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SEASONAL GROWTH VARIATION OF PEACH PALMS CULTIVATED IN CONTAINERS UNDER SUBTROPICAL CONDITIONS

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ABSTRACT: Peach palm (*Bactris gasipaes* Kunth) is grown in the São Paulo State, Brazil, under climate seasonal variation conditions, mainly temperature and rainfal with possible effects on plant physiology. Recently, due to a higher interest in carrying out physiological experiments on the species, there has been a requirement for more controlled experimental conditions. Therefore, with the aim of studying the seasonal variation of peach palm growth for heart-of-palm production, as well as the possibility of growing them until harvest in pots, for future utilization in physiological experiments, this work was carried out in Campinas, SP, Brazil, with 40 spineless peach palms. One year after seed germination, seedlings were transplanted to 80 L plastic pots, spaced 2 × 1 m, arranged in four rows of ten plants. All plants had vegetative growth evaluated monthly by measurements of main stem height, number of functional leaves, number of offshoots and length of leaf raquis. Seasonal variations were observed in terms of height and diameter growth as well as raquis length of the youngest leaf and in the evolution of the number of leaves. After two years, plants had an average height of 230 cm, six functional leaves and 11.7 offshoots. Positive correlations ($P < 0.001$) were observed between growth variables and the average temperatures, rainfall as well as insolation of the 30, 60, 90 or 120 days previous to the measurements. Peach palms could be grown in containers until first harvest, without restrictions to growth.

Key words: *Bactris gasipaes,* heart of palm, growth analysis

VARIAÇÃO ESTACIONAL DO CRESCIMENTO EM PUPUNHEIRAS CULTIVADAS EM RECIPIENTES EM CONDIÇÃO SUBTROPICAL

RESUMO: A pupunheira (*Bactris gasipaes* Kunth) é cultivada no Estado de São Paulo, Brasil, sob condições de variação estacional do clima, particularmente temperatura e precipitação pluviométrica, com possíveis efeitos na fisiologia das plantas. Recentemente, devido ao crescente interesse em se realizar experimentos sobre a fisiologia da espécie, tem havido necessidade de cultivá-la sob condições experimentais mais controladas. Com o objetivo de estudar a variação estacional do crescimento de pupunheiras, bem como a possibilidade de cultivá-las em recipientes até a colheita, para a realização de futuros experimentos fisiológicos, foi executado este trabalho, em Campinas, SP, com 40 pupunheiras inermes. Um ano após a germinação, as mudas foram transplantadas em recipientes plásticos de 80 L, em espaçamento 2 × 1 m, dispostos em quatro linhas de dez plantas. O desenvolvimento vegetativo foi avaliado mensalmente, em todas as plantas, por medidas de altura da haste principal, número de folhas funcionais, número de perfilhos e comprimento da ráquis. Foi observada estacionalidade de crescimento em altura e diâmetro, bem como em comprimento da folha mais jovem e na evolução do número de folhas. Após dois anos, as plantas apresentavam altura média de 230 cm, e média de 6 folhas e 11,7 perfilhos. Correlações positivas ($P < 0.001$) foram observadas entre variáveis de crescimento e as médias de temperatura, precipitação pluviométrica, bem como insolação vigente nos 30, 60, 90 ou 120 dias anteriores às mensurações. As pupunheiras puderam ser cultivadas em recipientes até a primeira colheita, sem restrições ao crescimento.

Palavras-chave: *Bactris gasipaes*, palmito, análise de crescimento

INTRODUCTION

The rational use of cultivated palms for heart-of-palm production has been an important alternative to aliviate the exploitation pression over the traditional native species. The Amazonian palm, peach palm (*Bactris gasipaes* Kunth), is known to be highly suitable to be cultivated in the São Paulo State, Brazil, where the growing area is in expansion. While in the rainy forest the species is under climate conditions nearly constant throughout the year in São Paulo, growing over the 21°S latitude, peach palms are under seasonal climate variation, mainly temperature and rainfall. Therefore consequences are to be expected on their growth pattern and evaluate its effects on crop development and yield is necessary.

Peach palm growth in São Paulo State conditions has been well studied over the last dacades, during different phases of development, until heart-of-palm harvest (Bovi et al., 1992; Bovi et al., 2002; Tucci et al., 2002; Ramos et al., 2004; Vega et al., 2004a; 2004b).

