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# SHELF LIFE EVALUATION OF FRESH-CUT GLOBE ARTICHOKE PACKAGED IN A COMPOSTABLE BIOBASED FILM

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## ABSTRACT

Globe artichoke is an important component in the Mediterranean diet, but its complexity of preparation and susceptibility to browning degree limit its consumption on a wider scale. Therefore, the aim of the present study was to propose on the one hand, a suitable processing to obtain fresh-cut globe artichoke heads using active compounds to delay browning and, on the other hand, the best packaging solution to reduce water loss. Ascorbic and citric acids were used as anti-browning agents and two different packaging solutions were tested. Heads were divided into homogeneous lots of 50 heads, and after the processing slices were placed in PET trays and packed in ordinary atmosphere using a Cast Polypropylene film and NatureFlex™ compostable BIObased film. Bags were hermetically sealed and stored at 4 °C for 14 days. Analysis of weight losses, texture, respiration rate, colour degradation, polyphenol and ascorbic acid content and microbiological analysis were performed. Our results highlighted as cv. Spinoso sardo proved to have suitable qualitative characteristics for industrial processing; both packaging films used ensured a prolonging of shelf life that seems to be enough for produce distribution to the local markets.

*Keywords:* biodegradable, browning, colour degradation, compostable, respiration rate

## 1. INTRODUCTION

Globe artichoke [*Cynaracardunculus* var. *scolymus* (L.) Fiori] is one of the most important vegetable crops in the Mediterranean Basin, with an annual production of ~1,4 Mt of heads (FAOSTAT, 2013). Among the most commonly grown traditional cultivars, Spinoso sardo is greatly appreciated for fresh consumption due to its pleasant and mild sensory attributes. However, the presence of long sharp spines on bracts and leaves limits its consumption on a wider scale. This boasts the development of new products, such as minimally processed ones, which could increase the level of Spinoso sardo consumption thanks to their ease of preparation and convenience. One of the main problem with fresh-cut globe artichoke heads is the high browning rate of the cut surfaces (receptacle and bracts) caused by oxidation; therefore, different chemical compounds were tested to overcome this problem, together with different packaging solutions. Weight loss is another phenomenon that negatively influences globe artichoke marketability (CAMPUS *et al.*, 2006); this may be attributed to respiration and other senescence-related metabolic processes during storage. The aim of this study is to propose a suitable processing to obtain fresh-cut globe artichoke heads using active compounds, to delay browning and to select the best packaging solution to defeat water loss.

