FLOWERING AND FRUIT SET OF MANGO IN DIFFERENT DOSES OF PACLOBUTRAZOL (PBZ)

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ABSTRACT

This work was carried out in a 4-year old mango orchard, cultivar 'Tommy Atkins', in a semi-arid region of the Bahia State, Northeast Brazil ('Iaçu Agropastoril' Corporation). To evaluate the effect of paclobutrazol (PBZ) on flowering and fruit set, four doses of PBZ (0.0; 0.5; 1.0 and 1.5 g per meter of canopy diameter) were applied, via soil, to 24 plants for each dose. Flowering and fruit set percentage, fruit production, and inflorescence compaction were evaluated. Five flowering evaluation were performed: at 98, 103, 112, 119, and 130 days from PBZ application (done on 26-May-2000). Percentage of fruit establishment was evaluated after 166 days and fruit production at the harvest time, 208 days after PBZ application. Results showed that PBZ, in all levels, promoted an increase of flowering percentage in relation to control. The flowering varied from 76% (with 0.5 g/m of PBZ) to 88% (with 1.5 g/m), while in the control the flowering was only 35%. PBZ caused an inflorescence compaction in a degree proportional to the PBZ doses. Fruit establishment also increased with PBZ for all levels, varying from 38% to 42%, which was significantly higher than control (10%). All PBZ levels promoted statistically similar fruit production (average of 57 kg/plant), significantly higher than control (34 kg/plant).
KEYWORDS: fruit production, inflorescence compaction *Mangifera indica*, Tommy Atkins,

FLORESCIMENTO E ESTABELECIMENTO DE FRUTOS DA MANGUEIRA SOB DIFERENTES DOSES DE PACLOBUTRAZOL (PBZ)

RESUMO

Este trabalho foi conduzido num pomar de mangueira cultivar Tommy Atkins na empresa Iaçu Agropastoril, na região semiárida da Bahia. Para avaliar the effect of paclobutrazol (PBZ) na floração e pegamento de frutos, quatro doses de PBZ (0,0; 0,5; 1,0 e 1,5 g por metro de diâmetro de copa) foram aplicados no solo para 24 plantas por dose. A percentagem de florescimento e pegamento de frutos, a produtividade de frutos e a compactação da inflorescência foram avaliadas. Foram feitas cinco avaliações de floração, aos 98, 103, 112, 119 e 130 dias da aplicação do PBZ. A percentagem de estabelecimento dos frutos foi avaliada após 166 dias e a

produção de frutos 208 dias após a aplicação de PBZ. Os resultados mostraram que a aplicação de PBZ em todas as doses promoveu um aumento na percentagem de floração comparado a testemunha. A floração variou de 76% (com 0,5 g/m de PBZ) a 88% (com 1,5 g/m de PBZ) enquanto o tratamento controle apresentou uma floração de apenas 35%. O PBZ causou compactação da inflorescência proporcionalmente a dose aplicada. O pegamento de frutos também aumentou com o PBZ em todos os níveis variando de 38% a 42%, o que foi significativamente maior que o tratamento controle (10%). A produção de frutos não diferiu estatisticamente para as doses de PBZ aplicadas (média de 57 kg/planta), mas diferiram significativamente da produção do tratamento controle (34 kg/planta).
PALAVRAS-CHAVE: *Mangifera indica*, Tommy Atkins, produção de frutos, compactação da inflorescência

INTRODUCTION

Mango is the second 'in natura' fruit in economic importance, based on export´s value, in Brazil, with a cultivated area of 73.310 ha and production of 1.175.735 t in 2012 (IBGE, 2014). It is cultivated in all Brazilian regions and 66% of the production comes from Northeast, in which Bahia State is the biggest producer. All mango-producing areas have a common problem: irregular flowering, causing an alternation of production, which is the primary cause of the low productivity in the tropical areas. Several studies have been accomplished to overcome this problem and one of the aspects that has been contributing to the mango cultivation in semi-arid tropical conditions is the possibility to produce fruits during the whole year, includind periods where the offer of fruits is scarce in the domestic and external market. This is possible, since techniques of flowering induction has been used during off-season (MOUCO et al., 2011).