Nevertheless, lately, a need has been imposed to grow peach palms with the aim of carrying out physiological experiments that require more controlled experimental conditions. In order to fullfil these requirements it was thought to grow peach palms in containers of great capacity until first harvest. This growing system was only referred to by Repellin et al. (1997) in a two-year experiment with coconuts, although ornamental palms have been traditionally grown in containers of different capacities (Meerow, 1994).

This work was carried out aiming to study the seasonal growth variation of peach palms growing in 80-L containers until first harvest, evaluating as well, the possibility of using this growing system in experiments under controlled conditions.

MATERIAL E METHODS

Localization and climate

The experiment was carried out in Campinas, SP, Brazil, at 22°54'S; 47°05'W and 674 m a.s.l. According to Köppen the climate is Cwa with a warm and rainy season from October to March, average temperatures ranging from 22 to 24°C and 1,057 mm rainfall; and a drier season, from April to September, with avearage temperatures ranging from 18 to 22°C, 325 mm rainfall, normal annual water surplus of 320 mm, and normal annual water deficit of 14 mm (Ortolani et al., 1995).

Vegetal material and growing conditions

Spineless peach palm seedlings from a Yurimaguas (Peru) population were grown under greenhouse conditions from June 1999 to June 2000 as recommended by Bovi (1998). In June 2000, seedlings were transplanted to 80 L-plastic pots (115 kg substrate), with holes in the botton to allow drainage and a 10 cm layer of broken stones placed on the botton.

The substrate was a mixture in equal parts (v/v) of soil, sand and cattle manure with the following physical and chemical characteristics: coarse sand – 41.0 (%); fine sand – 26.0 (%); silt – 11.0 (%); clay 22.0 (%); gravel – 10.6 (%); bulk density – 1.2 (g cm^{-3}); particle density - 2.5 (g cm^{-3}); porosity – 49.9 (%); pH ($CaCl_2$) – 5.5; pH (water) – 6.2; organic matter (g dm^{-3}) – 28.0; H (mmol$_c$ dm^{-3}) – 18.0; CTC (mmol$_c$ dm^{-3}) – 73.7; V (%) – 75.6; $P_{Mehlich}$ (mg dm^{-3}) – 64.6; P_{Resin} (mg dm^{-3}) – 117.6; K (mmol$_c$ dm^{-3}) – 20.7; Ca (mmol$_c$ dm^{-3}) – 27.0; Mg (mmol$_c$ dm^{-3}) – 8.0; S (mg dm^{-3}) – 16.1; Na (mg dm^{-3}) – 116.0; Fe (mg dm^{-3}) – 98.0; Mn (mg dm^{-3}) – 72.0; Cu (mg dm^{-3}) – 5.4; Zn (mg dm^{-3}) – 13.0; B (mg dm^{-3}) – 0.3.

Pots were spaced 2 × 1 m, disposed in four lines of ten, making up 40 plants. Due to plant growth it was necessary to build a wooden deck between the central lines, to allow the measurements towards the end of the experiment.

Throughout the experiment the containers were irrigated daily, until drainage. From March 2001 on, the evaluation of the water status of substrate on the 16 inner containers started, by Time Domain Reflectometry (TDR), using the Trase System I (SoilMoisture Equipment Corp., 1990). The substrate was kept throughout the experiment at field capacity, evaluated according to Arruda et al. (2002). The containers were irrigated with calculated amounts of water, dripping from a 2 L-plastic bottles, two per container, fixed to a wooden rod.

Fertilization and nutritional status evaluation of substrate and plants

After planting pots were fertilized, once a fortnight, with 2 g of potassium nitrate per plant, until March 2001. Thereafter plants started to be fertilized following a complete amendment schedule, which included the micronutrients zinc and boron, according to the forecast of biomass accumulation for a period of one month (Tucci, 2004). As stated by this estimate and in accordance to Bovi & Cantarella (1996), plants were fertilized three times a month, every ten days, as follows: first application – 12 g ammonium sulfate, 2.5 g potassium chloride, 0.25 g boric acid and 0.25 g zinc sulfate, per plant; second application – 7.5 g ammonium nitrate, 2.5 g potassium chloride, 0.25 g boric acid and 0.25 g zinc sulfate; third application – 7.5 g ammonium nitrate.