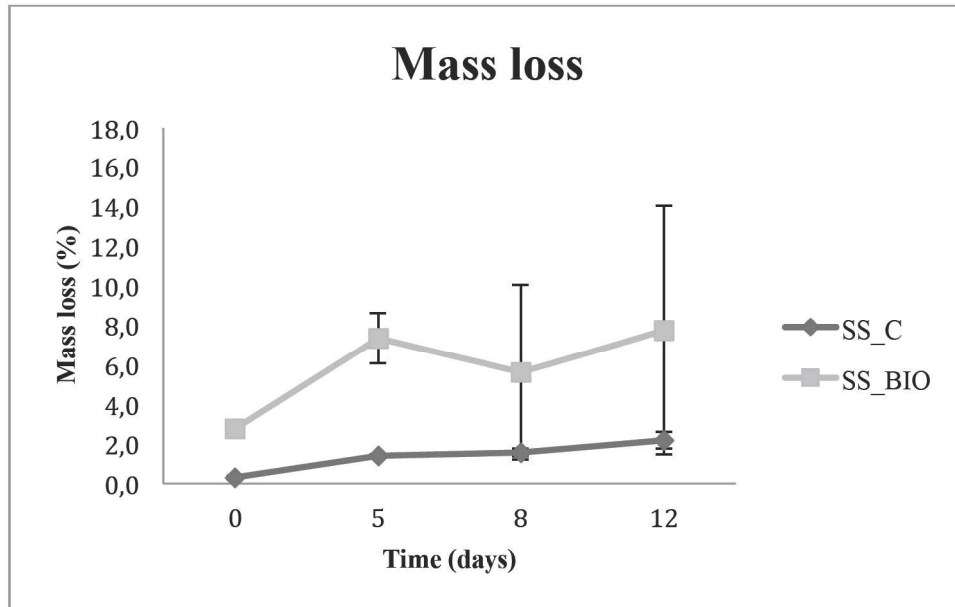
## 2. MATERIALS AND METHODS

Experimental field trial was conducted during the 2014–2015 growing season in a farm located in Cassibile in the Siracusa Plain (Sicily, Italy). Spinoso sardo, an early maturing cultivar that is normally harvested between November and April, was harvested during March-April 2015 at marketable stage (MAUROMICALE and IERNA, 2000). Homogeneous lots of 50 heads were prepared by removing the outer bracts and cutting the floral stems to 5 cm in length and the top of internal bracts. Then, they were sliced, washed in chlorinated water, immersed for 5 min in the anti-browning solution (0,5 and 2% citric and ascorbic acid), dried in a manual centrifuge. About ten slices were placed in PET trays and packed in ordinary atmosphere using a Cast Polypropylene film (OTR 3000 cc/m<sup>2</sup>/24h, 23°C 0% RH) and a compostable BIObased film (OTR 55 cc/m<sup>2</sup>/24h, 8°C 70% RH) kindly provided respectively by Rotocalco Mediterranea (Siracusa, Italy) and InnoviaFilms (Novara, Italy), identified throughout the manuscript as SS\_C and SS\_BIO, respectively. Bags were hermetically sealed, and stored at 4 ± 2°C for 14 days. Analysis of weight losses, texture using a ZwickRoell z 0,5 (Zwick GmbH & Co. KG, Ulm, Germany), respiration rate through a Dansensor A/S Checkpoint (Ringsted, Denmark), colour degradation (Handy colorimeter NR 3000; Nippondenshokuind. co. ltd) and microbiological analysis were performed. Total polyphenol content (TPC) was measured by Folin–Ciocalteu assay (SINGLETON & ROSSI, 1965) reading the absorbance at 760 nm using a Shimadzu 1601UV–visible spectrophotometer (Tokyo, Japan). The ascorbic acid (AAC) was determined according to the method proposed by RESTUCCIA *et al.* (2014). All the reagents and solvents, of analytical or high-performance liquid chromatography grade, were purchased from Sigma-Aldrich (Milan, Italy). All the chemical analyses were performed in duplicate.

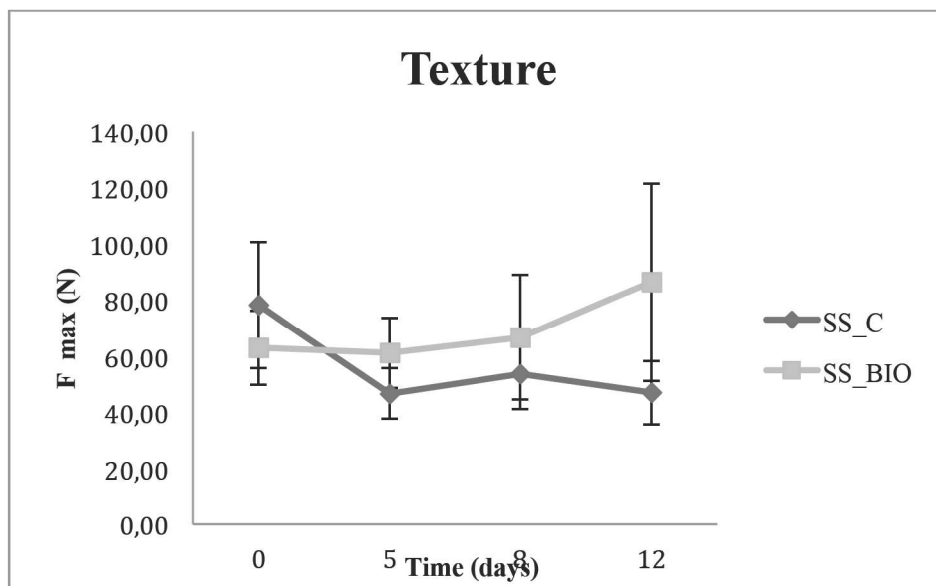
## 3. RESULTS

As expected, weight loss in fresh-cut heads of *cv.* Spinoso sardo was higher in samples packed in the BIObased film than in samples packed in PP cast bags (Fig. 1). In fact, the

compostable polymeric film shows a high water vapor transpiration rate (200 g/m<sup>2</sup>.24 hrs, 25°C 75% RH). With reference to the texture (shear tests were performed on 6 different slices), the compostable BIObased film showed the best performance even if with a high standard deviation among samples (Fig. 2).