Mango belongs to the group of plants, in which an antagonism between vegetative vigor and flowering intensity is observed. Therefore, any factor that reduces the vegetative vigor, without altering the metabolic activity, favors flowering. The interruption of mango vegetative growth in semi-arid can be performed by water deficit and growth regulators (MOUCO et al., 2010). The growth inhibitor that has been used widely in mango crop is paclobutrazol (PBZ), which stimulates flowering by inhibition of gibberellin synthesis according to many authors (MOUCO & ALBUQUERQUE, 2005).

PBZ [(2RS, 3RS)-1-(4-chlorophenyl)-4,4-dimethyl-2-(1H-1,2,4-triazol-1-yl) pentan-3-ol] (WU et al., 2013) has been used in all places where mango is cultivated, particularly, in the semiarid where temperature and light enhance growth and production. PBZ may also be used with pruning (DE NIZ et al., 2014). The Paraguassu valley located at east region of Bahia State has farms where mango is cultivated. The climate conditions of this region differ from those of irrigation poles such as Petrolina-Juazeiro. PBZ doses for better mango flowering are used based upon recommendation obtained from researches from these irrigation poles. Therefore, it is necessary to evaluate doses of PBZ for mango in Paraguassu Valley in order to provide recommendation more accurate to farmers. The objective of this work was to evaluate the effect of different doses of PBZ on flowering and fruit set in mango crop in the region of Paraguassu Valley.

MATERIAL AND METHODS

An experiment was carried out in Iaçu county, in a mango orchard belongs to "Iaçu Agropastoril Ltda" corporation, located in a Brazilian semi-arid region, in Bahia

State (Figure 1). Four years old non-bearing mango trees, cv. “Tommy Atkins” with canopy diameter of 3m were used in this study during the period of July to December, 2002.

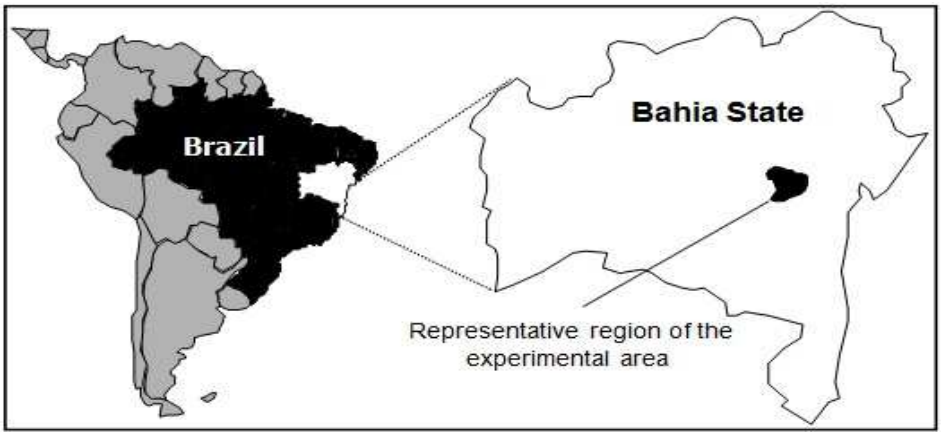

FIGURE 1. Geographical location of the representative region, in which the experiment was carried out.

In order to induce a uniform shoot development, a small prune was performed followed by spraying of potassium nitrate (1%). Thirty-eight days after nitrate application, three doses of PBZ (0.5; 1.0 and 1.5 g per meter of canopy diameter) were applied, via soil. Each dose, plus control, were submitted to 24 plants, comprising 96 plants. Plants were assigned to treatments in a completely random design. Sprout of buds was accelerated by calcium nitrate (2.5%) sprayed three times: 76, 83 and 92 days after PBZ application,

The following dependent variables were evaluated: a) percentage of flowering and fruit set; b) Inflorescence compaction; and c) Production of commercial fruits (>240 g) per plant. Flowering evaluation was performed in five periods: after 98; 103; 112; 119 and 130 days from PBZ application. Fruit set was evaluated 166 days after PBZ application. The flowering and fruit set were estimated based on visual evaluation of the percentage of branches with inflorescence and fruits, taking into account that a plant with 100% of flowering has, at least, one inflorescence in all of the apexes of the canopy. Fruit production was evaluated at the harvest time, 208 days from PBZ application. The independent variables were quantitative; therefore, regression analysis was used for statistical evaluation.

