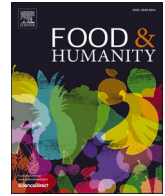


ARTIGOS CIENTÍFICOS



Effects of water deficit stress and salicylic acid preharvest treatments on postharvest biochemical parameters of potato

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Salicylic acid
Antioxidant activity
Post-harvest
Shelf-life

ABSTRACT

Harvest conditions, harvest state and the pre-treatments to which the potato plant is subjected to affect post-harvest quality. The present study was conducted to verify the effect of the SA foliar application challenged with water deficit stress (WDS, 45 kPa) and control (10 kPa). After the harvest process, the tubers of both treatments were treated with a SA solution (8 mM). Tubers were stored in a dark room at temperature (20 ± 3.5 °C) with relative humidity (65 ± 5 RH) for a period of 60 days, evaluated with different biochemical parameters. The results showed that foliar application of SA presented positive effects in the mitigation of oxidative damage through the dismutation of reactive oxygen species (ROS), suggesting the protection of the cellular membrane structure. Furthermore, there was less accumulation of malondialdehyde and synthesis of bioactive compounds, which certainly increased the antioxidative capacity of plants. WDS tuber was the treatment that presented the highest antioxidant activity with $1.82 \mu\text{M FeSO}_4 \text{ mg}^{-1}$. In general, the results indicated that the foliar application of SA and immersion with the same acid in post-harvest presented a positive effect in the biochemical parameters.

1. Introduction

Water deficit is one of the main physical stress modalities that limit crop yield (Cominelli et al., 2013). Plants exposed to water deficit can exhibit tolerance through diverse physiological mechanisms (Seleiman et al., 2021). These responses change according to the species, genotype, duration and stress intensity, in addition to the developmental stage (Peleg & Blumwald, 2011). Potato is not only a valuable source of starch, vitamin C and fibres, but also of proteins, potassium, unsaturated fatty acids, and well characterized phytochemicals polyphenols and carotenoids with antioxidant properties (Zaheer & Akhtar, 2016). In recent years, breeding programs aimed at raising potato's nutritional value have been mainly focused on the accumulation in the tubers of carotenoids and anthocyanins (Brown et al., 2003). Since carotenoids and

anthocyanins exhibit antioxidant activity, their enhanced levels in the tubers have been considered a desirable trait. Secondary metabolites levels and composition in the potato tubers are genetically determined; however, developmental, tissue specific and environmental cues also act as key players (Bassolino et al., 2022).

Multiple factors influence the post-harvest quality of potatoes, including the stage of crop maturity, pre-harvest conditions, harvest and handling practices, crop health (including pest and disease incidence), biochemical alterations, storage preparation and conditions, management of storage facilities, processing environment, and nutritional content of the potatoes (Pinhero & Yada, 2016). During post-harvest, due to internal and external factors, chemical and physical changes occurred in fruits and vegetables, which can result in loss of nutritional quality. Water loss during the storage of the potatoes depends on

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ORIGINAL ARTICLE

Agrosystems

The combination of irrigation regime and water cutoff date increases the yield and water use efficiency of castor bean (*Ricinus communis* L.)

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Abstract

Castor bean (*Ricinus communis* L.) is a fibrous and fast-growing plant with increasing economic importance due to its ability to generate energy and in the pharmaceutical and chemical industries. This research aimed to determine the best combination of irrigation regime and irrigation cutoff date (ICD) that maximizes grain and oil yields and water use efficiency (WUE) in the castor bean hybrid AG IMA 110204. The experiments were conducted in greenhouses in randomized blocks using subdivided plots and four replicates. The plots were allocated to five irrigation regimes based on soil water tension: 20, 30, 40, 50, and 60 kPa, corresponding to I1, I2, I3, I4, and I5, respectively. The subplots show the four ICDs: 120, 130, 140, and 150 days after sowing (DAS). The I1, I2, and I3 treatments showed the highest values and did not differ in the two cycles for the following variables: weight of 100 grains, grain yield, oil yield, WUE of the grain (WUE-grains), and WUE of the oil (WUE-oil). When the irrigation cutoff was 120 DAS, in both cycles, the water regimes I1, I2, and I3 presented the highest values and did not differ in terms of grain or oil yields or WUE-grains or WUE-oil. Higher grain and oil yields with lower water demand for castor

Abbreviations: DAS, days after sowing; ICD, irrigation cutoff date; WUE, water use efficiency.

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Physiological quality of zucchini seeds is positively affected by postharvest resting periods

Calidad fisiológica de las semillas de calabacín afectadas por los períodos de reposo del fruto después de la cosecha

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ABSTRACT

This study evaluates zucchini, *Cucurbita pepo*, seed quality after postharvest resting periods. Zucchini fruits harvested 63 days after transplanting were maintained for 0, 3, 6, 9, or 12 days before seed extraction. The percent of processed seeds (clean and whole seeds), the weight of 100 seeds, germination, first count in germination, germination speed index, electrical conductivity, nitrogen (N), and protein contents were evaluated. The weight of 100 seeds, percent of processed seeds, germination, vigor, seed N, and protein content increased as the resting period after harvest (days) increased. Seed electrical conductivity decreased as days of postharvest