The substrate was scarified superficially twice, in November 2001 and May 2003, 17 and 23 months after planting, respectively, and after each scarification 1.5 kg of cattle manure was applied on the surface.

In general, during the experiment plants presented nutrient levels within the range suitable to the species (van Raij & Cantarella, 1996), without presenting deficiencies that could impair growth.

Evaluation of vegetative growth

Growth was evaluated monthly (18 times) on selected 16 inner plants by measurements of the following variables positively correlated with heart-of-palm yield (Bovi et al., 2002): plant height (measured from soil level to the point of insertion of the youngest fully explanded leaf); diameter of the main shoot (measured at soil level); number of photosynthetic leaves; length of raquis of the youngest fully expanded leaf, named leaf +1 according to Tomlinson's criterion (1990); number of offshoots.

The absolute growth rate (AGR) was evaluated by the expression $AGR = (P_2 - P_1) / (t_2 - t_1)$, where P_2 e P_1 are the values of two consecutive samplings and $(t_2 - t_1)$, the number of days between them (Benincasa, 1988). On April 2002, 22 months after planting, every offshoot with at least one fully expanded leaf had the height (cm), diameter (mm) and number of leaves measured. The results were expressed by the average of the offshoots from the 16 inner plants.

Statistics

Linear simple correlations by the Pearson method were used to correlate the monthly average growth data (18 measurements7; n = 18) with the average of maximum, medium and minimum temperatures, insolation (hours day^{-1}) and rainfall, occurring 30, 60, 90 and 120 days previous to the days of measurement. The correlation coefficients were tested for significance at 5%, 1% e 0.1% levels of probability (Steel & Torrie, 1980). Meteorological data were collected at a meteorological station 500 m far from the experiment. The analyses were performed by means of the program Statgraphics 6.0 (Statistical Graphics System 1985 –1992).

Regression analysis and curve fittings were performed by means of the program CurveExpert 1.3 (Hyams, 1997). Growth curves except the number of leaves were fitted by Boltzmann's function which was considered by Beadle (1993), suitable to describe plants growth relationships, for the biological meaning conferred to the data. The number of leaves was fitted by Richards' function (Beadle, 1993). For the variables plant height and diameter as well as the length of the raquis of leaf +1 data were strategically divided in two phases, giving actually two equations, one for the first year experiment and the other one for the second.

RESULTS AND DISCUSSION

Climate

For the first and second years the mean values of medium, maximum and minimum air temperatures (Figure 1), 28.3; 16.5 and 22.3°C respectively, were 1°C higher than the climatological long term values for the region. From July 2001 to June 2002, the second year of the experiment, was considered an atypical period for the region (Alfonsi et al., 2002). Drier than the previous period, it had a precipitation of 1,262.1 mm, about 120 mm less than the climatological normal, and a temperature peak of 30.7°C, unusual for April.

Main stem growth

The growth curves showed two phases of more intense growth corresponding to the warmer months and a phase of less intense growth in winter. Growth in height of the main shoot as a function of

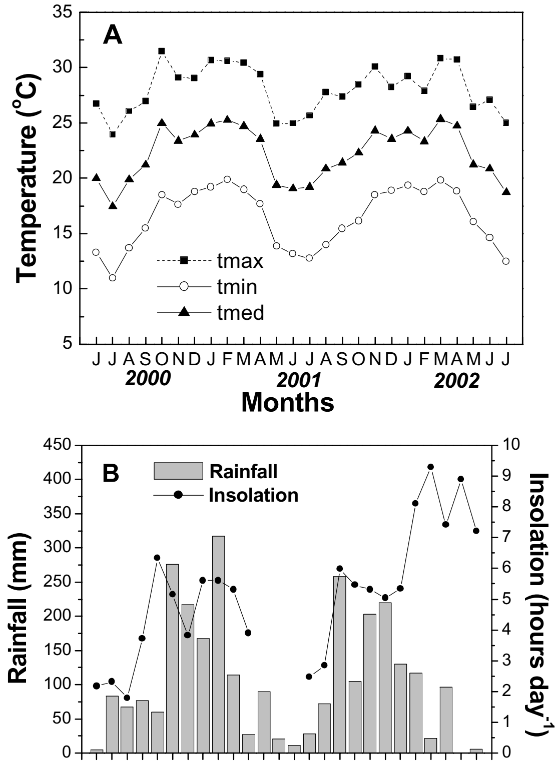

Figure 1 - Monthly average of maxima, media and minima temperatures (A) monthly total rainfall and hours of insolation (B) throughout the experiment (Ecophysiology and Biophysics Center of IAC). Campinas, SP, Brazil. 2000/2002.