RESULTS AND DISCUSSION

PBZ induced an increase in flowering percentage in relation to control, without difference among the three levels of PBZ (Figure 2). The percentage of fruit set, evaluated 166 days after PBZ application, also increased in the treatments with PBZ, without differences among PBZ levels (Figure 3). MOUCO & ALBUQUERQUE (2005) also concluded about the increase in flowering because of PBZ application. The increase of fruit set followed a second-degree polynomial function, in which 1,1 g m^{-1} is the dose that maximize fruit set.

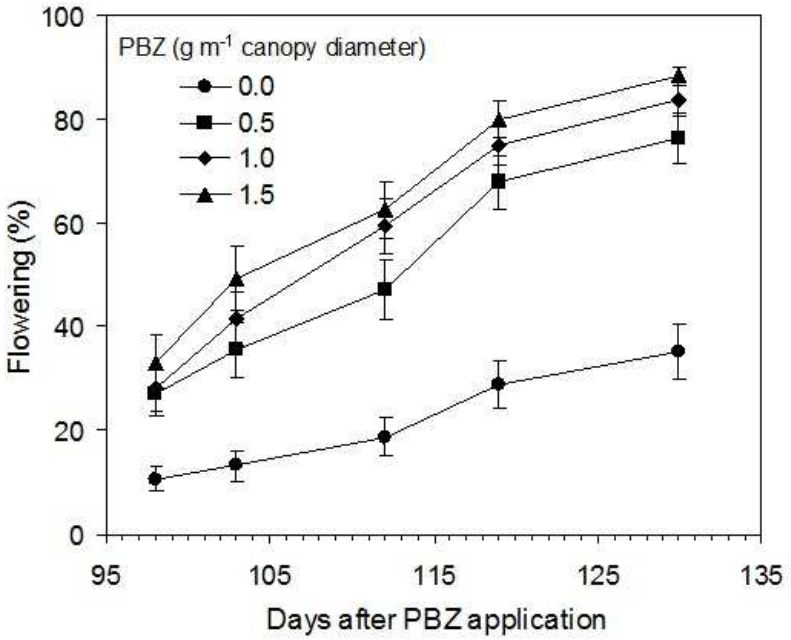

FIGURE 2. Percentage of flowering in different periods after applying several doses of paclobutrazol (PBZ) to 4-years old mango trees, cv. "Tommy Atkins". Iaçu, Bahia, Brasil, 2000. Each point is the average of 24 plants and bars represent standart error of the mean.

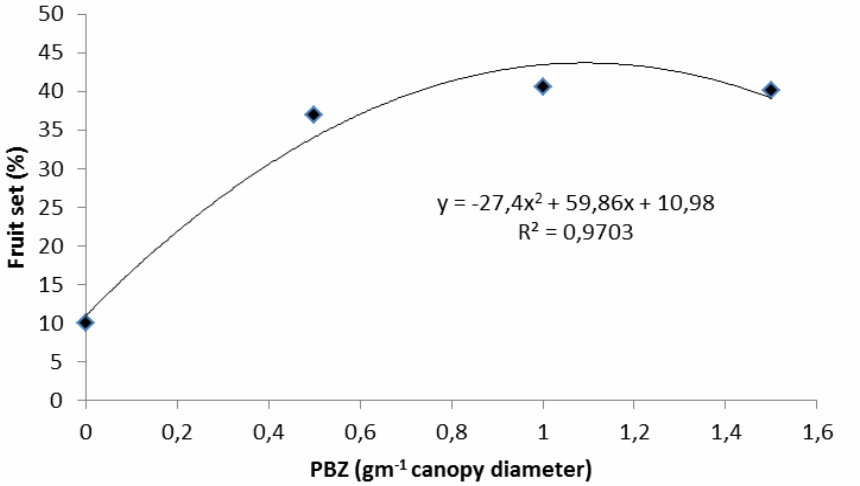

FIGURE 3. Percentage of fruit set in 4-years old mango trees, cv. "Tommy Atkins", after 166 days from application of different doses of paclobutrazol (PBZ). Iaçu, Bahia, Brazil, 2000.

