulp firmness during the storage time, compared to the conventional fertilized crop.

INTRODUCTION

Recent advances in organic fruit production allowed the application of many types of organic residues. However, the knowledge about the effect of these residues in the soil chemical conditions is limited. Organic compounds are usually applied to soil, promoting benefits on its structure and the microbial population, increasing the nutrient availability and plant growth and reducing the water stress in plants (Altiere, 1999).

The Brazilian semi-arid is a distinct region, having a unique tropical semi-arid climate in the world, different from other semi-arid regions such as the ones in Chile, Mexico, USA and Australia. This characteristic is an advantage because the constant heat, high sunlight and low air relative humidity associated to irrigation offer favorable conditions for efficient agricultural production.

Located in that Brazilian region, San Francisco Valley is recognized by using agricultural technologies based on irrigation, aiming to reach competitive and qualified markets. In this direction, the market of organic products can be a very interesting option. For melon, there is a demand for organic production and its cultivation can be carried out throughout the year in San Francisco Valley, under conditions that favor the soluble solids content in the fruits and reduce the incidence of diseases, improving fruit quality. This situation justified scientific initiatives to recommend management strategies that included the use of different organic residues for production of organic melon.

Several experiments have been conducted on the application of different composts on different crops (Bhattacharyya et al., 2003; Montemurro et al., 2006; Montemurro and Maiorana, 2007; Montemurro, 2010). The recommendations of doses vary with the type of organic compound applied, with soil and crop needs. In general, rates of application are from 10 to 100 t ha^{-1}, but higher levels are not uncommon. However, there is not enough information about agronomic value and nutritional efficiency of different organic materials under San Francisco Valley conditions.

Therefore, the objective of this research study was to evaluate the use of different organic compounds on melon yield and fruit quality under organic cropping.

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MATERIALS AND METHODS

The experiment was established in the Bebedouro Experimental Station of Embrapa Semi-arid Tropic, Petrolina-PE, Brazil, with yellow melon crop (*Cucumis melo* L.) 'AF 682'. The soil characteristics at 0-0.20 m depth were: pH=5.7, organic matter= 7.0 g kg^{-1}, P=3.0 mg dm^{-3}, K, Ca, Mg, H+Al, SB=0.18, 1.10, 0.60, 1.77, 182 $cmol_c\ dm^{-3}$, respectively, and V=51.0%.

A randomized complete block design experiment was conducted with eleven treatments and three replications. The treatments consisted of two doses of the following formulations(C) C1: 50% Napier grass + 40% goat manure + 10% castor bean cake, C2: 57% Napier grass + 40% goat manure + 3% thermo-phosphate, C3: 47% Napier grass + 50% goat manure + 3% potassium sulphate, C4: 77% coconut bagasse + 20% goat manure + 3% thermo-phosphate, C5: 77% coconut bagasse + 20% goat manure + 3% potassium sulphate. The compound formulations were applied per furrow linear meter at a rate of 5 and 10 L. There was a control treatment with conventional fertilizers (CF) based on soil chemical analyses. Bio-fertilizers (20 L $plant^{-1}$) were applied through irrigation water to all treatments, except to the control treatment.

In control treatment, nitrogen (80 kg ha^{-1} N) was applied together with potassium (120 kg ha^{-1} K_2O) through irrigation water by using a fertilizer electrical injector three times a week. Nitrogen and potassium sources were urea and potassium nitrate, respectively. Fertigation started after seedling transplant and lasted for 55 days. Phosphorus level (120 kg ha^{-1} P_2O_5) was applied as simple super-phosphate at transplanting time.

Plant spacing was 0.5×2.0 m and a drip irrigating system was used with 10 m lateral lines, spaced 2 m apart. The treatments were irrigated every day and the water level was calculated based on the crop coefficient (Kc), evaporation on class A tank and the correction factor due to soil cover (Kr), calculated by Pinto et al. (1998).