plant age for the first and second years is in Figure 2A. Plant height is considered an essential vegetative measure of growth and yield for peach palms (Clement & Bovi, 2000), since it is highly correlated with biomass and leaf area (Clement, 1995) and with heart-of-palm yield (Bovi et al*.,* 1992). It is an easy trait to be measured in experiments of heart-of-palm production, being one of the variables of less variability, with coefficients of variation lower than 20% (Bovi et al., 1992).

The phases of more intense growth in height are clearly shown by the AGR (Figure 2B). Higher growth rates of 0.6 cm day^{-1} or 18 cm month^{-1} were observed at the begining of the second summer (2002). At the end of the experiment in June 2002, 24 months after planting, plants presented average height around 230 cm, and it is important to refer that in commercial peach palm crops for heart production, plants are harvested after reaching 160 cm to 180 cm height (Bovi, 1998). Therefore the harvest could have begun in January 2002, 19 months after planting. The observed height was consistent with that verified by Ramos (2002), for plants of the same age growing in the field, under a climate very much alike to that of this experiment, indicating that, although peach palms were grown in containers, there were no restrictions to growth.

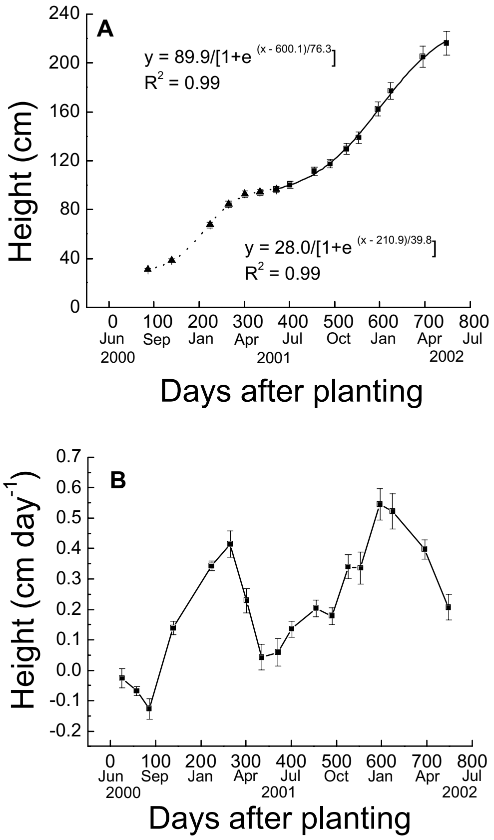

Figure 2 - Growth in height of the main stem (A) and Absolute Growth Rate in height (B) of peach palms growing in containers. Each point represents the average of 16 plants. Campinas, SP, Brazil, 2000/2002.

The negative absolute growth rates observed subsequently to planting may have been due to the period of acclimation. Around mid October 2000, four months after planting, most leaves had already passed from biphids to pinnates. The high growth rates in winter 2001 between July and September (Figure 2A) may have been due to the response of the growth in heitgh to fertilization, since from April 2001 plants started receiving complete fertilization based on dry material accumulation.

Positive correlations were observed between (AGR) in height and all climate factors considered. Nevertheless correlation coefficients of higher magnitude were observed between them and the mean temperatures of the 60 days prior to measurements, with r = 0.71, r = 0.80 and r = 0.84 ($P < 0.001$), respectively for the average of the maxima, media and minima. These values show the importance of temperature for peach palm growth, that being an Amazonian species yields more at medium temperatures above 24ºC (Mora-Urpí et al., 1997). In fact, temperature is a major determinant of crop growth, and a significant factor in climate change models (Beadle, 1993). Ramos (2002) also observed higher rates of growth in height in the summer for peach palms growing in the field, while Vega (2003) found positive correlation between growth in biomass and the average medium temperatures of the 180 days prior to measurements. For the areca palm (*Areca catechu* L.), minimum temperatures taking place two years prior to harvest correlated positively with fruit yield (Reddy & Vijayakumar, 1993).