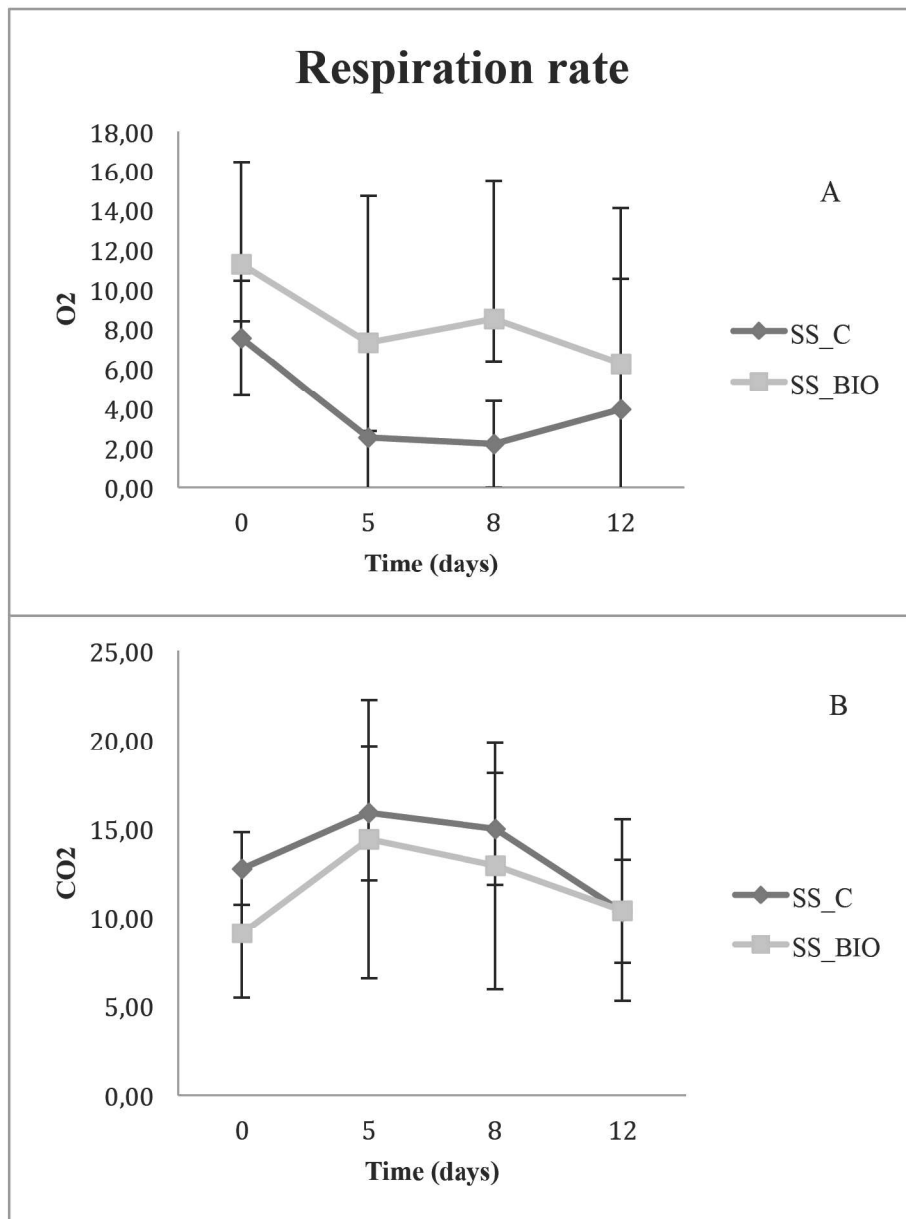


**Figure 1:** Effect of packaging film on the weight loss (%) of minimally processed globe artichoke heads during cold storage.