Doses of aminoethoxyvinylglycine (AVG) in tomato postharvest storage

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Abstract

Tomatoes are one of the main vegetables found daily in world cuisine and are highly perishable. The aim of this study was to evaluate the quality of 'Débora' tomato fruits over the post-harvest period in refrigerated storage, after immersion in solutions with different concentrations of aminoethoxyvinylglycine (AVG). The experimental design was entirely randomized in a 4 × 5 double factorial scheme, with four treatments, AVG doses 0 (control), 500, 1,000, and 1,500 mg·L⁻¹, and five days of evaluation during the 28 d of refrigerated storage (days 0, 7, 14, 21 and 28) with three replications. Physicochemical analyses were carried out on weight loss, respiration rate, firmness, hydrogen potential (pH), soluble solids, titratable acidity and external and internal fruit color parameters, luminosity, chroma, and 'hue. Two-way ANOVA, Tukey's mean test ($p < 0.05$), and multivariate statistical analysis by principal components (PCA) were carried out. The PCA allowed us to infer that, as weight loss increased, firmness decreased, an effect that was minimized with AVG at a dose of 1,500 mg·L⁻¹, which may be related to the inhibition of the fruit's ethylene production rate. AVG delayed the post-harvest ripening of tomato fruit, reduced the respiration rate of the fruit, and the changes in external and internal chroma. The doses of AVG did not affect the luminosity and pH of the fruit pulp.

Citation: Rocha Lacerda V, Aparecida dos Santos J, Sílvia Angélica de Oliveira H, Gaona Acevedo AF, Lopes Vieites R. 2024. Doses of aminoethoxyvinylglycine (AVG) in tomato postharvest storage. *Technology in Horticulture* 4: e011 <https://doi.org/10.48130/tihort-0024-0008>

Introduction

Tomato (*Solanum lycopersicum* L.), is one of the main vegetables found daily in the world's cuisine. It can be eaten both fresh and processed. The heightened demand for this fruit contributes significantly to job creation within the tomato production sector, and it plays a significant role in agribusiness^[1]. In addition to its aroma, flavor, and texture, tomatoes are widely accepted for their many benefits for human health. It is a food rich in lycopene, vitamins A and C, and minerals such as potassium, phosphorus, and magnesium, which are important for human nutrition^[2].

Climacteric fruits, like tomatoes, are highly perishable. They show a rapid and significant increase in respiration during ripening, with a series of biochemical and visual changes occurring^[3]. Post-harvest losses of fruit and vegetables begin at harvest and continue throughout the marketing stage until consumption, i.e. during packaging, transportation, storage and at the consumer level.

Ethylene is the main hormone responsible for ripening and its control is one of the main factors in reducing post-harvest losses. There are several inhibitors used in the conservation of climacteric fruits, which control the action and/or synthesis of ethylene, extending the shelf life of the product^[4]. One form of control, for example, is the compound aminoethoxyvinylglycine (AVG).

AVG suppresses ethylene biosynthesis by inhibiting the enzymatic activity responsible for converting S-adenosyl methionine (SAM) to 1-aminocyclopropane-1-carboxylic acid

(ACC)^[5,6]. Several studies have used AVG to delay ripening and maintain post-harvest quality in climacteric fruits such as bananas^[7] and apples^[8]. In pears, AVG treatment suppressed the rate of fruit respiration, reduced the loss of firmness, reduced internal browning, senescence disorders, and consequently effectively delayed fruit ripening^[9].

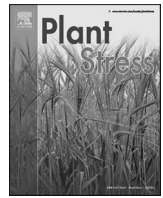
Considering the quality and shelf life of the product, there are several damages caused to tomatoes, including handling, transportation, mechanical damage and exposure to high temperatures^[3], resulting in rapid ripening with intensification of the red color. As such, tomatoes require a great deal of care and technology for their preservation.

As the effect of AVG can vary depending on the dose and the type of fruit^[10], and as there are few studies with AVG in tomatoes, more detailed studies are needed to better understand the issues of the feasibility of using AVG at an appropriate dose. In this context, the aim of this work was to evaluate the quality of tomato fruit cultivar 'Débora' over various postharvest times in refrigerated storage, after immersion in solutions with different concentrations of aminoethoxyvinylglycine (AVG).

Materials and methods

Plant material

Tomato fruits (*Solanum lycopersicum* L. Cultivar 'Débora') obtained from commercial cultivation were used. The fruits were harvested at the salad tomato stage of ripeness, green and ripe, and transferred to the Fruit and Vegetable PostHarvest



Foliar salicylic acid application to mitigate the effect of water deficiency on potato (*Solanum tuberosum* L.)

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ARTICLE INFO

Keywords:

Salicylic acid. Potato. Abiotic stress. Bioactive compounds

ABSTRACT

Water deficiency (WD) is one of the main factors that limit the growth and productivity of crops in the world. Salicylic acid (SA) is considered a plant hormone that has an important role in the plants' growth, development, and tolerance to abiotic stress. There is a hypothesis that the application of SA could mitigate the impact of the physical stress in potato plants. From the imposition of WD the physiological and biochemical indexes, including the antioxidative defense system, were evaluated in potato plants treated with the foliar application of SA. The assay revealed that the moderate WD 45 kPa negatively affected the metabolic parameters in potato plants. Foliar application of SA presented positive effects in the mitigation of oxidative damage through the dismutation of reactive oxygen species (ROS), suggesting the protection of the cellular membrane structure. Furthermore, there was less accumulation of malondialdehyde and synthesis of bioactive compounds, which certainly increased the antioxidative capacity of the plants. In conclusion, the results indicate that the foliar application of SA can have a positive regulatory role in alleviate water deficiency stress in potato plants.

