REVISTA CONTRIBUCIONES A LAS CIENCIAS SOCIALES

Post-harvest management and characteristics of melon cultivars fruits and their prospects in the Roraima savannah: a review

Manejo e características pós-colheita de frutos de cultivares de melão e suas perspectivas na savana de Roraima: uma revisão

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Ignácio Lund Gabriel da Silva Carmo
PhD Student in Agronomy
Institution: Universidade Federal de Roraima – campus Cauamé
Address: Boa Vista – RR, Brasil
E-mail: ignacio.carmo@yahoo.com.br

Roberto Dantas de Medeiros
PhD in Plant Science
Institution: Embrapa Roraima
Address: Boa Vista – RR, Brasil
E-mail: roberto.medeiros@embrapa.br

José de Anchieta Alves de Albuquerque
PhD in Plant Science
Institution: Universidade Federal de Roraima – campus Cauamé
Address: Boa Vista – RR, Brasil
E-mail: anchietaufrr@gmail.com

João Luiz Lopes Monteiro Neto
PhD in Agronomy
Institution: Universidade Federal de Roraima – campus Cauamé
Address: Boa Vista – RR, Brasil
E-mail: joao.monteiro.neto@hotmail.com

Richard Alcides Molina Alvarez
PhD Student in Agronomy
Institution: Universidade Federal de Roraima – campus Cauamé
Address: Boa Vista – RR, Brasil
E-mail: r.molinalvarez@gmail.com

Maurício Lourenzoni Augusti
PhD Student in Agronomy
Institution: Universidade Federal de Roraima
Address: Boa Vista – RR, Brasil
E-mail: mauricioaugusti86@gmail.com

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Deila Cristina Vieira da Silva
Master's Student in Agronomy
Institution: Universidade Federal de Roraima
Address: Boa Vista – RR, Brasil
E-mail: deilacris.16@gmail.com

Natalia Vieira de Sousa
Master's Student in Agronomy
Institution: Universidade Federal de Roraima – campus Cauamé
Address: Boa Vista – RR, Brasil
E-mail: nataliavieirasousa@gmail.com

ABSTRACT
The melon (*Cucumis melo* L.) holds significant economic importance on the global stage, with Brazil standing out as a strong exporter. Climatic conditions such as high temperatures, low relative humidity, and extended periods of sunlight are beneficial for the fruit's production and quality. The Northeast region of Roraima, particularly the municipalities of Bonfim and Normandia, close to the border with Guyana, has a semi-arid climate with an average annual rainfall between 1,200 and 1,400 mm. After harvesting, horticultural products begin to respire, a process that compromises post-harvest quality, leading to a decrease in organoleptic characteristics, firmness, sugar content, and loss of mass. The *Cantaloupensis and Reticulatus* melons, which are climacteric, have a high synthesis of ethylene and high respiratory rates in the fruit, resulting in flavor deterioration, firmness loss, and a shorter post-harvest shelf life. In contrast, non-climacteric melons, such as the inodorus group, display reduced ethylene synthesis, white flesh, subtle aroma, no pronounced ripening, and a longer post-harvest lifespan. It's worth noting that the melon market offers a variety of significant cultivars, resistant to pests, with high productivity and excellent post-harvest quality. This study aimed to address a literature review on the management of melon cultivation, development conditions of the crop, and post-harvest of melon cultivars in the Roraima Savanna."

Keywords: *Cucumis melo* L., varieties, soil and climate conditions.

RESUMO
O melão (*Cucumis melo* L.) tem significativa importância econômica no cenário mundial, com o Brasil destacando-se como um robusto exportador. Condições climáticas como temperaturas elevadas, baixa umidade relativa do ar e prolongados períodos de insolação são benéficas para a produção e qualidade dos frutos. A região do Nordeste de Roraima, especialmente os municípios de Bonfim e Normandia, perto da fronteira com a Guiana, possui clima semiárido com uma pluviosidade média anual entre 1.200 e 1.400 mm. Após a colheita, os produtos hortifrutícolas começam a respirar, processo que compromete a qualidade pós-colheita, levando à redução das características organolépticas, firmeza, teor de açúcares e perda de massa. Os melões *Cantaloupensis e Reticulatus*, climatéricos, têm elevada síntese de etileno e alta taxa respiratória nos frutos, o que resulta em deterioração do sabor, perda de firmeza e menor vida útil pós-colheita. Em contraste, melões não climatéricos, como o grupo *inodorus*, exibem síntese reduzida de etileno, polpa branca, aroma discreto, sem amadurecimento pronunciado e uma vida útil pós-colheita mais extensa. Vale ressaltar que o mercado de melão oferece uma diversidade de cultivares relevantes, resistentes a pragas, com alta produtividade e excelente qualidade pós-

colheita. O presente trabalho teve como objetivo abordar uma revisão bibliográfica sobre o manejo do meloeiro, condições de desenvolvimento da cultura e pós-colheita de cultivares de melão na Savana de Roraima.