The AGR in height correlated positively also with insolation, hours day^{-1}, with correlation coefficients of 0.617 and 0.623 ($P < 0.1$), for the average hours day^{-1} of the 30 and 60 days prior to measurements, respectively. As far as palms are concerned, for the oil palm for instance, an amount of 1,800 hours year^{-1} insolation is thought to be suitable, while values under 1,500 hours year^{-1} are restrictive (Carvalho, 2000). The coconut is also quite exigent for light, requiring 2,000 hours year^{-1} with minimum 120 hours month^{-1} to develop properly (Passos, 1998). According to Mora-Urpí et al. (1997), cultivated peach palms require full sun light for optimum yield of either heart-of-palm or flowers, fruits and offshoots. Reference to values of hours insolation year^{-1} suitable for the peach palm were not found in the surveyed literature.

Main stem diameter

The growth in diameter of the main stem as a function of plant age for the first and second year, fitted by the Boltzmann equation is represented in Figure 3A, with R^2 values of 0.99 and 0.99, respectively. Higher AGR occured in the first phase of rapid growth during the summer 2001, with maximum 0.042 cm day^{-1}, or 1.26 cm month^{-1} (Figure 3B). At the end of the experiment plants had on average 14.32 cm diameter. The main shoot diameter is highly correlated with heart-of-palm weight (Bovi et al., 1992) and with total biomass (Clement & Bovi, 2000). However it is a difficult variable to be measured sharply under field conditions due to offshoots and, therefore, it is thought to be an optional measure in growth and yield analysis of peach palms (Clement & Bovi, 2000). It is also a variable used to estimate the harvesting point (Bovi, 1998; Ares et al., 2002).

Similarly to height, the diameter also presented a peak of growth in winter, which could be due to fertilization. However, the diameter response to the fertilization was faster than that of height, inversely to what has been observed by Ramos (2002), probably because this author has started the measurements 12 months after planting peach palms in the field. Also for the diameter, the development of the plants cultivated in containers has been consistent with that observed by Ramos (2002) for the first two years of the peach palms in a trial in the field, indicating that there were no restrictions also to growth in diameter.

Positive correlations were also obseved between the AGR in diameter and some weather variables. The mean maximum, medium and minimum temperatures of the 30 days prior to measurements correlated with the diameter with coefficients of 0.52; 0.54; 0.54, respectively ($P < 0.05$). However they were of less magnitude than those observed for height. The diameter was also correlated with the number of leaves (r = 0.90; $P<0.001$), the number of offshoots (r = 0.98; $P < 0.001$) and the raquis length of leaf +1, with "r" values of 0.98, 0.99 e 0.99 ($P < 0.001$), respectively. Except for the first pair of variables, these correlations differed from those mentioned by Bovi et al. (1992).

Number of offshoots

The evolution of number of offshoots as a function of plant age (Figure 4A) could be estimated by the equation: $Y = 11.7 + (1.2 - 11.7) / [1 + e^{(x-198.0) / 48.8}]$ ($R^2 = 0.98$). In multiple stemmed palms like peach palm, the plant habit is determined by the offshoots that come from the axillary buds, from older leaves at the base of the stems, building up the characteristic plant architecture (Tomlinson, 1990). In the

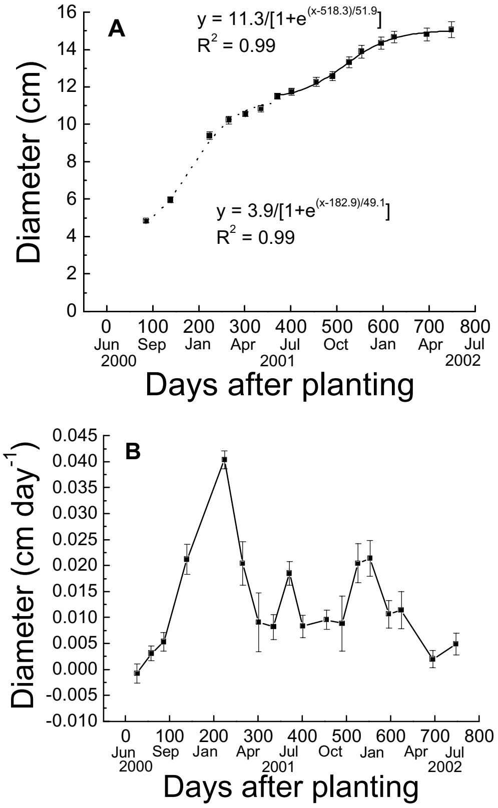

Figure 3 - Growth in diameter of the main stem (A) and Absolute Growth Rate in diameter (B) of peach palms growing in containers. Each point represents the average of 16 plants. Campinas, SP, Brazil. 2000/2002.