1. Introduction

Abiotic stress is caused by any change in the environmental conditions where the plant is growing and can slow down its development. The main abiotic stresses include high and low temperatures, drought, flood, light, radiation, salinity, heavy metals or changes in the nutrient levels (Vats, 2018).

Water deficiency (WD) is an abiotic factor that negatively affects the growth and productivity of plants, altering morphological, biochemical, and molecular characteristics (Balestrini et al., 2018). A constant state of WD causes the reproductive development upsets, leading to the premature senescence of the leaves, withering, desiccation and death (Reddy et al., 2004).

Damage caused by WD are mainly due to the accumulation of reactive oxygen species (ROS). (Kundu et al., 2020). ROS can trigger harmful effects, such as damage to the DNA structure, amino acids and protein oxidation and lipidic peroxidation. In this last process, the phospholipid

components of the cellular membranes are oxidized, which alters their biological function, causing loss of fluidity and inactivation of enzymes linked to the membrane (Gill and Tuteja, 2010).

Phenolic compounds are an important class of plant secondary metabolites with a wide variety of medical and pharmacological uses. Biosynthesis of the phenolic compounds is triggered as a response to different biotic and abiotic stresses, as a defense mechanism, specially regarding its antioxidant capacity, which neutralizes reactive oxygen species (ROS) created by several stress factors (Khalil et al., 2018).

In addition to the plant immunological signaling, salicylic acid (SA) also acts in the signaling of several physiological responses, such as drought, thermogenesis, stomatal closing, seed germination, flowering, salt stress, ozone and cooling (Kumar, 2014; Wani et al., 2017).

Salicylic acid acts as an important regulator of plant growth, in the modulation of physiological and biochemical characteristics under abiotic stress. The hormone reduces the stress by increasing the proline, antioxidants, heat shock proteins (HSPs), secondary metabolites and

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Silicon as a mitigator of water deficit stress in radish crop

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ARTICLE INFO

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Drought stress
Irrigation management

ABSTRACT

Silicon is the second most abundant element in the Earth's crust and has several beneficial effects on plants, such as increase photosynthetic capacity and improve the architecture of the aerial parts. Water stress negatively affects plant development and, specifically in horticultural species, impacts metabolic processes with consequences on quality and productivity. The aim of this research was to investigate through physiological and biochemical parameters if the use of silicate in place of dolomitic limestone can contribute to the tolerance of radish plants submitted to water deficiency. The experiment was carried out in a greenhouse in Botucatu, Brazil, with radishes of the Apolo variety, distributed in randomized blocks in a 3×2 factorial scheme, being three irrigation depths, with high soil moisture at tensions corresponding to 10 kPa (control, FC - field capacity), 20 kPa (MWD - moderate water deficiency), and 30 kPa (SWD - several water deficiency), and two soil correctives, limestone and silicate, totaling six treatments and three repetitions. Irrigation management was performed with tensiometers. The parameters evaluated included biometrics, biomass, growth rates, photosynthesis, enzymatic activity, soluble protein, and proline. Through discussion of the results, it was possible to conclude that the silicate provided tolerance to water stress, reduced the percentage of cracked roots, and increased yield in the radish crop. Therefore the use of silicate in arid areas with low water availability is of great importance.

1. Introduction

Radish (*Raphanus sativus* L.) belongs to the Brassicaceae family, and is characterized by yield of globular roots, bright scarlet in color with white pulp, and for having a short cycle, between 25 and 35 days, cultivated in fertile soils with a pH of around 5.5–6.8 (Cardoso and Hiraki, 2001; de Paiva et al., 2013).

Although silicon is not considered an essential element for plant growth, it has numerous positive effects, such as increase photosynthetic capacity, and improve the architecture of aerial parts, tolerance to water stress, mitigates ammonium toxicity and attack by pests and pathogens (Viciedo et al., 2019; Ma and Yamaji, 2006; Bakhat et al., 2018). This element is the second most abundant in the Earth's crust, surpassed only by oxygen and found in practically all rocks and soil types, in various forms of pure or impure silica (Russell, 1994; Sommer et al., 2006).

Fertilization using silicate, containing silicon in the chemical composition, has been gaining ground in agriculture mainly due to the benefits of its application coupled with low acquisition costs. It is

necessary that these silicon sources demonstrate characteristics that are favorable for their use, which aim to improve soil conditions, such as a high concentration of this element in soluble form and low concentration of heavy metals (Korndorfer and Oliveira, 2010).

Silicon presents several beneficial effects in plants by improving soil chemical conditions, such as increasing pH, acting as a corrective, decreasing Al^{3+} levels, increasing base saturation, acting in the conversion of toxic elements from soluble to insoluble fractions, and acting in the polymerization and precipitation of these toxic elements with silicate compounds (Korndorfer and Oliveira, 2010; Majumdar and Prakash, 2020).