Palavras-chave: *Cucumis melo* L., variedades, condições edafoclimáticas.

1 GENERAL INTRODUCTION

The melon (*Cucumis melo* L.) stands out as one of the most economically and socially important vegetables in Brazil (PINTO et al., 2022). In 2020, production reached a total of 457 thousand tons in an area of 157 hectares, resulting in an average productivity of 28.63 t ha^{-1}, according to IBGE report (2022).

The climate and soil characteristics in Brazil are favorable for melon cultivation in all regions of the country. Among the producing states, Rio Grande do Norte, Ceará and Pernambuco in the Northeast stand out; São Paulo in the Southeast; Paraná and Rio Grande do Sul in the South; Mato Grosso in the Center-West; and Amazonas and Tocantins in the North (IBGE, 2022).

Roraima presents an advantageous geographical positioning, bordering Venezuela and the Cooperative Republic of Guyana, which would facilitate the flow of its production to international markets such as China through the Panama Canal to follow the Pacific Ocean and the United States and Europe following the Atlantic Ocean (SOUSA NETO et al., 2019).

However, there is still a gap in research on melon cultivation in the state, including information on the available cultivars and the climate and soil conditions most conducive to its cultivation. For this reason, it becomes indispensable to initiate studies on the management of the crop, looking for techniques that potentialize the production and quality of the fruit, identifying the best cultivars and planting seasons for the region.

A study by Carmo et al. (2017) evaluated melon cultivars in the conditions of the Boa Vista Savanna, Roraima, achieving a productivity of 10.32 t ha^{-1} with the Valenciano Amarelo cultivar. Although this productivity is lower than in the main producing regions of Brazil, due to the limited technology employed, the culture is becoming a promising economic alternative for the state, considering that the climatic conditions are favorable.

The geographical location of Roraima, far from the main national and international markets, creates a considerable risk of post-harvest losses, one of the most critical stages of

production. This stage involves preserving and maintaining the optimal quality of the fruit for the consumer market.

As mentioned by Bessa et al. (2018), melons present challenges in post-harvest conservation due to their perishable nature and high water content. These factors become problematic during transport, storage, distribution and marketing.

The fruits after harvest start a process of intense breathing, facilitating post-harvest loss due to temperature and low relative humidity in the storage environment (FERREIRA et al., 2018). Firmness is one of the most important characteristics post-harvest, being a quality factor that determines the resistance to mechanical damage and the shelf life and post-harvest (ARAGÃO et al., 2019).

It is therefore essential to evaluate the behavior of different melon cultivars after harvesting and to define the ideal moment for these varieties to be sent to the external market. These aspects need to be investigated to support melon producers, in order to minimize fruit losses and increase profitability.

The Northeast of Roraima was chosen for these management studies, given the climatic importance of the region that favors the development of the melon.

Determining the best planting date during the rainy season in this region will provide valuable information for local producers, optimizing the profitability of melon cultivars according to regional conditions.

The present study aimed to carry out a literature review on the agronomic yield of melon cultivars, post-harvest characteristics of the crop in Roraima Savannah.

2 LITERATURE REVIEW

2.1 CULTURE OF THE MELON: GENERAL ASPECTS AND CHARACTERISTICS OF THE FRUIT

The melon, belonging to the subtribe Cucumerinae, tribe Melotricae, family Curcubitaceae, genus Cucumis and species Cucumis melo L., is subdivided into two subspecies (ARAGÃO et al., 2019). The subspecies melo is stratified into 11 botanical varieties, including reticulatus, cantalupensis, inodorus, adana, chandalak, ameri, flexuosus, chafe, tibish, dudaim and chito, while the subspecies aggrestis comprises five botanical varieties: conomon, momordica, makuwa, chinensis and acidulus (PITRAT, 2013).

Among the Cucurbita genera, C. melo stands out as the most polymorphic species, exhibiting expressive variations in the plant characteristics such as flowers, leaves and fruits, with polymorphism predominating in the attributes of its fruits, which encompass different colors of pulp and bark, aromas and sizes. This genetic diversity has helped the improvers to identify in botanical varieties of interest for agriculture, recognizing the marked morphological diversity in the fruits, arising from variations in colors, shapes and sizes (MCCREIGHT et al., 1993; LUAN et al., 2010).

