Growth and Physiological Responses of Chinese Cabbage cv. ‘Chungwang’ to Different Temperatures during Early to Middle Growth Stages

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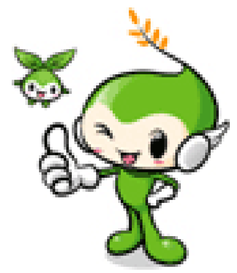

Introduction

According to a report of the IPCC (2007), the average temperature of the earth has increased by around 1.0℃ during the 20th century. The increase was particularly rapid in the later part of the century, suggesting that global warming is being accelerated. Among the scenarios, RCP 8.5, a scenario on the assumption that there is no effort to reduce greenhouse gas, temperature is expected to increase considerably compared to the present level.

Chinese cabbage is one of important vegetable crops produced and consumed in many countries including the Asian nations, and particularly in Korea it is a representative vegetable crop cultivated all the year round through different types of cultivation because it is used as the main material of kimchi, the representative Korean traditional food. Among various cultivation types used in Korea, the summer cultivation of Chinese cabbage during the period from early June to mid and late August is very important because its production has a significant impact on the price of Chinese cabbage from other types of cultivation. Thus, this study set future climate conditions with high temperature according to the RCP Climate Change Scenario and apply them to the growth stage of ‘Chungwang’ Chinese cabbage.

Material & Methods

This study was conducted using a SPAR system at the USDA-ARS facility in Beltsville Maryland USA, which allowed the control of temperature and carbon dioxide concentration.

Temperature treatment was set, respectively, 14/9, 17/12, 20/15, 23/18, 26/21, and 29/24℃ (day/night; 16/8h). growth surveys according to temperature were measured for each treated group once in every 7 days so a total of 6 times through 49 days from planting. Photosynthetic rate and transpiration were measured at 28 days after planting with a photosynthesis analyzer for leaves after 25 days of foliation.

Results

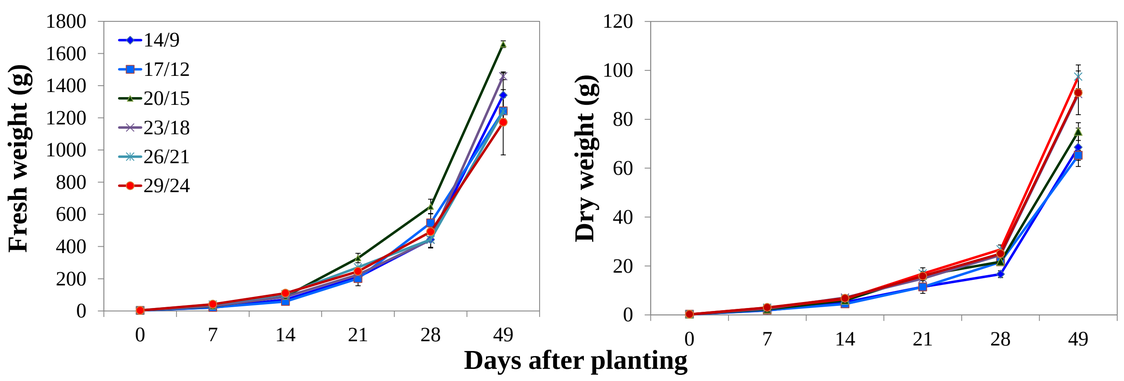

Fig. 1. Changes of fresh and dry weight according to different temperature conditions for early-middle growth stage in 'Chungwang' Chinese Cabbage. Bars represent the standard error of means from 5 replications.

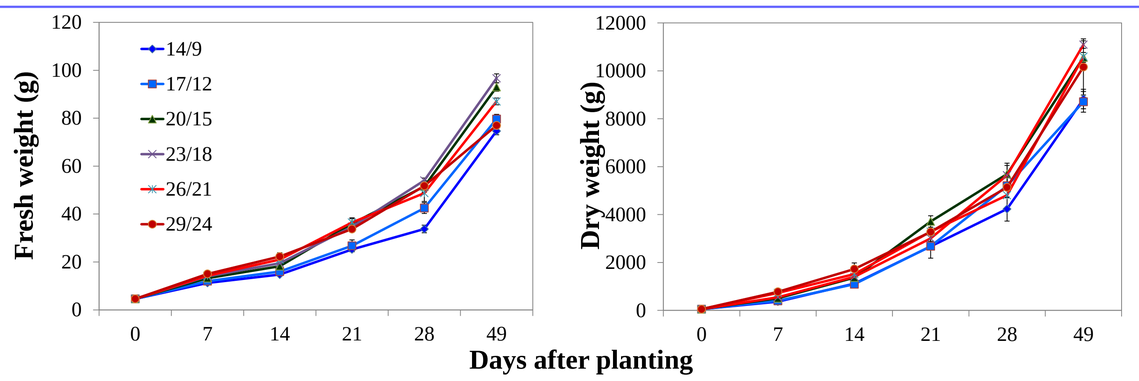

Fig. 2. Changes of leaf number and leaf area according to different temperature conditions for early-middle growth stage in 'Chungwang' Chinese Cabbage. Bars represent the standard error of means from 5 replications.