The liming technique is performed by applying limestone to the soil to correct acidity, neutralizing the protons in the soil solution, however, silicates can be a viable alternative to neutralize acidity as a replacement for conventional liming (Galindo et al., 2021a). Silicate can reduce the time associated with liming reactions in the soil profile due to its greater solubility and alkalinity compared to limestone (Crusciol et al., 2016; Galindo et al., 2021b).

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Physiological quality and antioxidant enzymes activity in eggplant seeds with different ages and resting periods after harvest

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ABSTRACT

Constant changes during the seed maturation process affect its final quality and the post-harvest fruit resting, which can improve seed physiological quality. Therefore, the objective of this study was to evaluate the physiological and enzymatic activities of eggplant seeds extracted from fruits harvested at different ages and resting periods after harvest. Fruits were harvested presenting different colors at 40, 50, 60, and 70 days after anthesis (DAA) and rested for 0 (freshly harvested fruits), 10, and 20 days. The experimental design was set as completely randomized, with four replications and evaluated seeds extracted from six fruits per plot. The resting periods in eggplant fruits harvested at less than 60 DAA improved the mass of 1000 seeds, germination, vigor, and protein content. Seeds with higher germination and vigor presented lower dismutase (SOD), catalase (CAT), and peroxidase (POX) enzymatic activity. The results indicated that the ideal moment of eggplant harvest for seed production is when the fruit reaches the yellowish-brown color corresponding to about 60 DAA; however, if the eggplant fruit is harvested earlier (40 or 50 DAA), it has to rest for about 10 to 20 days to achieve high physiological quality (germination and vigor).

RESUMO

Qualidade fisiológica e atividade de enzimas antioxidantes em sementes de berinjela com diferentes idades e períodos de repouso após a colheita

Mudanças constantes durante o processo de maturação das sementes afetam sua qualidade final, assim como o repouso pós colheita dos frutos pode melhorar a qualidade fisiológica das sementes. O objetivo deste estudo foi avaliar a qualidade fisiológica e a atividade enzimática de sementes de berinjela provenientes de frutos com diferentes idades e períodos de repouso após a colheita. Os frutos foram colhidos apresentando cores diferentes aos 40, 50, 60 e 70 dias após a antese (DAA) e mantidos em repouso por 0 (frutos recém-colhidos), 10 e 20 dias. Foi utilizado delineamento experimental inteiramente ao acaso, com quatro repetições e foram avaliadas as sementes extraídas de seis frutos por parcela. O repouso dos frutos de berinjela colhidos com menos de 60 DAA possibilitou maiores massas de 1000 sementes, germinação, vigor e teor de proteínas das sementes. As sementes com maior germinação e vigor apresentaram baixa atividade enzimática da superóxido dismutase (SOD), catalase (CAT) e peroxidase (POX). Os resultados indicaram que o momento ideal da colheita é quando o fruto atinge a cor amarelada-marrom correspondente a cerca de 60 DAA; no entanto, se o fruto de berinjela for colhido precocemente (40 a 50 DAA), ele tem que permanecer em repouso por cerca de 10 a 20 dias para as sementes alcançarem alta qualidade fisiológica (germinação e vigor).

Keywords: *Solanum melongena*, germination, seed vigor, seed maturation.

Palavras-chave: *Solanum melongena*, germinação, vigor de sementes, maturação das sementes.

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The eggplant (*Solanum melongena*) crop is adapted to hot environments, stopping plant development at low temperatures (10-12°C), and the culture is very sensitive to frost (Gürbüz *et al.*, 2018).

The eggplant fruit is usually

harvested for consumption before the ideal seed maturation point (Gürbüz *et al.*, 2018); however, the fruit must reach maturity for seed production. The appropriate moment of eggplant fruit harvest may result in a high percentage of seed germination and vigor. Due to

the indeterminate growth habit of the eggplant plants, the fruits do not ripen simultaneously, resulting in seeds with different maturity stages. This situation can decrease the quality of an eggplant seed lot. However, the post-harvest resting of the fruits can improve seed

Efecto del Uso de Antioxidantes en Plátano Verde Dominico-Hartón (*Musa AAB Simmonds*) Cortado en Rodajas

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Resumen

Se evaluaron las propiedades físico-químicas, firmeza en la pulpa e índice de pardeamiento del plátano verde (*Musa AAB Simmonds*) mínimamente procesado durante 21 días de almacenamiento a temperatura de 11 ± 2 °C y humedad relativa de 92 ± 2 %. El plátano verde es uno de los frutos de mayor producción y consumo en Colombia. Sin embargo, cuando sufre un daño mecánico como un corte, ocurren cambios, en su apariencia y sabor debido a la elevada actividad metabólica típica de un producto climatérico. El plátano verde (fisiológicamente maduro) fue higienizado con agua clorada, removida la cáscara, cortado en rodajas, sometido a inmersión en soluciones antioxidantes de L-cisteína 0,5% (w/v), ácido cítrico 0,92% (w/v) y control (sin inmersión) y acondicionadas en bolsas de polietileno al vacío y en empaque PET. Durante el almacenamiento se encontró que las rodajas tratadas con ácido cítrico y L-cisteína evitan el pardeamiento enzimático y cuando son acondicionadas en empaque al vacío su conservación se prolonga en por lo menos 21 días.

