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INFLUENCE OF FUNGICIDES AND ANTAGONISTIC YEAST PRODUCT ON POSTHARVEST STRAWBERRIES QUALITY

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Abstract

Decay of fruits after harvest often causes loss as a great 30-40% of harvest crop. Much of this is due to rot microorganisms which are currently controlled by fungicides and antagonistic yeast treatments but they may have potential toxicity on human health and the environment. Biological control of postharvest diseases presents an alternative and attractive option. Therefore the aim of this study was to evaluate effects of preharvest application of fungicide treatments on decay and quality of strawberry fruit and during storage. Strawberry fruits were analysed in all experimental variants for quality parameters (dry matter, titratable acidity, soluble solids, ascorbic acid content, anthocyanins) at harvest and after cold storage. The results obtained indicates that preharvest application of antifungic treatments maintaing quality of strawberry postharvest and during storage and reduce the appearance of gray mold. Vitamin C and soluble solids slightly decreased after cold storage period for both control and treatments variants. Also, preharvest treatment does not affected the total anthocyanins content in fruit at harvest and during cold storage.

Key words: *biologic control, Botrytis cinerea, decay, fruit quality.*

INTRODUCTION

Strawberries are known as a highly perishable fruit and susceptible to mechanical injury, physiological deterioration and microbial decay, but very appreciated by the consumers (Costa et al., 2011). However, a considerable amount of strawberry fruit is lost during fruit growth and after harvest because decay.

The flavour is one of the most important properties that gives commercial value to the fruits in generally. Strawberry flavor is conditionated in part by the balance between sugars and acids expressed in ripe fruit. It is very important to know the best stage at which we can harvest the fruits. Attempts have been made to assess the stage of ripeness of strawberry fruits in terms of titratable acidity or sugar/acid ratio.

The high perishability of strawberry is the reason for its relatively short period of harvest compels the producer to sell the fruits immediately, evidently prejudicing him with respect to the reduced price due to its sale in large volumes. Due to high moisture, sugars and acids content, these fruits are high perishable, being an ideal substrate for the proliferation of microorganisms, such as fungus of the generous: *Botrytiscinerea* and *Rhizopus stolonifer*.

Among the main problems associated with the quality of strawberry, we can distinguished the grey mold (*Botrytis cinerea*) a common type of rottenness that attacks the fruit during any of its developing stage, and is the main disease during ripening time. (Sesan, 2006; Wszelaki and Mitcham, 2003).

Due to the high affinity to rotting, researches are being conducted to find a method of conserving the fruit for a longer period by the use different methods in order to make its transport to farther markets viable.

Promising results have been achieved using antagonistic microorganisms to effectively inhibit postharvest pathogens of different harvested commodities (Abano and Sam-Amoah, 2012; Zhao et al, 2011; Xianghong and Shiping, 2009; Grabenisan et al., 2007; Janisiewicz and Korsten, 2002).

Taking into the account these and the fact that fruits are eaten especially by the children and by the people with health problems, the researchers are concerned to find storage methods without chemicals like synthetic fungicides (De Souza et al.,1999; Sanz et al., 1999). The cold storage atmosphere prevents decay development by retarding pathogenic microorganisms growth and reducing pathogen enzyme activity (Menel et al., 2012).

The use of synthetic fungicides render severe side effects affecting the environment and human health. The usage of antagonistic yeast product against postharvest pathogens offers a viable option with hopeful results.

The potential use of *Saccharomyces cerevisiae* yeast was studied and emphasize by some authors for corn and sorghum species (Piccinin et al., 2005; Roncatto and Pascholati, 1998). Until now, in literature there are very few information about the effects of *S. cerevisiae* yeast on disease and maintaining quality postharvest of strawberry (Gouvea et al., 2009). Therefore, the objective of this study is to evaluate the combined effect of antagonistic yeast (based on S.cerevisiae), synthetic fungicides and cold storage to prevent decay development and extend the shelf life of strawberry.

MATERIALS AND METHODS

Strawberry cultivars studied were Favette, Cardinal, Pandora, Hood. For all cultivars were applied three plant treatments prior to harvest, in different stages: at full bloom, fruit onset and preripening of fruit in three experimental variants:

V1-control-plants was sprayed with distilled water

V2-plants was sprayed with Topsin solution

V3-plants was sprayed with antagonistic yeast product (suspension of *Saccharomyces cerevisiae*)

Samples were taken from 15 fruit at harvest and after 6 days during cold storage (4º-5ºC). There were three replication for the assays in each treatment, and the experiment was repeated in two seasons. Fruits quality attributes was analyzed by specific methods:

- dry matter was measured by drying some known amount of fresh fruit to a constant weight in a oven at 105°C, the results were expressed in percentage
- soluble solids content (SSC) was determined by measuring refractive index of strawberry juice using an Abbe refractometer with temperature correction, and the results were expressed as °Brix
- titratable acidity (TA) content was measured by titration of fruit juice with solution 0.1 N NaOH until reaching an endpoint of pH 8.1 and expressed as a percentages of citric acid
-the ratio between the soluble solids content and the titratable acidity, which reflects the fruit taste feature, was derived.
- ascorbic acid content was spectrophotometrically determined using the 2,6-dichlorophenol-indophenol method and the results were expressed as mg /100 g FW
- total anthocyanins content was determinated using the pH diferential method (Giusti and Wrolstad, 2001). The pigment content was calculated and expressed as pelargonidin-3-glucoside/100 g FW, the most abundant anthocyanin in the strawberry fruit.
- the presence of Botrytis cinerea was visually evaluated during the experiment, expressed as a percentage of fruit showing decay symptoms.

RESULTS AND DISCUSSIONS

Strawberry fruits were analyzed in all experimental variants for quality parameters at harvest and after 6 days of cold storage (4-5ºC) in the aim to evaluate influence of antifungic treatments on fruit quality evolution.

The dry matter content remained practically constant at Favette and Pandora cultivars at harvest for all 3 variants (table 1). However we can observe an increase of dry matter for V2 and V1
variants at Cardinal and Hood at harvest. After storage dry matter increased slightly in case all variants studied for all four cultivars (table 2).

The fruits treated with antagonistic yeast (V3) had higher levels of the SSC to control for all cultivars studied at harvest stage. These results are in accordance with dates obtained by Gouvea et al., 2009. Strawberry fruit SSC decreased slightly after 6 days of cold storage for all three variants studied. Similar

results were obtained by Costa et al., 2011 and Almenar et al., 2007. This parameter is of commercial interest, especially for fresh fruit, because the consumer prefer sweeter fruit.

Little differences in TA content were also observed among treated strawberry and control at harvest (table 1) Strawberry presented an increase in acidity during storage as seen in table 2. These results are in agreement with studies of De Souza et al., 1999; Sanz et al., 1999.

The SSC/TA ratio decreased after 6 days of cold storage ranging from 16.62 to 8.54 (table 2) with values above the commercial required (8.00) characterized by equilibrate taste.

Sugars and acids are utilized as the main substrates of respiratory metabolism, causing corresponding changes in SS, TA and pH during storage. The differences in TA and SSC results among different experiments may be related to different respiratory rates of cultivars. Thus as higher SSC degradation is related to great respiratory rate and to higher fruit decay.

At harvest there are no differences between the anthocyanins content of varieties treated with fungicides or yeast product and the untreated varieties (table 1). The content of anthocyanins varies according to the cultivar. Such as Hood cultivar have a content higher compared to Favette and Cardinal and closed to Pandora These results are in agreement with results of Costa et al., 2011 and Zheng et al., 2007.

After 6 days of storage the total anthocyanins content increase slightly. There are no differences between cultivars treatments and untreatment after storage.

The strawberry are fruits with medium ascorbic acid content and all cultivars studied presents an average content of 65 mg/100 g fresh weight and varied with cultivar at harvest**.** After 6 days of cold storage ascorbic acids content decrease for all cultivars studied and there are no differences between control and treatment fruit (table 2).

It can be seen that the cultivars with high content of anthocyanins at the same time have a high concentration of ascorbic acid. These cultivars have also had a low percentage of *Botrytis cinerea* compared to other, after 6 days of storage.

The quantity of decayed fruit increases with storage time but is decrease in variants treated with fungicides and antagonistic yeast (table 2). In our study the presence of Botrytis cinerea was observed in great percent at untreated sample especially after 6 days of cold storage. These results are in agreement with observations of Costa et al., 2011 and Menel et al., 2012. Thus it can be concluded that as both treatments with fungicides and antagonistics yeast support resistance to infections and thus increase shelf –life of cultivars.

According to the results obtained by us, an essential role in maintaining the quality of fruits and disease resistance postharvest it has the antioxidant capacity of cultivars expressed their increased content in anthocyanins, ascorbic acid, polyphenols. Spraying with fungic treatments were effective in inhibiting strawberry fruit decay especially at harvest. Mold development on the fruits were also reduced by cold storage and treatments with yeast.

CONCLUSIONS

The results showed that efficacy of yeast product in inhibiting gray mold decay and maintaining the quality of fruit during storage. Evolution of quality parameters postharvest and after cold storage was dependent on cultivar.

An essential role in maintaining the quality of strawberries and disease resistance postharvest it has the antioxidant capacity of cultivars.

Therefore a combination of yeast product treatment with resistant cultivar provides a great new potential in preventing and controlling major diseases.

The results suggest that application of antagonistic yeast product before harvest may be a promising technology to maintain quality of strawberry postharvest and during cold storage.

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