

学 位 論 文 要 旨

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題 目	Study on growth and photosynthetic characteristic of leaf vegetables under hypoxia conditions (低酸素環境下における葉菜類の生育および光合成特性に関する研究)
<p>Oxygen gas is an important factor that strongly influences photosynthesis, photorespiration and respiration. It is well known that hypoxia can increase photosynthesis during short-term exposure in C₃ plants. On the other hand, the effect of long-term exposure to hypoxia is still unclear. The objective of this study is to determine the responses of plant growth, photosynthesis and associated components to long-term hypoxia treatment.</p> <p><u>1. Development of a novel growth chamber</u></p> <p>The novel growth chamber was developed in order to determine the effect of long-term exposure to hypoxia. The growth chamber combined with an N₂ gas generator can control the O₂ and CO₂ concentrations simultaneously. Using this growth chamber, hypoxia condition can be controlled stable for a long time.</p> <p><u>2. The effect of long-term exposure to hypoxia</u></p> <p>The decrease of leaf area of spinach and red leaf lettuce was shown at 14 and 20 days exposure to 3% O₂. There was no difference between 3 and 21% O₂ in photosynthesis. Moreover, it was shown that anthocyanin content was significantly increased at 3% O₂. The anthocyanin increase was occurred at 2% O₂ treatment only for 3 days with 350 μmol m⁻² s⁻¹ light intensity conditions. This is because nitrogen absorption was decreased followed by the inhibition of respiration and/or dark-respiration under hypoxia conditions, and assimilation of secondary metabolism in the leaf.</p> <p><u>3. The effect of different O₂ concentrations and light conditions</u></p> <p>From the results of different O₂ concentrations and PFD treatments for 14 days, anthocyanin content was increased at hypoxia and 180 μmol m⁻² s⁻¹ of light intensity conditions. Moreover, it was shown that the photosynthesis at 7% O₂ was increased. From this result, I consider that there is optimum O₂ concentration for photosynthesis, which is regulated with the balance of inhibition of photosynthesis and respiration or dark-respiration. From the results of hypoxia treatment under fluorescent light and red- and blue-LEDs, it was shown that total polyphenol and anthocyanin content of red leaf lettuce was increased at hypoxia treatment under LEDs.</p> <p>From the present study, it was demonstrated that the response of photosynthesis to long-term hypoxia is different from that of short-term treatment and the O₂ concentration can control the content of functional ingredient such as anthocyanin.</p>	