Palabras clave: plátano verde; Musa AAB Simmonds; oscurecimiento enzimático; antioxidante

Effect of use of Antioxidants on Green Plantain Slices Dominico-Hartón (*Musa AAB Simmonds*)

Abstract

The physicochemical properties, pulp firmness and browning index of fresh-cut green plantain (*Musa AAB Simmonds*) were evaluated during 21 days of storage at a temperature of 11 ± 2 °C and 92 ± 2 % relative humidity. Green plantain is one of the fruits of largest production and consumption in Colombia. However, when the fruit suffers mechanical damages, such as cuts, changes occur in appearance and taste, due to the metabolic activity commonly found in climacteric crop. The green plantain (physiologically mature) was sanitized with chlorinated water, the peel was removed, cut in slices, immersed in antioxidant solutions of L-cysteine 0.5% (w/v), citric acid 0.92% (w/v) and control (without immersion) and conditioned in polyethylene vacuum bags and PET boxes. During storage it was found that the slices treated with citric acid and L-cysteine prevented enzymatic browning and when conditioning in vacuum bags the conservation is prolonged in at least 21 days.

Keywords: fresh-cut green plantain, Musa AAB Simmonds; enzymatic browning, antioxidant

Content and Accumulation of Macronutrients in Radish Seeds in Response to Sulfur and Organic Compost

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Abstract

Sulfur (S) is usually the second most accumulated nutrient in seeds of Cruciferae plant species such as the radish. Tropical soils have low S availability creating a challenge to manage plant nutrition and balanced plant development to produce high-quality seeds. This study evaluated the influence of S doses and organic compost fertilization on the content and accumulation of macronutrients in radish seeds. Eight treatments were studied in subdivided plots, where the presence (50 t ha⁻¹) or absence of organic compost was placed in the main plot, and the S doses (0, 60, 120, 180 kg ha⁻¹ of S) were placed in the subplots. A randomized block design with six replications was used. Seed dry weight, N, P, K, Ca, Mg, and S concentration (g kg⁻¹ of dry matter), and the accumulation of nutrients in seeds (g plant⁻¹) were evaluated. There was no significant effect of S doses, or organic compost, on the contents of macronutrients in radish seeds. When organic compost was not applied, great doses of S generated great dry weight and accumulation of macronutrients in the radish seeds. However, the application of organic compost increased the dry weight and the accumulation of all macronutrients in radish seeds in low S doses (up to 66 kg ha⁻¹). Also, the presence of organic compost increased the dry weight and the concentration of macronutrients in radish seeds. The decreasing order of macronutrient content and accumulation by the radish seeds was: N > S > K > P > Ca > Mg.

Keywords: *Raphanus raphanistrum*, composted cattle manure, dry seed mass, nutrient decreasing order

Caracterização físico-química, nutricional e compostos bioativos de romã

Physical-chemical, nutritional characterization and bioactive compounds of pomegranate

Caracterización físico-química, nutricional y compuestos bioactivos de la granada

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Resumo

A romã é conhecida por seus efeitos benéficos a saúde, principalmente por suas propriedades antioxidantes e é amplamente cultivada em diferentes regiões do mundo, o que reflete na grande diversidade de composição dos frutos. Desta forma o objetivo do presente trabalho foi avaliar as características físicas, físico-químicas, bioquímicas e composição centesimal da romã cv. Comum cultivada no Oeste Paulista. Os frutos utilizados foram colhidos no estágio de maturação comercial, no município de Alvares Machado, região de Presidente Prudente, estado de São Paulo e avaliados quando ao peso, firmeza, coloração, pH, sólidos solúveis (SS), acidez titulável (AT), Ratio (SS/AT), compostos fenólicos totais, atividade antioxidante por DPPH, antocianina monomérica total, composição mineral, umidade, cinzas, proteínas, lipídeos, fibras, açúcares redutores e valor calórico total. Os frutos de romã cv. Comum apresentaram a casca de coloração laranja e polpa (sarcotesta) vermelho-violeta. O potássio (K) foi o macronutriente predominante na casca e na polpa. A polpa apresentou alto teor de sólidos solúveis e baixo teor de acidez titulável, caracterizando sabor adocicado. A casca apresentou maior teor de compostos fenólicos totais e atividade antioxidante em relação a polpa. A polpa apresentou maior valor calórico total.

Palavras-chave: *Punica granatum* L.; Cv. Comum; Composição nutricional; Compostos fenólicos; Antioxidantes.

Abstract

Pomegranate is known for its beneficial effects on health, mainly for its antioxidant properties and is widely cultivated in different regions of the world, which reflects the great diversity of fruit composition. Thus, the objective of this work was to evaluate the physical, physicochemical, biochemical and proximate composition of pomegranate cv. Comum cultivated in the west of São Paulo. The fruits used were harvested at the commercial maturation stage, in the municipality of Alvares Machado, Presidente Prudente region, state of São Paulo and evaluated for weight, firmness, color, pH, soluble solids (SS), titratable acidity (TA), Ratio (SS/AT), total phenolic compounds, antioxidant activity by DPPH, total monomeric anthocyanin, mineral composition, moisture, ash, proteins, lipids, fibers, reducing sugars and total caloric value. Pomegranate fruits cv. Comum skin had an orange color and pulp (sarcotesta) red-violet. Potassium (K) was the predominant macronutrient in the skin and pulp. The pulp had a high content of soluble solids and a low content of titratable acidity, characterizing a sweet taste. The peel showed higher content of total phenolic compounds and antioxidant activity in relation to the pulp. The pulp had the highest total caloric value.

