



**ORIGINAL ARTICLE**

## IMPACT OF CHITOSAN AND BENZYL ADENINE ON SHOOT MULTIPLICATION OF KUMQUAT PLANT (*CITRUS JAPONICA* THUMB.) *IN VITRO*

Hazim Sultan Safana, Majid Abdulhameed Ibrahim\* and Abdulkareem Mohammed Abd

Department of Horticulture and Landscape Design, College of Agriculture, University of Basrah, Basrah, Iraq.

E-mail: [majid.abdulhameedl@uobasrah.edu.iq](mailto:majid.abdulhameedl@uobasrah.edu.iq)

**Abstract:** The study aims to evaluate benzyl adenine (BA) and chitosan that were added to MS media on shoot multiplication of kumquat plant by culturing the shoot tips as explants. The interaction treatment between 15 mg L<sup>-1</sup> chitosan and 2 mg L<sup>-1</sup> BA significantly achieved the highest value in the number of shoots and shoot length that reached 5.20 shoots explant<sup>-1</sup> and 2.40 cm, respectively. The interaction treatment between 10 mg L<sup>-1</sup> chitosan and 3 mg L<sup>-1</sup> BA achieved the best value in a leaf area of 2.24 cm<sup>2</sup>. The interaction treatment between 25 mg L<sup>-1</sup> chitosan and 2 mg L<sup>-1</sup> BA achieved the highest number of nodes that reached 3.60 nodes shoot<sup>-1</sup> using MS media supplemented at 2 mg L<sup>-1</sup> naphthalene acetic acid (NAA) and 15 mg L<sup>-1</sup> chitosan for rooting. The plants were acclimatized and foliar spraying them with chitosan at 15 mg L<sup>-1</sup>. At the end of the acclimatization stage, the percentage of plant survival was 80%.

**Key words:** Plant tissue culture, Chitosan and cytokine, Micro propagation, Acclimatization.

### Cite this article

Hazim Sultan Safana, Majid Abdulhameed Ibrahim and Abdulkareem Mohammed Abd (2022). Impact of Chitosan and Benzyl adenine on Shoot Multiplication of Kumquat Plant (*Citrus japonica* Thumb.) *in vitro*. *International Journal of Agricultural and Statistical Sciences*. DocID: <https://connectjournals.com/03899.2022.18.359>

### 1. Introduction

Kumquat (*Citrus japonica*) fruit is one of the shrubs that belongs to the Rutaceae family. This fruit shrubs grow in the Japan and Taiwan in East Asia, India in South Asia, and Philippines in Southeast Asia. The fruits of this plant are one of the common citrus fruits used in the edibles due to its high nutritional value to its high content of vitamins, fibers and bio-active substances. [Hasan *et al.* (2016), Al-Janabi and Aubied (2021)]. Propagation of kumquat plants is carried out in two main methods, the sexual method in which the seeds are used to produce seedlings cultured in the permanent place. The second method is the asexual method (vegetative propagation), as it is widely used to propagate most of the desired economically important kumquat cultivars, either through budding or grafting. One of the most critical problems facing the cultivation of kumquat is its propagation by seeds, which is an unfavorable method for farmers because it delays much

in its vegetative growth and fruiting compared with vegetative propagated plants. Therefore, many researchers have resorted to the method of micro propagation to produce large numbers that are identical to the mother plant, as well as being early in fruiting and free from diseases and pathogens, especially viral ones that are transmitted from infected seedlings to healthy ones through insects [Hasan *et al.* (2020)]. Chitosan is a compound with biological activities, as it acts as an antimicrobial, antioxidant, and stimulant of plant growth. Chitosan consists of D-glucosamine residues and N-acetyl-D-glucosamine that are linked together by a β-1,4-glycoside bond [Uthairatanakij *et al.* (2007), Odat *et al.* (2021)].

Phytohormones are the most important endogenous substances for moderating physiological and molecular responses, a critical requirement for plant survival, Phytohormones act at their site of synthesis or elsewhere in plants following their transport [AL-Taey *et al.*