Commercial and total fruit yields were evaluated at harvest and four fruits per plot of all treatments were sampled to measure the following characteristics at 15, 25 and 35 days of storage at ambient temperature, total titratable acidity (TTA), soluble solids content (SS), pH, mass loss and pulp firmness.

RESULTS AND DISCUSSION

It was observed that the melon yield for the conventional fertilizer treatment was significantly higher compared to the organic compound treatments (Table 1). The compound treatments 1, 2, 3 and 4, at 10 L m^{-1}, showed similar commercial and total fruit yields, higher than the other compound treatments. However, there were no significant differences among the compound treatments using the rate of 5 L m^{-1}.

Soluble solids content was higher in the conventional fertilized crop, and did not differ between the different organic fertilized crops treatments. The highest mass loss (6.5%) was observed in the first 15 days of storage, followed by 4.2% between 15 and 25 days and 1.8% between 25 and 35 days of storage, probably as a consequence of higher water steam pressure deficit between the fruit, which showed maximum water content in the initial growth period (Menezes et al., 1998). Pulp firmness decreased 2.6 times during the storage period and ranged from 16 to 32 kg cm^{-2}. Variation in mass loss and pulp firmness did not affect fruit appearance that maintained commercial condition up to the 35th day of storage.

There were no significant differences between crop treatments with organic compounds concerning the pH, total titratable acidy and soluble solid contents of melon fruits. The average total titratable acidity was 0.19%, which attends the external market requirements, the average pH was 5.63, which is similar to the ones obtained for yellow melon (Lester and Shellie, 1992).

The use of organic compounds resulted in some protection against fruit water loss. Melon pulp softening is related to the degradation of the cell wall compounds (Seymour and McGlasson, 1993), but other factors such as water losses may also contribute to the process (Menezes et al., 1998).

The components related to flavor, TTA and SS did not change expressively after harvest. TTA for fruits varied from 0.09 to 0.11 mg 100 g^{-1} of citric acid, in spite of statistically significant effect of time. Menezes et al. (1998) considered that TTA variation in melon fruit is not commercially important due to its low concentration.

CONCLUSIONS

Higher commercial melon yield was obtained with conventional fertilizer and the highest yields obtained with the organic compounds were 27.13, 26.58, 26.45 and 24.67 t ha^{-1}, for treatments 4, 1, 3 and 2, at 10 L m^{-1} application rate, respectively. There were no significant effects of the organic compounds on the melon fruit chemical characteristics (pH, TTA), but the organic management caused mass loss and reduced pulp firmness during the storage time.

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Tables

Table 1. Yields and soluble solids content (SS) of melon fruit according to organic compound (C) and conventional fertilizer (CF) tested.

Treatments	Total productivity[1] ($t\ ha^{-1}$)	Commercial productivity[1] ($t\ ha^{-1}$)	SS[1] (°Brix)
C1, dosage 5 $L\ m^{-1}$	19.94C	18.15C	8.77B
C2, dosage 5 $L\ m^{-1}$	16.20C	15.96C	8.33B
C3, dosage 5 $L\ m^{-1}$	22.80C	20.57C	8.60B
C4, dosage 5 $L\ m^{-1}$	20.38C	18.01C	8.70B
C5, dosage 5 $L\ m^{-1}$	19.40C	17.37C	9.03B
C1, dosage 10 $L\ m^{-1}$	26.58B	24.11B	8.73B
C2, dosage 10 $L\ m^{-1}$	24.67B	22.34B	8.33B
C3, dosage 10 $L\ m^{-1}$	26.45B	23.86B	9.00B
C4, dosage 10 $L\ m^{-1}$	27.13B	25.46B	9.33B
C5, dosage 10 $L\ m^{-1}$	22.75C	20.98C	9.10B
CF	31.08A	28.89A	10.53A
Coefficient of variation (%)	9.63	10.38	5.34

[1] Means followed by the same capital letter in each column do not significantly differ by the Tukey's test at 5% probability.