Keywords: *Punica granatum* L.; Cv. Comum; Nutritional composition; Phenolic compounds; Antioxidants.

Resumen

La granada es conocida por sus efectos beneficiosos para la salud, principalmente por sus propiedades antioxidantes y se cultiva ampliamente en diferentes regiones del mundo, lo que refleja la gran diversidad de composición de la fruta. Así, el objetivo de este trabajo fue evaluar la composición física, fisicoquímica, bioquímica y próxima de la granada cv. Comum cultivado en el occidente de São Paulo. Los frutos utilizados fueron cosechados en la etapa de maduración comercial, en el municipio de Alvares Machado, Región Presidente Prudente, estado de São Paulo y evaluados por peso, firmeza, color, pH, sólidos solubles (SS), acidez titulable (TA), Ratio (SS / AT), compuestos fenólicos totales,

Agronomic performance of the beet Tall Top Early Wonder as a function of nitrogen and borate fertilization

Desempenho agrônômico da beterraba Tall Top Early Wonder em função da adubação nitrogenada e boratada

Rendimiento agronómico de la remolacha Tall Top Early Wonder en función de la fertilización con nitrógeno y borato

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Abstract

The supply of nutrients in suitable proportions of nutrients in the beet culture is one of the most important factors in the growth process and root quality. However, few studies are evaluating the influence of the interaction between nutrients in this culture. The objective of this work was to evaluate the effects of the combination of nitrogen fertilization with boron on the production characteristics and quality of the beet Tall Top Early Wonder. The experiment was carried out at the São Manuel Experimental Farm (FCA/Unesp), located in São Manuel-SP. The experimental design was in randomized blocks, with four replications. The evaluated factors were: nitrogen and boric fertilization, in the factorial scheme (2 x 2), totaling 4 treatments: T1 (0 kg ha⁻¹ of N and 0 kg ha⁻¹ of B), T2 (0 kg ha⁻¹ of N and 4 kg ha⁻¹ of B), T3 (90 kg ha⁻¹ of N and 0 kg ha⁻¹ of B) and T4 (90 kg ha⁻¹ of N and 4 kg ha⁻¹ of B). The results showed that there was a positive interaction between nitrogen and boron when applied together, providing increases in productivity and greater uniformity in beetroots.

Keywords: *Beta vulgaris* L.; Interaction between nutrients; Plant nutrition; Commercial roots.

Effect of different modified atmosphere packaging and storage time on bioactive compounds in fresh-cut Tropic Beauty peaches

Efeito de diferentes embalagens em atmosfera modificada e tempo de armazenamento sobre os compostos bioativos em pêssegos Tropic Beauty minimamente processados

Efecto de diferentes empaques en atmosferas modificadas y tiempo de almacenamiento sobre compuestos bioactivos en duraznos Tropic Beauty recién cortados

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Abstract

Modified atmosphere packaging (MAP) was evaluated for respiration rate, color, total phenolic content (TPC), antioxidant activity DPPH, flavonoids and pigments of fresh-cut Tropic Beauty peach. Modified atmospheres (21% O₂ [Control], 5% CO₂ [MAP₁], 8% CO₂ [MAP₂] and 0% O₂ [MAP₃]) were evaluated for storing fresh-cut peaches for up to 10 days in temperatures of 5°C. MAP significantly ($p < 0.05$) affected the proprieties investigated as compared to control. Peaches with MAP₃ have higher respiration ($p < 0.05$) respiration rate than the peaches with the other treatments. Fresh-cut peaches in MAP₂ showed more stable ($p < 0.05$) carotenoid and anthocyanin contents, better attributes in the bioactive compounds. MAP₁ and MAP₂ exhibited better antioxidant proprieties at low storage temperature (5°C) for up to 10 days storage and similar result was verified by principal component analysis used where modified atmosphere was observed as major factor.

Keywords: (*Prunus persica* (L.) Batsch); Fresh-cut; Modified atmosphere packaging; Respiration rate; Bioactive compounds; Shelf-life.