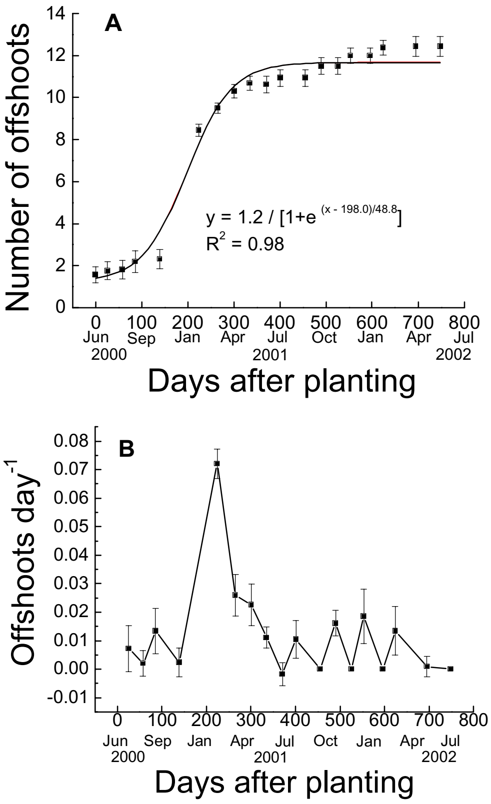

Figure 4 - Evolution of the number of offshoots (A) and Absolute Growth Rate in number of offshoots (B) of peach palms growing in containers. Each point represents the average of 16 plants. Campinas, SP, Brazil. 2000/2002.

same way as plant height, the number of offshoots was listed by Clement & Bovi (2000) as an essential measure in growth and yield analyses of peach palms, since it correlates directly with the crop life-span and with the capacity of the cluster after harvesting. In peach palms evaluated by Bovi et al. (1992), the number of offshoots had high variability, with variation coefficienst over 46%.

From October 2000, considered as the end of acclimation phase, a sharp rise in the number of offshoots was observed (Figure 4B), at AGR of 0.075 offshoots day^{-1}, or 2.25 offshoots month^{-1}, higher than that related by Ramos (2002) in a field trial. The stability was observed around July 2001, one year after planting with a maximum average of 11.7 offshoots per plant, higher than that related by Bovi et al. (2002), also in a field trial, showing that growing in containers does not restrain the shooting of the palms. The higher number of offshoots may be related to the small area of this trial, plants in the containers have received individually, more sunlight than in commercial crops, even spaced the same way as those. The number of offshoots correlated positively with the average maxima, media and minima temperatures, but higher correlation coefficients were observed with the minima of the 120 days prior to measurements (r = 0.578; $P < 0.05$), highlighting the importance of proper temperatures for the shooting of the species.

Positive correlation (r = 0.98; $P < 0.001$) was also observed between the number of offshoots and the diameter. Taking into account the fact of shooting is a juvenile character, this result seems to be related to the suitable developement and the proper mineral nutrition of the plants in containers, since Bovi et al. (1992) found a negative correlation between the diameter of the main stem and number of offshoots, ascribing it to the competition for photoassimilates inside the cluster. As a matter of fact, as related by Jansen (1993), the number and initial size of the offshoots are in accordance to the relationship between the CO$_2$ assimilation rate and the carbohydrate demand to maintain the main stem growth.

Number of leaves

The evolution of number of leaves as a function of plant age (Figure 5A) could be described by the equation: $y = 6.0 / (1 + e^{0.46-0.017x})^{0.67}$ ($R^2 = 0.79$). At the begining of trial there was an average of three leaves per plant, going towards a maximum average of seven leaves per plant in February 2002, about one and a half year after planting. This number of leaves is consistent with the range considered proper by Ares et al. (2002) for peach palms under commercial cropping for hear-of-palm production. It is similar to that observed by Ramos (2002), for the peach palms in an irrigation and fertilization trial under lowest nitrogen rate and the lowest irrigation level, and lower then that of the other treatments. The number of leaves of palms represents an accessible morfological marker for growth events, once at each internode there is one single leaf, and leaves are produced in regular acropetal order, with sheaths that circle completely the shoot base (Tomlinson, 1990). Younger leaves are surrounded by older leaves in a way that the population of leaves in the canopy includes both a succession of not exposed leaves and a series of exposed leaves. Peach palms growth analyses include only the fully expanded green leaves of the main stem, not considering yellow or dead leaves, since they are not photosynthetically active (Clement & Bovi, 2000). These authors listed the number of leaves among the essential vegetative measures for growth and yield analyses of the peach palm, since it is a variable closely related to yield.