The production of fruits was also larger in the treatments with PBZ, which had an average production of 57 kg/plant while the plants without PBZ (control) produced 34 kg/plant (Figure 4A). This result is in agreement with Chatzivagiannis (2008) and Mouco & Albuquerque (2005), although differs from JASMINE et al., (2011) who obtained larger production for 3.2 gm^{-1} PBZ application, considering application in soil. A second-degree polynomial function fitted reasonably fruit production as a function of PBZ doses with a maximum for 1.1 gm^{-1}. This dose is larger than that obtained by CHATZIVAGIANNIS (2008) for Palmer variety, but similar to that obtained for 'Bourbon' whose doses of 0.8 to 1.2 gm^{-1} resulted the larger productivities. On the order hand, the average of individual fruit weight was higher in the control than in plants treated with PBZ (Figure 4B).

Fruit weight was related to PBZ by a second-degree function, however with inverse concavity compared to the fruit production. This indicated a decrease of fruit weight with the increase of PBZ dose. PBZ enhances flowering, fruit set and fruit number. Therefore, fruit weight reduced up to 402 g. This weight is still marketable according to the international market that defines a weight higher than 360g as acceptable (ALBUQUERQUE et al., 1999). These results showed that paclobutrazol increased the number of branches with flowers and, consequently, provided a larger fruit set and production of fruits. Since mango flowering has been associated with the reduction of the vegetative growth, which is usually induced by low activity of gibberellins, it might be inferred that paclobutrazol enhanced flowering by blocking gibberellins synthesis. Similar results were also reported in other mango varieties from other countries (TONGUMPAI et al. 1991; CHATZIVAGIANNIS, 2008).

In relation to inflorescence compaction, PBZ caused compaction, whose degree was proportional to the doses (Figure 5). This result is expected according to MOUCO & ALBUQUERQUE (2005) who emphasizes that high doses of PBZ promote inflorescence compaction. This happened because PBZ is a plant hormone that reduces the growth of the internodes, reducing the spaces between floral stalks, resulting in panicle compaction. These data show the importance of studies to define the minimal dosage of PBZ, since the high compaction of inflorescences can create a microclimate within panicles (high humidity due to water accumulation and little air circulation), which favors the incidence of pests and diseases. A compressed panicle does not dry out very well and can develops powdery mildew or anthracnose even after a light dew (DAVENPORT, 1993).

