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Phenolic compounds, maturation and quality in fresh green olives for table use during exposure at 20 °C after preharvest ReTain treatment

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ABSTRACT

The aim of this work was to investigate the effects of ReTain (4.15%, w/w, amino ethoxyvinyl glycine, AVG), an ethylene synthesis inhibitor, sprayed at concentrations up to 250 mg L⁻¹ before the green maturation of 'Konservolia' olives (*Olea europaea* L.) on colouring in fruit harvested up to 20 d later and on ripening variables in fruit selected green at harvest and exposed at 20 °C for up to 7 d. Earlier applications and higher ReTain concentrations were more effective in preventing colouring at harvest, and softening and green losses at 20 °C. Ethylene production was non-measurable or very low. Increased respiration was observed only in early treated fruit with ReTain on day 1 at 20 °C, but respiration reduced in all fruit during exposure time. Oleuropein (OE), the major phenolic, hydroxytyrosol, tyrosol, luteolin 7-O-glucoside, luteolin 4-O-glucoside, rutin, and ferulic and p-coumaric acids were measured in all samples. OE, confirmed by HPLC–ESI–MS, and total antioxidant activity were lower in ReTain treated fruit than in controls and remained so after the increases at 20 °C in all fruit. Conclusively, ReTain could be used to extend the harvest period and/or improve the quality of fresh green olives for table use, and particularly those destined for Spanish-style processing.

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1. Introduction

Quality of fresh olives destined for table use is critical for the final product since decreases in quality parameters are magnified during processing. Green table olives of good quality require firm texture and green colour at harvest (Nanos et al., 2002). Particularly, the commercial harvest for green Spanish-style processing ceases when the skin colour becomes straw (Nanos et al., 1999). These prerequisites imply that olives should be processed soon after harvest to avoid green losses and softening. However, in many olive industries storage of fresh fruit for a short time is inevitable and sometimes occurs even under unfavourable conditions. Also, storage at low temperature may not prevent the colour development (Yousfi et al., 2008) or damage the fruit of some cultivars, such as 'Konservolia' (Nanos et al., 2002). In consequence, delay of olive

green maturation on tree and prevention of ripening after harvest would be a desirable alternative.

ReTain is a formulation of amino ethoxyvinyl glycine (AVG), an inhibitor of 1-aminocyclopropane-1-carboxylic acid synthase (Boller et al., 1979), and is used commercially to delay ripening, extend the harvest season of climacteric fruit, optimise fruit maturity and increase fruit size and yield when harvest is delayed (Schupp and Greene, 2004; Stover et al., 2003; Venburg et al., 2008). Although it is disputed whether olives behave as climacteric fruit while on tree (Ranalli et al., 1998) or as non-climacteric (Kader, 2002), they behave as non-climacteric at least when harvested at the green maturity stage (Tsantili and Pontikis, 2004). However, ethylene action is not excluded from non-climacteric fruit (Trainotti et al., 2005). Indeed, the application of the inhibitor of ethylene perception 1-methylcyclopropene (Watkins, 2008) to harvested green 'Konservolia' olives prevented skin colouring and flesh softening (Ramin, 2007). Similarly, preharvest ReTain treatment prevented reddening on tree, and green loss and softening in fruit at 20 °C, while ReTain treated green fruit showed reduced total antioxidants 1 d after harvest, but recovered partially afterwards (Tsantili et al., 2010).

The objective of this work was to investigate different ReTain application times and its effects on other ripening variables during exposure at a ripening temperature along with green losses and softening. Olives and their products are recommended for human diets due to phenolic compounds that have the capacity to scavenge

Abbreviations: AA, antioxidant activity; AVG, amino ethoxyvinyl glycine; DAD, diode-array detector; ESI, electron spray ionisation; FID, flame ionisation detector; FRAP, ferric reducing antioxidant power; HPLC, high performance liquid chromatography; HT, hydroxytyrosol; IRGA, infrared gas analyser; LC/MS, liquid chromatograph–mass spectrometer; Lut 4-O-glu, luteolin 4-O-glucoside; Lut 7-O-glu, luteolin 7-O-glucoside; MSD, mass selective detector; OE, oleuropein; TE, trolox equivalents.

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