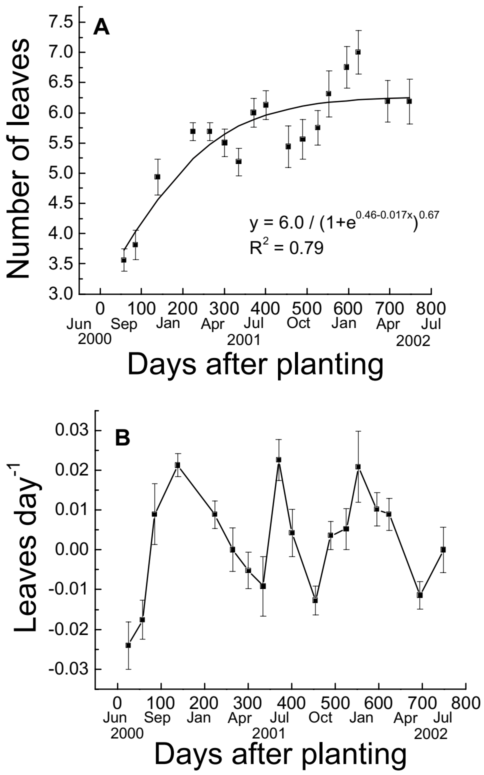

Figure 5 - Evolution of the number of leaves (A) and Absolute Growth Rate in number of leaves (B), of peach palms growing in containers. Each point represents the average of 16 plants. Campinas, SP, Brazil. 2000/2002.

It was noticed by the AGR (Figure 5B) analyses that the phases of more intense rise of number of leaves corresponds to the warm months of summer. According to Passos (1998), low temperatures also slowed down the foliar emission rhythm of young coconut palms. However, also high AGRs are seen in the winter 2001. Since there was a positive correlation between the number of leaves and the average minima temperatures of the 60 and 90 days prior to the measurements (r = 0.661 e r = 0.679; $P < 0.01$), the high leaf emission rate in the winter probably reflects the effect of the application of complete fertilization this year, in April. As a matter of fact, the number of functional leaves is prone to decrease in a situation of nutritional deficit (Clement & Bovi, 2000). The number of leaves is given by the balance between emitted leaves and senescent ones and so, higher emission rates follow higher senescence, thus giving to the evolution of the number of leaves a pulse characteristic.

Length of the foliar raquis

The length of raquis of leaf+1 as a funtion of plant age is represented in Figure 6A. The R^2 values were 0.99, either for the first or the second year. Curves were not fitted for raquis+2 and +3, since these measurements have started some months after leaf+1. However a similar trend could be seen. Throughout the experiment the length of leaf +1 (Figure 6B) was always higher in size than that of the two subsequent leaves (data not shown), indicating a proper vegetative shape of plants. Each younger leaf of the crown is longer than the older subsequent one, whenever the peach palms are in a proper nutritional status (Clement & Bovi, 2000). This can be seen as an additional sight for peach palms growing in containers, which did not show any restriction to growth until the end of the experiment.