Although there are controversies about its true origin, due to the great diversity of extant species, it has probably been located in different centers of Iran and Egypt about 2,500 years ago. However, different diversity centers have been established (ROBINSON & DECKER-WALTERS, 1997; JOHN et al., 2012; SABATO et al., 2015).

Melon is widely consumed in the world, either for its medicinal properties, its pleasant taste or its juicy pulp (GÓMEZ-GARCÍA et al., 2020). In Brazil, different melon cultivars stand out, the melons Gália and Cantaloupe being those that had a significant increase in their market share in recent years (DAMASCENO et al., 2012). However, yellow melons are particularly notable, with a high-quality flavor and resistance to post-harvest transport, in addition to features such as yellow skin, white to cream flesh, oval round shape and beneficial properties after harvest.

The melon Cantaloupe, of American origin and widely grown in the world, has a lacy rind, a round or slightly flattened shape, a light greenish-green rind with different degrees of lace and orange-colored pulp, exuding an intensely pleasant aroma when ripe (NICK & BORÉM, 2019).

2.2 SOCIOECONOMIC IMPORTANCE

Melon (*Cucumis melo* L.) is a crop of high economic relevance globally, with Brazil excelling as a significant exporter, mainly to the European market, providing fruits in natura (MEDEIROS et al., 2015; BESSA et al., 2018). In 2021, global melon production reached 27.3 million tons, grown on 1.05 million hectares. China leads this production, with an impressive 13,489,377 tons of fruit in 2021, which is equivalent to 61% of world production. Brazil ranks 12th among the largest producers, with a production volume of 581,478 tons in 23,858 hectares, boasting an average productivity of 25.44 tons per hectare (IBGE, 2022).

Melon consumption is extensive globally and is particularly significant in European countries (CUNHA et al., 2020). Brazilian melon production plays an important role in the economy, mainly because of its weight in national exports. Besides generating income, this crop creates thousands of jobs in the country, estimated at about 1.5 to 2 jobs per hectare (ABRASFRUTAS, 2022). Melon is the second most exported fruit in Brazil, only behind mango (COMEX STAT, 2021), due to its wide acceptance for consumption in natura and its benefits to human health, with antioxidant, purifying and refreshing properties (NILE & PARK, 2014).

In 2019, the state of Roraima produced 278 tons of melon (0.10% of national production), which increased to 874 tons in 2021, representing a 31% increase in state production and 0.14% of national production (IBGE, 2021). The municipality of Bonfim stood out, being responsible for 100% of the production in 2021. Evaluating melon cultivars under the pedo-climatic conditions of Sanava de Boa Vista - RR, Carmo et al. (2017) obtained productivity of 10.32 tons per hectare with the Valenciano Amarelo cultivar. Melon productivity in Roraima is still modest compared to Brazil's producing regions, due to the limited adoption of technology.

However, this crop is becoming an economic alternative for the state, given the favorable soil and climatic conditions and the evolution of cultivation techniques, which have allowed to increase productivity and improve the management of the crop.

In addition, Brazil has a favorable position in the world market, since its production takes place between harvests in other countries, especially in the northern hemisphere, facilitating the marketing of the Brazilian product (VARGAS et al., 2021).

As of 2020, the opening of the Chinese market for melon has generated export expectations for the coming years. Roraima, a Brazilian state located in the extreme north of the country, has a strategic geographical position for trade relations, due to its border location with other countries. Therefore, it is indispensable to intensify studies for the proper management of the crop, implementing techniques beneficial for a high productivity and quality of the melon fruit in the state, considering the periods of planting, quality of the post-harvest fruit and the most adaptable melon cultivars.

2.3 AGRONOMIC CHARACTERISTICS AND CLIMATIC CONDITIONS OF THE CULTURE FROM THE MELON TO RORAIMA

The melon (*Cucumis melo* L.), which belongs to the Cucurbitaceae family, has an annual vegetative cycle, with an average duration of 60 to 80 days. Its root system is robust, reaching up to 1 meter in airy soils. Although it is adaptable to various types of soils, the melon thrives best in medium-textured, sandy, deep, well drained and nutrient-rich soils, tolerating average acidity and developing well in a pH range of 5.5 to 7.0. The plant is adapted to tropical regions (SAFRI, 2018).

Conditions such as high temperatures, low relative air humidity and long periods of sunshine during the development of the crop favor increased production and quality of the fruit (VANOMARK et al., 2018; MELO et al., 2020). The melon develops best under hot weather, with temperatures ranging from 25 to 35 oC and tolerating extremes from 12 to 40 oC. The temperature above these limits stimulates the production of male flowers, and there should not be a large variation between the daytime and nighttime temperature (OLIVEIRA et al., 2011). Low temperatures, close to 12 oC, reduce the speed of emergence of seedlings and the incidence of pathogens causing diseases, negatively impacting the productivity and quality of the fruit (FIGUEIRA, 2008).