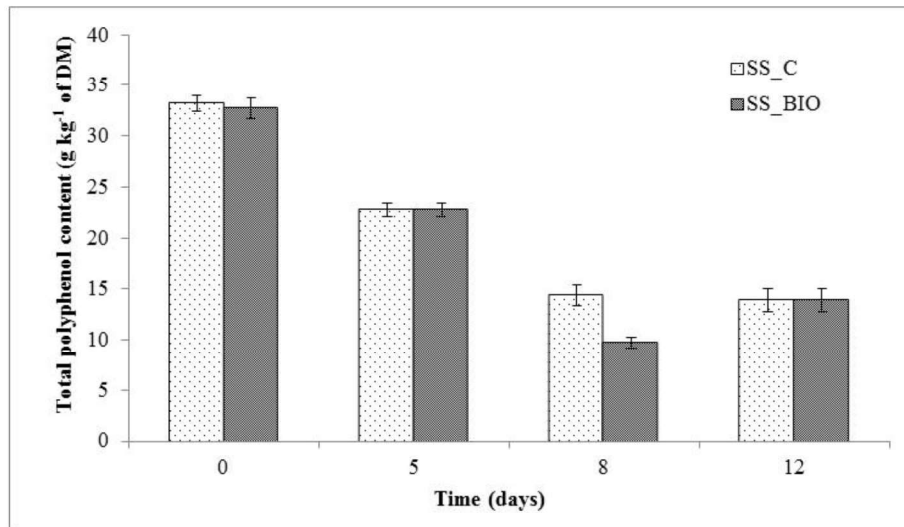


**Figure 2:** Effect of packaging film on the texture (N) of minimally processed globe artichoke heads during cold storage.

There were not differences between the packaging films for the colorimetric parameters (data not shown). Also for the respiration rate, both analyzed gases (oxygen and carbon dioxide) did not show significant differences between the packaging films (Figs. 3 and 4).

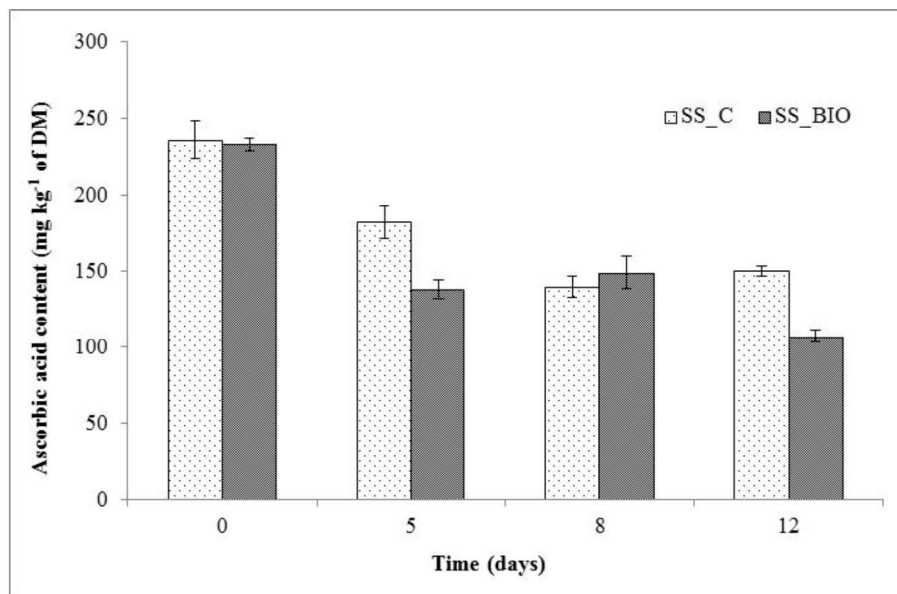


**Figure 3:** Respiration rate of minimally processed globe artichoke heads during cold storage, as effected by packaging film. Oxygen rate (A); Carbon dioxide rate (B).



**Figure 4:** Effect of packaging film on the total polyphenols content of minimally processed globe artichoke heads during cold storage.

At each sampling time, no differences were observed between the packaging films under study for both TPC and AAC (Figs. 5 and 6). In particular, the TPC significantly decreased throughout the storage time up to 13.9 g/kg of DM for both packaging films, as observed previously by RICCI *et al.* (2013) due to an increase in electrolytic leakage during cold storage. Analogously, AAC significantly decreased from the processing day up to 12 days of cold storage. This phenomenon may be attributable to AA conversion into dehydroascorbic acid (DHAA), which is less stable than AA (DAVEY *et al.*, 2000). With reference to microbiological counts, all the microbial groups gradually increased throughout the refrigerated storage.



**Figure 5:** Effect of packaging film on the ascorbic acid content of minimally processed globe artichoke heads during cold storage.

The different films used for packaging did not affect the microbial growth, except for mesophilic bacteria and yeasts and moulds whose count increase was slightly reduced by the BIObased film.

#### 4. CONCLUSIONS

Our results demonstrated as *cv.* Spinoso sardo is suitable for industrial processing, due to its physiological, nutritional, sensory and microbiological traits of ready-to-use heads. Despite the results, we think that the opportunity to use a compostable BIObased film is interesting in order to reduce wastes and the environmental impact.

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