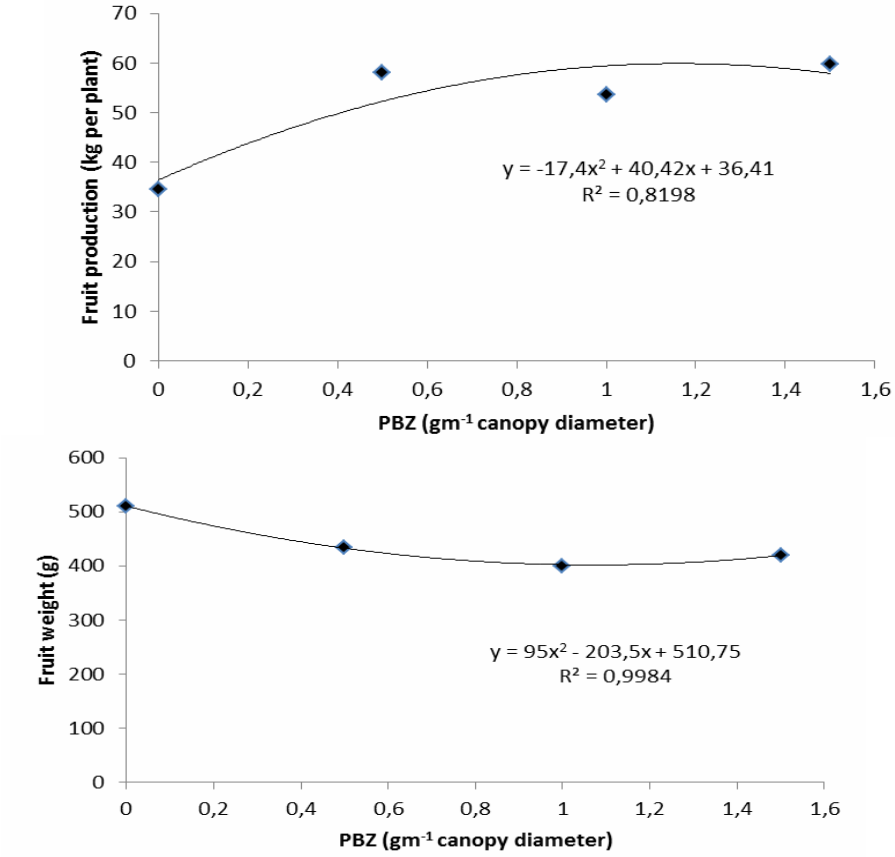

FIGURE 4. Fruit production (A) and commercial fruit weight (B) in 4-years old mango trees, cv. “Tommy Atkins”, harvested after 203 days from application of different doses of paclobutrazol (PBZ). Iaçu, Bahia, Brazil, 2000.

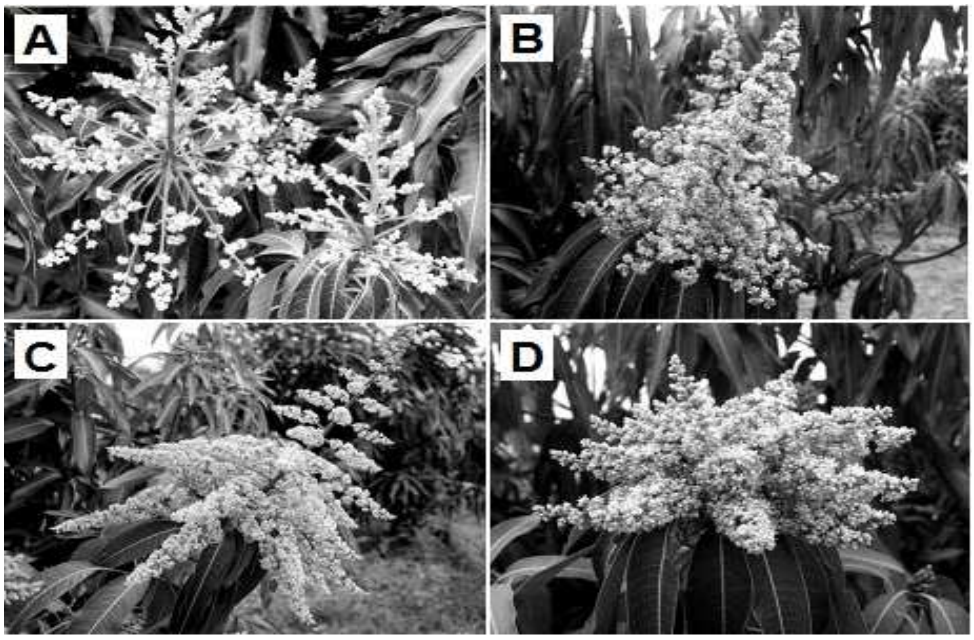

FIGURE 5. Inflorescence compaction in 4-years old mango trees, cv. "Tommy Atkins, submitted to different doses of paclobutrazol: 0.0 (A); 0.5 (B); 1.0 (C) and 1.5 (D) g m^{-1} canopy diameter. Iaçu, Bahia, Brazil, 2000.

CONCLUSIONS

PBZ increases the compaction of inflorescence in mango trees, cv. "Tommy Atkins", proportionally to the applied dose.

In mango orchard, with 4 to 5 years old, cultivated in semi-arid condition, under irrigation, the percentage of flowering and fruit production may be increased by application of 0.5 g of PBZ per meter of canopy diameter, applied via soil.

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