High-brightness locations, in the range of 2,000 to 3,000 hours of light per year, and with low rainfall rates for most of the year, are ideal for the melon. The ideal relative humidity is around 60 to 70%. Humidity below 50% can irreversibly impair the growth and development of the crop, making it susceptible to water loss by evapotranspiration (ARAGÃO et al., 2019). On the other hand, moisture above 75% can result in small fruits, occurrence of fungal diseases and reduced ability of the plant to produce photoassimilated.

In Roraima, research by Carmo et al. (2017) found that the region of savannah presents maximum temperatures of 32.5 oC and minimum of 28 oC, with relative air humidity of 65% are suitable for the development of the culture. Thus the state is in an advantageous situation for the management of the crop and can reach high productivity levels, considering that the region of Roraima Savana is characterized by high temperatures and luminosity, decisive factors for the productivity and quality of the fruits (BARNI et al., 2020).

The state has three types of climates (Aw, Am and Af). The Af climate is characterized by heavy rainfall for most months of the year, two months with precipitation less than 60 mm,

the Am climate, or tropical monsoon, is the most prevalent in the state, interspersed with the climates Aw and Af (BARNI et al., 2020).

This region, which covers the central, southern and northwestern part of the state, shows a decrease in rainfall in the North, while the South begins the rainy season in September. The northeastern region of Roraima, particularly the municipalities of Bonfim and Normandia, near the border with English Guiana, has a semi-arid climate, with average rainfall between 1,200 and 1,400 mm per year. It may be a promising alternative for melon production, given the climate adequacy.

2.4 POST-HARVEST STORAGE AS MELON FRUIT

The location of Roraima, far from the main markets in Brazil and abroad, poses a significant challenge in minimizing the loss of fruit after harvest. This stage is critical in the harvesting process, as the preservation capacity and maintenance of the optimal quality for the consumer market are crucial.

Every year, seed companies strive to introduce new hybrid and conventional cultivars, aiming to obtain varieties that present excellent responses in the post-harvest phase.

After being harvested, the fruit and vegetable products begin a process of breathing which, unfortunately, reduces post-harvest quality. This process can lead to a decrease in organoleptic properties, firmness, total sugars and loss of fresh mass (AMARO et al., 2012), influenced by temperature and relative humidity during post-harvest storage days (FERREIRA et al., 2018).

Soluble solids decrease post-harvest due to aerobic respiration, which uses soluble sugars as an energy substrate. This process can cause the fruit to deteriorate to some extent, leading to significant changes in the color and texture of the fruit during storage (CHONG et al., 2015). The changes in the quality of the fruit call for more in-depth studies to understand which cultivars adapt best, in which temperature ranges and how many days of storage will influence the fruit.

When choosing cultivars, the producer must consider, in addition to the productive aspect, the market, marketing, agronomic aspects such as resistance to pests, diseases and transport, post-harvest conservation and soluble solids (YURI, RESENDE and COSTA, 2022). This includes observing the demands of European, Asian and US markets while maintaining high quality and an attractive look of the fruits (PREVIDELLI et al., 2020).

The *Cantaloupensis* melons and *Reticulatus*, climacteric fruits, have a high catalytic synthesis of ethylene and a high rate of cellular respiration in the fruit, deterioration of taste, loss of firmness and consequently a short post-harvest life (SCHEMBERGER, et al., 2020). The non-climacteric melon, for example, the group of odorless melons, has a lower ethylene synthesis, white pulp, low aroma, no ripening and abscision and a longer post-harvest shelf life (LEIDA et al., 2016).

Studies such as de Paiva et al. (2008) observed a decrease in soluble solids by 2% on the eighth day of storage and the firmness of the fruits depreciating from the 32 days of post-harvest storage and ambient temperature for the Gold Mine melon. Improper storage can result in a loss of quality, as melon fruits are usually eaten in the wild. However, the melon market has a variety of important cultivars, which are pest-resistant, have high fruit productivity and high post-harvest fruit quality (DEUS et al., 2015).

3 CONCLUSIONS

The soil and climatic conditions of Boa Vista in Roraima enhance the agronomic characteristics and the quality of the fruit of melon cultivars.

The strategic location of Roraima, near Guyana and Venezuela, both located on the sea coast, confers geographical advantages on the state.

Post-harvest storage of melon needs to be well investigated on the issue of cultivars, as improper storage results in low quality fruit for the market.

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