Resumo

Embalagens em atmosferas modificadas (MAP) foi avaliado quanto a taxa respiratória, cor, conteúdo fenólico total (TPC), atividade antioxidante DPPH, flavonoides e pigmentos de pêssego Tropic Beauty minimamente processado. Atmosferas modificadas (21% O₂ [Control], 5% CO₂ [MAP₁], 8% CO₂ [MAP₂] e 0% O₂ [MAP₃]) foram avaliados para armazenar pêssego minimamente processado por até 10 dias em temperatura de 5°C. MAP afetou significativamente ($p < 0.05$) as propriedades pesquisadas em comparação com o controle. Os pêssegos com MAP₃ tem taxa respiratória mais alta ($p < 0.05$) do que os pêssegos com os outros tratamentos. Os pêssegos embalados em MAP₂ exibiram teores de carotenoides e antocianina mais estáveis ($p < 0.05$), melhores atributos nos compostos bioativos. As MAP₁ e MAP₂ exibiram melhores propriedades antioxidantes em temperaturas de refrigeração (5°C) por até 10 dias

Macronutrient contents of eggplant seeds with different ages and postharvest resting times

Ariel Santivañez Aguilar¹, Henrique Vasque¹, Ricardo Adriano Felito¹, Andres Felipe Gaona Acevedo¹, Estefânia Martins Bardivieso¹, Raíra Andrade Pelvine¹, Antonio Ismael Inácio Cardoso¹ and Ernane Miranda Lemes^{2*}

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Abstract

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The seed nutritional status is of essential importance to seed storage capacity and vigor, especially for horticultural crops, such as the eggplant. Thus, this study aimed to evaluate the macronutrient contents in eggplant seeds with different ages and times after the fruit harvest. Twelve treatments were evaluated - four fruit ages (40, 50, 60 and 70 days after anthesis), and three periods of resting after the harvest of the fruits (PRAHF) (0, 10 and 20 days). The experiment was conducted in a protected cultivating area. The dry biomass of 1000 eggplant seeds and contents of seed macronutrients were evaluated. The N concentration decreased with the increase of the fruit age, however, the PRAHF did not affect its content. The seed P content did not change with fruit age or PRAHF. For the seed K, Mg, S and Ca contents it was observed interaction between fruit age and PRAHF, and generally, the contents of these macronutrients decreased with fruit age and the PRAHF. The reductions in seed N, K, Ca and Mg contents correlate with the increase of the 1000 seeds dry mass, probably due to a dilution effect. The descending order of macronutrients contents in eggplant seeds is N>K>P>Mg>S>Ca.

Keywords: *Solanum melongena* L.; seed maturation; storage period; seed biomass; seed nutritional status

Introduction

Eggplant (*Solanum melongena* L.) belongs to the Solanaceae family and is well adapted to the hot and humid environments of the tropics, with the plant growth interrupted at temperatures below 10°C (Concellón et al., 2005; Padmanabhan et al., 2015; Gürbüz et al., 2018). Despite being classified as an autogamous plant, the eggplant presents a high rate of cross-fertilization and the presence of pollinating insects can increase seed production (Taher et al., 2017).

Seeds are the main way of eggplant propagation; thus, they are an input of great importance. However, there are few studies regarding eggplant seed production. The eggplant plant has indeterminate growth habit and continuous flowering, consequently, fruit ripening is not uniform and results in seeds of different maturation stages and it can reduce the quality of the seed lot.

In species with fleshy fruits, such as plant from the Solanaceae and Cucurbitaceae family, the storage, or post-harvest rest period, allows the seeds to complete the process of

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CAPÍTULO 11

INFLUÊNCIA DO MANEJO NUTRICIONAL NA ATIVIDADE ENZIMÁTICA DA NITRATO REDUTASE

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1. INTRODUÇÃO

Elemento presente em diversas biomoléculas como DNA e participante de importantes reações bioquímicas do metabolismo vegetal, o *Nitrogênio* (N) é um nutriente primordial ao desenvolvimento de plantas.

Quantidades insuficientes de N podem limitar o desenvolvimento vegetal mesmo na presença de quantidade adequada de outros nutrientes. As plantas absorvem o N pelo sistema radicular nas formas minerais de NO_3^- ou NH_4^+ .

A via de assimilação do nitrato é o principal percurso pelo qual o nitrogênio inorgânico é incorporado em compostos orgânicos (FALCÃO, 2006), esta assimilação ocorre

CAPÍTULO 12

PROCESSO ENZIMÁTICO DE PRODUÇÃO DO ETANOL LIGNOCELULÓSICO

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1. INTRODUÇÃO

Combustíveis renováveis derivados de biomassa vegetal são uma ótima opção para substituir os combustíveis fósseis. O etanol substitui a gasolina em motores de combustão interna e pode ser facilmente transportado. Contribui também pela redução das emissões de CO₂ causando dessa forma menos impactos ambientais que são conceitos imprescindíveis da Química Verde (VERARDI et al., 2016).

O etanol produzido a partir de resíduos agroindustriais possui inúmeras vantagens devido à grande quantidade da biomassa lignocelulósica produzida pelas indústrias, matéria prima rica em celulose e hemicelulose. A produção de combustíveis renováveis tem constantemente gerado diferentes tecnologias que visam adquirir sustentabilidade econômica em larga escala de produção (PITARELO et al., 2012; ZHOU et al., 2016).

O etanol lignocelulósico também denominado etanol de segunda geração (2G), quando produzido a partir de resíduos e rejeitos da cana-de-açúcar, possui um alto valor agregado

CAPÍTULO 13

FITOHORMÔNIOS E ATIVIDADE ENZIMÁTICA ANTIOXIDANTE EM DANO POR FRIO DURANTE A PÓS- COLHEITA DE FRUTAS E HORTALIÇAS

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1. INTRODUÇÃO

O armazenamento de frutas e hortaliças a temperaturas muito baixas causam certos distúrbios fisiológicos conhecidos como dano por frio. Os sintomas clássicos deste distúrbio são casca marrom, aparência de tecido granulado e lignificação nos tecidos subcutâneos (SUO et al., 2018).

