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Growing plants for long-term spaceflight environments is essential for providing nutritional, physiological, environmental and psychological well-being of the astronauts. Plants will supplement oxygen, scrub CO_2, purify water, and supply food. In addition, plants provide phytochemicals (bioprotectants) that safeguard astronauts from the ionizing cosmic radiation exposure during long-term habitation. There are important engineering and crop production advantages in growing plants under hypobaric (reduced atmospheric pressure) conditions for extraterrestrial base environments. However, hypobaric conditions can lead to hypoxic-stress (low-oxygen), affecting plant photosynthesis and growth. A goal of the research was to enhance production of bioprotectants via hypobaria and hypoxia without reduction of plant biomass. The companion paper reports on plant gas exchange and growth, while this paper elucidates the enhanced production of plant bioprotectants. Twenty-one day-old seedling lettuce plants (Lactuca sativa L. cv. Red Sails) were grown under variable total gas pressures [25 (hypobaria) and 101 kPa (ambient)] during 10-d studies with partial pressures of oxygen (pO2) at: 101/21 (ambient), 101/6 (hypoxia), 25/12, and 25/6 (hypoxia) pO2; two other treatments included exposing plants to 101/21 or 25/12 for 7-d, then to hypoxia (101/6 or 25/6) during the final 3-d of production. In general, hypobaria in combination with hypoxia (during the final 3-d of production) enhanced the antioxidant activity (ORAC-value) of lettuce by stimulating the greatest synthesis of anthocyanins, total phenolics, chlorophyll a, chlorophyll b, and total carotenoids. While a 10-d exposure to hypoxia decreased biomass production (regardless of total atmospheric pressure)—there was no affect on chlorophyll or total carotenoid biosynthesis of ambient total pressure plants, while there was a reduction in hypobaric plants. Hypobaria enhanced chlorophyll and total carotenoids synthesis. The results show that bioprotectants can be increased by exposing hypobaric plants to hypoxia during the end of the production cycle, without loss of biomass.

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(088) Effect of GA_3 and Ethephon on Photosynthesis of Wild *Rhododendron delavayi* Franch

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Flowering and growth of wild populations of *Rhododendron delavayi* Franch. could be regulated using GA3 and ethephon. To better understand their effect, diurnal photosynthesis was monitored using portable LI-6400 photosynthesis system. The photosynthetic active radiations at the site were between 127.4 and 1257.3 $\mu mol \cdot m^{-2} \cdot s^{-1}$ and the temperatures ranged from 16.3 to 27.4 °C. Ambient CO_2 concentrations were 307.1–390.4 $\mu mol \cdot mol^{-1}$ and the relative humidity was 80.3% at 7:30 AM. The results indicated that both GA_3 and ethephon did not alternate the trend of diurnal photosynthesis rates. Under the treatments of 100, 200 $mg \cdot L^{-1}$ and control (just pure water), the first peak rates were 11.60, 10.1, 8.29 $\mu mol \cdot m^{-2} \cdot s^{-1}$ of CO_2 at 11:30 AM and the 2nd peak rates were 9.41, 9.42, 7.42 $\mu mol \cdot m^{-2} \cdot s^{-1}$ of CO_2 at 3:30 PM, respectively. However, ethephon treatments reduced the photosynthesis rates. As ethephon concentration increased from 100 to 200 $mg \cdot L^{-1}$, the photosynthesis rate was much lower. Transpiration rate showed similar trend as the photosynthesis rate under all treatments. But, the highest rate, 4.62 $mmol \cdot m^{-2} \cdot s^{-1}$ of H_2O, occurred under the treatment of GA_3 200 $mg \cdot L^{-1}$ at 1:30 PM. Compared with the control, plants spayed with GA_3 at 100 $mg \cdot L^{-1}$ increased water use efficiency (WUE), while reduced WUE at GA_3 200 $mg \cdot L^{-1}$. Stomata conductance and stomata limitation followed the same trend as the photosynthesis rates. When spaying GA_3 on *Rh. delavayi*, intercellular CO_2 concentrations (Ci) reduced. If ethephon was applied, Ci was higher than that of the control. It is possible that GA_3 could improve the photosynthesis rates because GA_3 regulated stomata function. Further studies are needed to address how did application of ethephon reduce the photosynthesis rates of *Rh. delavayi*.

(089) Nutritional Quality and Chemical Characteristics in *Citrus sinensis* (L.) Osbeck Sweet Oranges from Northern Italy (Piedmont)

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