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DOES SPROUT CONTROL TREATMENTS AFFECT QUALITATIVE INTERACTIONS ANALYSIS ONFRIED CHIPS OF SWEET POTATOES CV. BRS RUBISSOL?

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ABSTRACT

Sweet potatoes roots have become the focus of research in the past recent years due to their unique nutritional and functional properties. Under Brazilian climate conditions, sweet potato cultivar BRS Rubissol has high yield on average 40 tonnes per hectare and presents excellent quality for industrial processing; however, when the roots are stored at room temperature, the shelf life is over in two to four weeks due to the sprouting and weight loss (withered). Ethylene and its inhibitors 1-methylcyclopropene (1-MCP) and amino-oxyacetic acid (AOA) can act in controling tuberous roots sprouting stored at room temperature, contribute to the sweet potato production chain for industrial processing.

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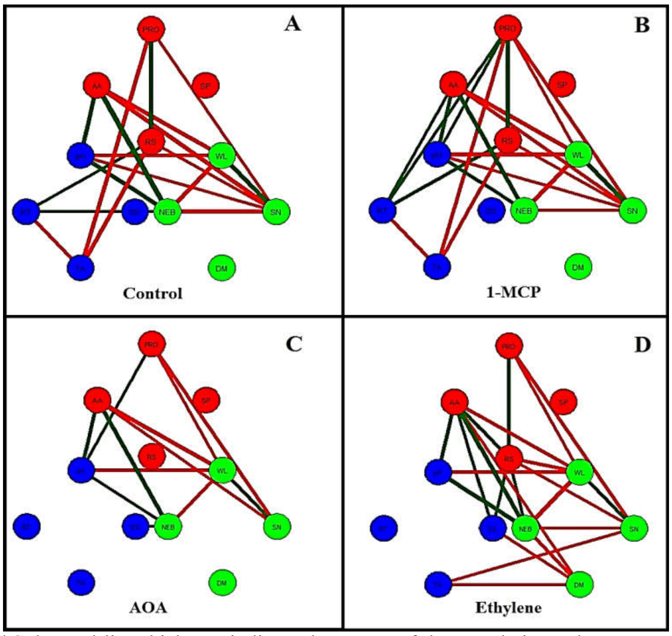
INTRODUCTION

Sweet potatoes roots (*Ipomoea batatas* Lam) have become the focus of research in the past recent years due to their unique nutritional and functional properties (Wang*et al*., 2016). Under Brazilian climate conditions, sweet potato cultivar BRS Rubissol has high yield on average 40 tonnes per hectare and presents excellent quality for industrial processing (Castro and Becker, 2011); however, when the roots are stored at room temperature, the shelf life is over in two to four weeks due tothe sproutingand weight loss (withered). Ethylene and its inhibitors 1-methylcyclopropene (1-MCP) and amino-oxyacetic acid (AOA) can act in controlling tuberous roots sprouting stored at room temperature, contribute to the sweet potato production chain for industrial processing (Lima *et al.*, 2019). During sprouting, there is a highly dynamic hormonal crosstalk, affected by endogenous factors related to development, cellular activity and tissue specificity (Van de Poel *et al*., 2015). Ethylene to regulates many physiological and biochemical mechanisms in plants, as the growth, cell division and cell expansion, but its effects can be either positive or negative, depending on the environmental context and target organ (Dubois *et al*., 2018). Previously it was demonstrated that use of ethylene inhibitors is efficient in inhibiting the rate of sprouting in sweet potatostretching in sweet potato (Cheema *et al*., 2013; Lima *et al*., 2019). The constant development of new processed products by the food industry elevate the importance of sweet potato market, including the production of baked and frid chips.Processing of sweet potato roots into food products such as flour or chips can be used as one of the ways to address the challenges facingstorage and shipping the raw sweet potato roots in developing countries (Ngoma *et al*., 2019). However, in fried starchy products there is potential contaminant residue that affect consumers and the industry, mainly by acrylamide formed during baking or frying. The presence of acrylamide in processed foods can be estimated by non-enzymatic browning and is consider one of the most important problem for the food industry (Muttucumaru *et al*., 2017). The effects of ethylene and its inhibitors (1-MCP and AOA) on the qualitative interactions between physical, biochemical and physicalchemical analyzes of fried chips processing of cv. BRS Rubissol stored at room temperature were evaluatedin this study. Interactions between analysis groups and their correlation are shown in Figure 1. Regarding the evaluated treatments, it can be seen that some characteristics were common, mainly the strong positive correlation between amino acids content (AA) and non-enzymatic browning (NEB). Other characteristics common to all treatments are that pH, which correlated positively with AA and NEB; and weight loss (WL) correlated positively with sprouts number (SN). In addition, the variable WL correlated negatively with NEB, AA, protein content (PRO) and pH; and PRO correlated negatively with SN.



*Color and line thickness indicate the nature of the correlation, where green-large consists of a strong positive correlation and red-large consists of a strong negative correlation.

Figure 1. Interaction between physical analyzes [shown in green - weight loss (WL), sprouts number (SN), dry matter content (DM) and non-enzymatic browning (NEB)]; biochemical analyzes [shown in red - protein content (PRO), soluble phenols (SP), reducing sugars (RS) and amino acids content (AA)] and physicochemical analysis [shown in blue - pH, soluble solids (SS), titratable acidity (TA) and SS/TA ratio (RT)]in sweet potato roots (BRS Rubissol) stored at 25 ºC, according the treatments: control (A), 1-MCP (B), AOA (C) and Ethylene (D)

It has been noted that the sprouting process increases weight loss during storage, because respiration and water loss increase rapidly with the onset of sprouting and continuous sprout growth. This process consumes mainly the protein reserves for sprout growth, decreasing the amino acids contents and reducing the pH values. In this case, reducing sugars contents on its own did not showed a significant correlation with non-enzymatic browning, but, on the other hand, amino acids contents correlated strongly with non-enzymatic browning. Therefore, the sprouting process changed this complex relationship between the concentrations of reducing sugars, amino acids and the formation of acrylamide, and the total amino acid content seems to be the over-riding factor. Reducing sugars reacts with amino acids during the frying and give rise to Maillard reaction products, which lead to non-enzymatic browning and flavor formation. This process is initiated when the carbonyl group of the reducing sugar reacts with an amino group of free amino acids. The initial products of the reaction are N-glycosylamines and N-fructosylamines, which give rise to intermediate products and final heterocyclization and polymerization (Liu*et al*., 2019). Unlike potatoes, sweet potatoes contain low contents of free asparagineand high reducing sugar levels, therefore, asparagine is probably a limiting factor in the acrylamide formation in fried sweet potato chips (Truong *et al*., 2014). Based on Chenstudy et al. (2015) sweet potato sporamins also function as the major storage proteins and provide nutritional resources for seedling growth in sprouting storage roots. Therefore, sporamin degradation provides nitrogen as nutrient for the regrowth of sprouts during thestorage of roots. It can be speculated that sweet potato sporamin degradation is initiated in the outer flesh close to the skin and sprout, then spreads to the whole outer flesh, and finally reaches the inner flesh of sprouting storage roots. In sweet potato roots cv. BRS Rubissol, the amino acids content is the major limiting factor for the non-enzymatic browning in fried chips and treatments that reduce root sprouting such as 1-MCP and AOA may be applied to extend the shelf-life of roots and improve the processing potential.

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