



Postharvest Performance and Antioxidant Capacity of Kiwi Fruits Under the Application of a Glycine-betaine-based Biostimulant During the Growing Season

Vasileios Papantzikos

Department of Agriculture, University of Ioannina, Arta Campus, 47100, Greece

INTRODUCTION

Greece is one of the top kiwi fruit exporters on the global market, with 307.44 Kt [1]. Nevertheless, Greece's kiwi fruit production faces several challenges attributed to abiotic stress related to climate change, such as prolonged periods of drought combined with high temperature and precipitation deficiency [2]. The effects of these challenges can be reduced by the use of compounds such as Glycine-betaine and proline (GBP), which induce metabolic responses by acting as osmolytes, scavenging reactive oxygen species (ROS) [3] in abiotic stress conditions [4].

MFTHODS

In this experiment, the quality traits of kiwifruit of the most marketable cultivar in Greece, *Actinidia deliciosa* "Hayward", were studied 60 days after harvest (DAH), for 2 consecutive years (Picture 2). 2 teatments were aranged: one where a glycine–betaine–proline-based biostimulant was applied (Fitomaat (Futureco Bioscience Co., S.A., Barcelona, Spain) (GB) and ii) the control biostimulant-free treatment (C). For each cultivation season, the cold-stored kiwi fruits (Picture 1) were measured for their fresh and dry weight (g), titratable acidity (TA), soluble solids content (SSC), antioxidant capacity by the radical scavenging method (DPPH), and the ascorbic acid content (Vitamin C).



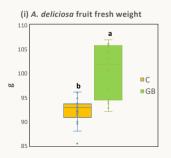




Picture 1. Representative photos of the kiwifruits of each treatment: C (i), GB (ii), and kiwifruit juice extraction for postharvest analysis.

RESULTS & DISCUSSION

Fresh weight was higher in the case of GB (100.57 \pm 5.45 g) compared to the C (92.2 \pm 2.69 g), with a statistically significant difference (p<0.05) (Figure 1i), and the same goes for the dry weight of GB (22.05 \pm 1.99 g) compared to the C (15.44 \pm 1.89 g) (Figure 1ii). SSC is an important parameter for kiwi fruit harvest and maturity [5], and when it increases may also signify the fruit senescence and decreased shelf life [6]. Adak et al. 2019 mention that the exogenous GBP application has a positive impact on the strawberry [7], on the SSC. This is in agreement with the results of this research, as the SSC was GBP (10.41 \pm 0.72%) lower compared with C (12.65 \pm 1.03%) with a statistically significant difference (p<0.05) (Figure 2i). Moreover, TA was statistically higher in the case of GB (1.16 \pm 0.13%) compared to C (1.09 \pm 0.07%) (p<0.05) (Figure 2ii).



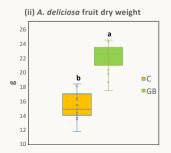


Figure 1. Variation in A. deliciosa fruit fresh (i) and dry weight (ii) 60 days after harvest (g±SD). Definition of treatments: (GB) Glycine-betaine-based biostimulant and (C) control. Different letters between treatments indicate significant differences according to the Bonferroni test (ρ <0.05).

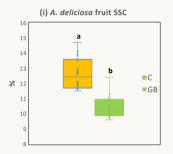
CONCLUSIONS

The post-harvest performance of kiwifruit was enhanced in terms of their weight, ripening, and antioxidant potential on DPPH and ascorbic acid content in the GB treatment, 60 DAH. This study paves the way for further research on GB biostimulants in kiwifruit, as an eco-friendly alternative that can be integrated into management programs for abiotic stress relief.





Picture 2. The kiwi orchard where the experiment was conducted (i), and collection of the kiwifruits at the harvest season (ii).



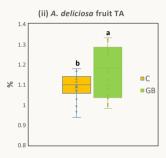
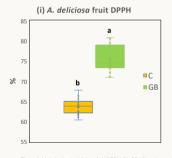


Figure 2. Variation in A. deliciose fruit SSC (i) and TA (ii) 60 days after harvest (%±SD). Definition of treatments: (GB) Glycine-betaine-basec biostimulant and (C) control. Different letters between treatments indicate significant differences according to the Bonferroni test (p≤0.05).

GBP is frequently reported for its high osmoprotection ability, which is accompanied by antioxidant potential [8] to prevent cellular damage and reinforce plant metabolism to various environmental stress conditions [9]. Kiwifruit antioxidant indicators during the cold storage were enriched in the treatments where the biostimulant was applied. DPPH 60 DAH was higher in both seasons in the case of GBP (75.71±3.23 %) compared to C (63.76±1.99 %) (p≤0.05) (Figure 3i).



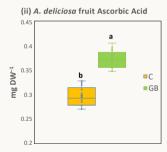


Figure 3. Variation in A. deliciosa fruit DPPH (%±SD) (i) and ascorbic acid content (mg DW¹±SD) (ii) 60 days after harvest. Definition of treatments: (GB) Glycine-betaine-based biostimulant and (C) control. Different letters between treatments indicate significant differences according to the Boneferon test (gs.0.05).

Ascorbic acid content 60 DAH was also higher in the case of GBP (0.37±0.02 mg DW⁻¹) compared to C (0.30±0.02 mg DW⁻¹) (p≤0.05) (Figure 3ii). An analogous antioxidant performance of plants under GB treatment has been mentioned by Shafiq et al. 2021 where the ascorbic acid content was increased in *Z. mays* L. [10]. Adak's 2017 study on strawberry *Fragaria ananassa* 'Albion' reports that the exogenous GB application led to greater ascorbic acid concentration [7]. Further insights emerging from the GB postharvest application relate to the improvement of fruit chilling tolerance. In the study of Shan et al. 2016 the GBP application to peaches resulted in enhanced chilling tolerance attributed to the induction of endogenous proline, GB, and γ-aminobutyric acid (GABA) content, maintaining membrane stability [11]. A similar postharvest-application effect of GB formulations has been found in other studies with fruits such as banana *Musa acuminata* [12], sweet pepper *Capsicum annuum* L. [13], and loquat *Eriobotrya japonica* [14].

RESOURSES

2 Addison, M. (Salada, P. Parposauc, D. (Georgia, P. Model Againston for the Similation of lay of Procession A. Case Bully in Information Section (Procession Association Association Association Association Association Association Association Association Association Information Association Association Association Association Association Association Association Association Information Association Information Association Asso

TOWN IN CONTRACT CONT

1 February 1 Section Described by 1972, 279, 1779, 281 11 10251407728 at 11 110251407728 at 11 11025140728 at 1

Chrimica and succeptual incorrectional in in-groundar souris, 2 — 110, concrit in transferance of counts of multi-coloration.

1. Gratherman, 2. Shouldard, X., Barray, T., Babel, V. P. Eding, T. Babel, V. P. Eding, T. Shouldard, C. Regard, T. Should, V. P. Eding, T. Shouldard, X. Regard, T. Shouldard, Y. Regard, T. Shouldard, T. Shou