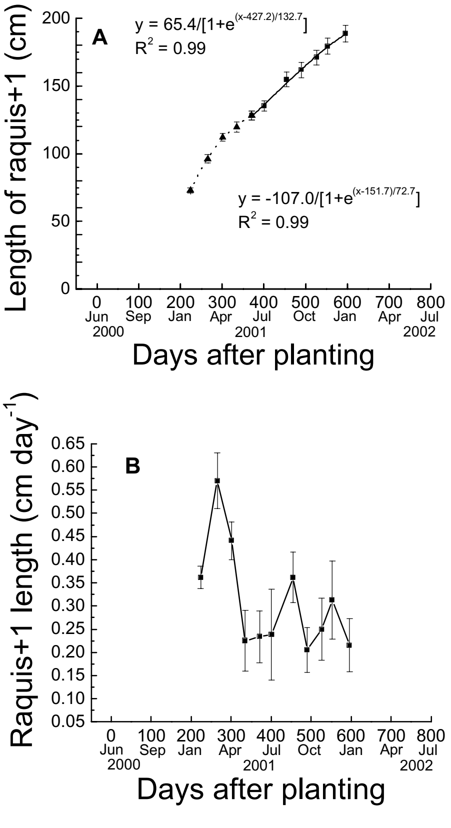

Figure 6 - Growth in length of the raquis of leaf +1 (A) and Absolute Growth Rate in length of the raquis of leaf +1 (B), of peach palms growing in containers. Each point represents the average of 16 plants. Campinas, SP, Brazil. 2000/2002.

The length of the foliar raquis is a measure often used in peach palm growth analysis and according to Bovi et al. (1992), it has been shown to be positively correlated with the heart-of-palm weight. In their opinion this is one of the variables of low variability, with variation coefficients below 20%. Similarly to what was observed for the already mentioned variables, the length of raquis +1 presented two phases of more intense growth corresponding to both summers, 2001 and 2002, keeping apart a lower growth phase during winter 2001. In fact, positive correlations were observed between the raquis +1 length and the average minima temperature of the 30 and 60 days prior to the measurements, with correlation coefficients of 0.648 and 0.607 ($P < 0.05$), respectively. A possible effect of fertilization on the length of raquis +1 was also observed due to the high winter AGR. As a rule, throughout the experiment, peach palms showed mineral nutrient levels within the range suitable for the species (van Raij & Cantarella, 1996), and nutritional defficiencies that could impair growth were not observed.

Offshoots

Offshoots growth in height or in diameter was higher in the summer (data not shown). The last measurements of the offshoots were obtained in April 2002, 22 months after planting, two months before the end of the experiment, and they averaged 43.9 cm height, 30 mm in diameter and had 3.6 functional leaves. These data could not be compared with other trials since in the surveyed literature no mention was found in relation to growth analysis of offshoots in peach palms under growing phase before the first harvest. In June 2002, two years after planting the heart-of-palms of all plants were harvested from the main stems. The aspect of plants before harvesting is presented in Figure 7.

Root system

In spite of the importance of the evaluation of the root system productivity in plant growth studies (Nilsen & Orcutt, 1996), throughout the experiment neither morphological nor quantitative studies were performed to evaluate the effect of the restriction of the containers on the root system. Nevertheless, at the end of the experiment, after cutting the containers, the root system of two of the peach palms was observed in detail. Both containers had almost no soil and the root system seemed vigorous and healthy, filling up all the container volume (Figure 8). The presence of the four classes of roots described according to Tomlinson´s criterion: first order roots or primary roots, of horizontal development and some vertical primary roots considered as sustentation roots; second order roots branching off from primary roots, with the superficial ones developing above the substrate, as well as third and fourth order roots (shorter and slender). The two latter classes of roots are considered the site of absorption in palms. For the peach palm, this root system pattern has been described among others by Bovi et al. (1999) and Vega (2003).

Figure 7 - Aspect of the peach palms growing in containers in June 2002, two years after planting. Campinas, SP, Brazil 2000/2002.

Figure 8 - Aspect of the root system of one of the peach palms cultivated in containers at the end of the experiment, in June 2002, two years after planting. Campinas, SP, Brazil 2000/2002.

In spite of the observations of several authors concerned with roots circling in the container, either for palms (Meerow & Bergeman, 1991) or others species (Appleton, 1995) growing in containers, for the peach palms grown in this size container the occurence of circling was not observed in the roots.

CONCLUSIONS

Peach palms grown for heart-of-palm production in the São Paulo State presented seasonal differences in relation to the following growth variables closely related to heart yield: main stem height, diameter as well as raquis leaf+1 length and the evolution of leaf number. For all of them, growth was more intense in the warmer summer and spring months.

Positive correlations were observed between growth variables and the average temperatures, rainfall as well as insolation of the 30, 60, 90 or 120 days previous to the measurements.

Peach palms could be grown in containers up to the first harvest of heart-of-palms, showing throughout the two-year experiment, a consistent development with that of plants from conventional field experiments, not presenting any restriction to growth.

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