Flavonoid and leaf gas exchange responses of centella asiatica to acute gamma irradiation and carbon dioxide enrichment under controlled environment conditions.

ABSTRACT

The study was couducted to investigate the effects of gamma irradiation and CO 2 on flavonoid content and leaf gas exchange in C.asiatica. For flavonoid determination, the design was a split split plot based on Randomized Complete Block Design (RCBD). For other parameters, the designs were split plots. Statistical tests revealed significant differences in flavonoid contents of Centella asiatica leaves between different growth stages and various CO 2 treatments. CO 2 400, G20 (400 = ambient CO 2; G20 = Plants exposed to 20 Gy) showed 82.90% higher total flavonoid content (TFC) in the 5th week than CO 2 400 as control at its best harvest time (4th week). Increasing the concentration of CO 2 from 400 to 800 μmol/mol had significant effects on TFC and harvesting time. In fact, 800 μmol/mol resulted in 171.1% and 66.62% increases in TFC for control and irradiated plants, respectively. Moreover, increasing CO 2 concentration reduced the harvesting time to three and four weeks for control and irradiated plants, respectively. Enhancing CO 2 to 800 μmol/mol resulted in a 193.30% (CO 2 800) increase in leaf biomass compared to 400 μmol/mol and 226.34% enhancement in irradiated plants (CO 2 800, G20) [800 = Ambient CO 2; G20 = Plants exposed to 20 Gy] than CO 2 400, G20. In addition, the CO 2 800, G20 had the highest amount of flavonoid biomass in the 4th week. The results of this study indicated that all elevated CO 2 treatments had higher PN than the ambient ones. The findings showed that when CO 2 level increased from 400 to 800 μmol/mol, stomatal conductance, leaf intercellular CO 2 and transpiration rate had the tendency to decrease. However, water use efficiency increased in response to elevated CO 2 concentration. Returning to the findings of this study, it is now possible to state that the proposed method (combined CO 2 and gamma irradiation) has the potential to increase the product value by reducing the time to harvest, increasing the yield per unit area via boosting photosynthesis capacity, as well as increasing biochemicals (flavonoids) per gram DM.

Keyword: C.asiatica; CO2 enrichment; Gamma irradiation; Leaf gas exchange.