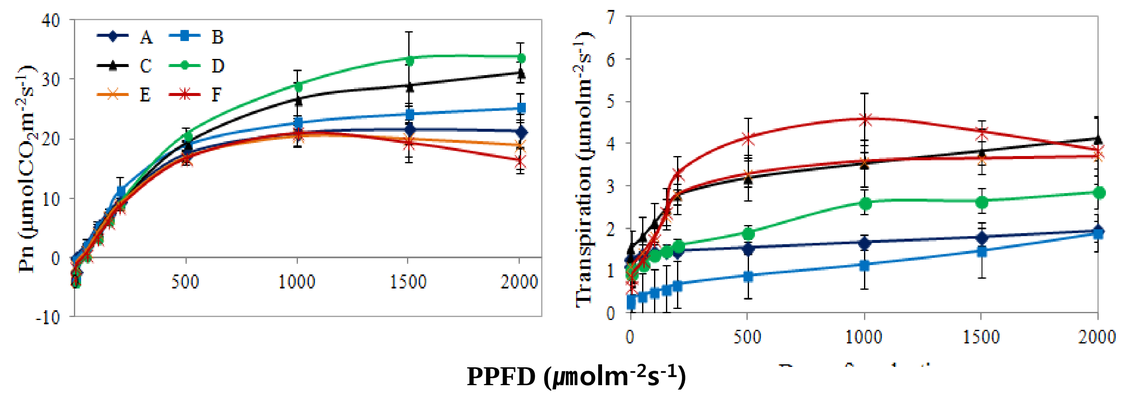

Fig. 3. Changes of leaf number and leaf area according to different temperature conditions for early-middle growth stage in 'Chungwang' Chinese Cabbage. Bars represent the standard error of means from 5 replications.

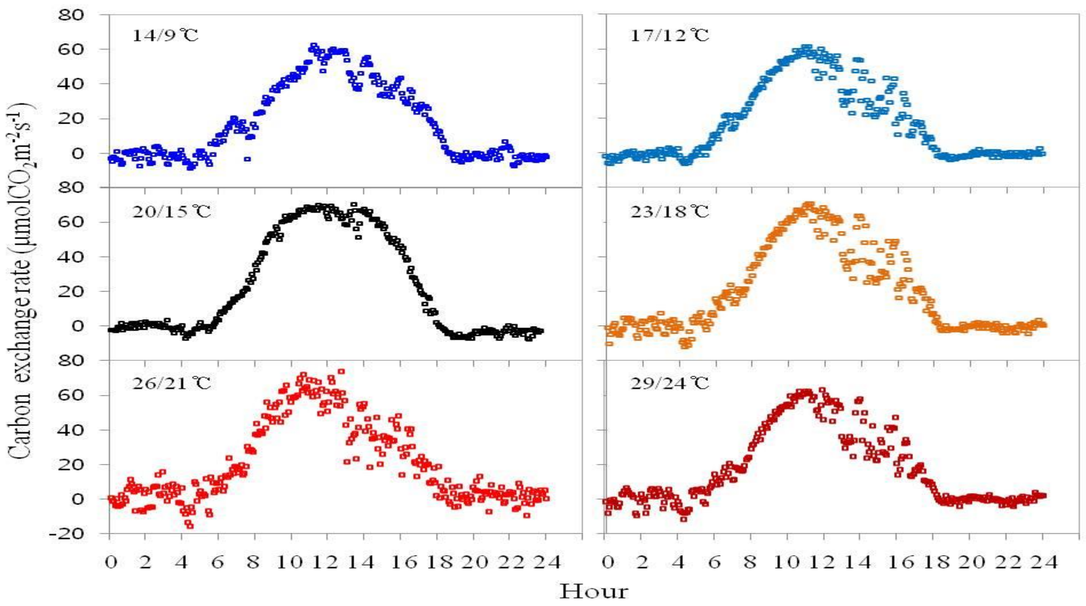

Fig. 4. Fluctuation of carbon exchange rate according to different temperature conditions in 'Chungwang' Chinese Cabbage at 28 days after transplant.

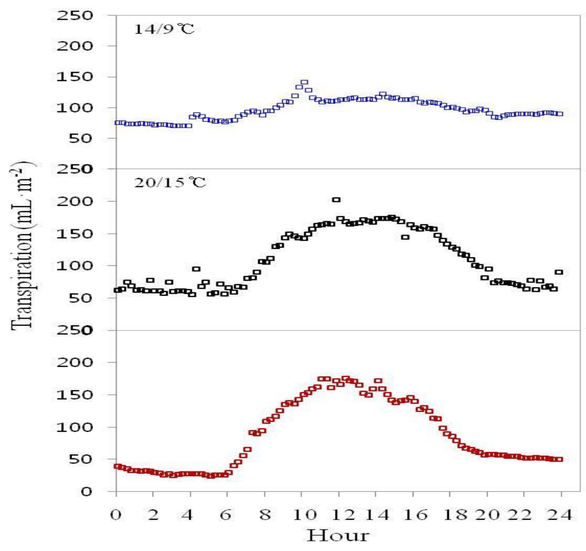

Fig. 5. Fluctuation of transpiration according to 3 temperature levels in 'Chungwang' Chinese Cabbage at 28 days after transplant.