A aparência do dano por frio é frequentemente associada ao estresse oxidativos, resultante de uma produção elevada de espécies reativas de oxigênio. O desequilíbrio na produção de espécies reativas de oxigênio reage como os lipídios da membrana, o que leva a peroxidação lipídica e degradação da membrana (CAO et al., 2018).

Devido a este fenômeno, a qualidade da fruta é significativamente deteriorada durante o armazenamento pós-colheita e a vida de armazenamento é limitada.



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CAPÍTULO 11

ATMOSFERA MODIFICADA ATIVA NA CONSERVAÇÃO DE PÊSSEGO CV TROPIC BEAUTY MINIMAMENTE PROCESSADO

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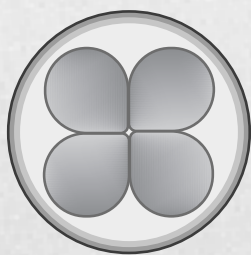
RESUMO: O pêssego minimamente processado deteriora-se rapidamente após o processamento do mesmo. O objetivo do presente trabalho foi avaliar a influência das concentrações de atmosfera modificada e tempo de armazenamento nos atributos de qualidade do pêssego minimamente processado. Os pêssegos foram selecionados, cortados em fatias ($1,5 \pm$

$0,2$ cm de espessura e $3,0 \pm 0,5$ cm de largura), embalados em diferentes atmosferas, (atmosfera ambiente, 5%, 6%, 7%, 8% de CO_2 com 4% O_2 e a vácuo) e armazenados a 5 ± 2 °C por 10 dias. As análises bioquímicas (compostos fenólicos, atividade antioxidante total e flavonoides), foram realizadas a cada dois dias ao longo do período de armazenamento. Diferenças significativas foram encontradas entre as diferentes atmosferas modificadas e o tratamento controle para o pêssego minimamente processados nos parâmetros analisados. O tratamento 4% O_2 + 6% CO_2 apresentou melhor característica de qualidade e prolongou a vida útil em seis dias, em comparação com a testemunha do pêssego minimamente processado. Além de contribuir na manutenção da atividade antioxidante, compostos fenólicos e flavonoides.

PALAVRAS-CHAVE: *Prunus pérsica* L., pós-colheita, qualidade, atividade antioxidante.

MODIFIED ATMOSPHERE ACTIVE IN PRESERVATION OF MINIMALLY PROCESSED PEACH CV TROPIC BEAUTY

ABSTRACT: Minimally processed peach deteriorates rapidly after processing. The aim of the present work was to evaluate the influence of modified atmosphere concentrations and storage time on the quality attributes of minimally processed peach. The peaches were selected, cut into slices (1.5 ± 0.2 cm thick and 3.0 ± 0.5 cm wide), packed in different atmospheres, (ambient atmosphere, 5%, 6%, 7%, 8% CO_2 with 4% O_2 and vacuum) and stored at 5 ± 2 °C for 10 days. Biochemical analyzes (phenolic compounds, total



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Capítulo 14

Quantificação dos compostos bioativos da casca e polpa dos frutos de pitayas de polpa branca e vermelha

Vander Rocha Lacerda*¹; Andres Felipe Gaona Acevedo¹; Juliana Aparecida dos Santos¹;
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Resumo

A pitaya é uma fruta que vem conquistando o mercado devido a sua alta aceitação pelos consumidores e seus benefícios para a saúde. Objetivou-se quantificar e comparar os compostos bioativos e atividade antioxidante da casca e polpa dos frutos de pitaya de casca vermelha com polpa branca e pitaya de casca vermelha com polpa vermelha. Os frutos foram colhidos em pomar comercial localizado no município de Presidente Prudente-SP, e em seguida transportados para o Departamento de Produção Vegetal da FCA-UNESP Botucatu. Após, foram armazenados em câmara fria no Departamento de Horticultura, onde foram realizadas as análises bioquímicas da casca e polpa dos frutos. O delineamento experimental foi inteiramente casualizado em esquema fatorial 2 x 2, sendo duas espécies de frutos, de casca vermelha e polpa branca e casca vermelha e polpa vermelha e avaliação de duas partes dos frutos separadamente, casca e polpa. Com exceção da casca e polpa da pitaya branca, houve diferença significativa para todos os parâmetros avaliados. A pitaya de casca vermelha e polpa vermelha contém mais compostos bioativos e atividade antioxidante que a pitaya de casca vermelha e polpa branca. Esses compostos estão cerca de 200 a 300% mais concentrados na casca em comparação com a polpa. As correlações foram todas significativas, com ênfase para os flavonoides, que com o aumento destes, aumentou-se a atividade antioxidante ($r=0,850$). O mesmo ocorreu para as betalaínas, porém de forma menos expressiva ($r=0,613$). Também houve correlação positiva entre betalaínas e flavonoides ($r=0,902$).

Palavras-chave: Antioxidantes. Betalaínas. Metabolismo secundário. Pós-colheita.

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