Collection Data with Growth of Three Strawberry Cultivars in High Bed System for Development of the Edge Computing

Jung Su Jo, Ha Seon Sim, Sung Kyeom Kim*
Kyungpook National University
jungsu@knu.ac.kr, dlfurgml1@knu.ac.kr, skkim76@knu.ac.kr

Abstract

Strawberry (Fragaria × ananassa) cultivation methods are rapidly changing from traditional soil cultivation to high bed hydroponics, which are easy to agricultural working. The objective was to evaluate the growth characteristics of three strawberry cultivars cultivated high bed system. The "Seolhyang", "Altaking", and "Keumsil" strawberry plants were transplanted in a glass-type greenhouse at Kyungpook National University Gunwi Agricultural Field. The cultivation period was approximately seven months from September 17, 2021 to April 21, 2022. Growth parameters measured including the number of leaves, plant height, petiole length, leaf length, leaf width, and crown diameter at two-week intervals. The environmental parameters for each location in the greenhouse were collected. Plant height in all cultivars continued to decrease from the early stage to the late stage of growth. The crown diameter was increased by 50 DAT, and then gradually decreased until late growth stage in all cultivars. Results indicated that the growth parameters represented to vary according to the cultivar of strawberry plants.

1. Introduction

Strawberry (*Fragaria* ×*ananassa*) is a high-value crop in South Korea. The production area and marketable fruit yield in 2020 were 5683 ha and 163,736 tons, respectively (KOSIS, 2022) [1]. The harvest season of June-bearing strawberry cultivars is from November to May, and the winter season is dry and cold.

Many studies have demonstrated characteristics using growth data of strawberries. However, few studies have been conducted to evaluate from various cultivars cultivated in the same environment conditions and high bed system. Moreover, environmental data, including air and soil temperature, photosynthetic active radiation (PAR) density, soil water content, and electrical conductance was stored a data logger, which were installed many parts of the strawberry community. Therefore, this study's objective was to evaluate the growth parameters of three cultivars of strawberries grown in high bed system and to collect environmental parameters for each location in the greenhouse. The collected growth and environmental variables will be used as basic data for creating edge computing in the future.

2. Materials and Methods

Three cultivars of strawberry were cultivated for this experiment; "Seolhyang", "Altaking", and "Keumsil". The experiment was conducted using hydroponics in a glass-type greenhouse located in the Kyungpook National University Gunwi Agricultural Field (36°06N, 128°38′E), Gyeongsangbuk-do (Fig. 1). Strawberry plants were cultivated using Yamazaki nutrient solution in different concentration between Electrical Conductivity 1.0 and 1.5 dSm^{-1}. The experiment was conducted from September 17, 2021 to April 21, 2022. "Seolhyang" and "Altaking" were cultivated 216 days after transplanting (DAT); "Keumsil" was cultivated 192 DAT. Growth parameter measurements, including the number of leaves, plant height, petiole length, leaf length, leaf width, and crown diameter were evaluated at two-week intervals. An individual was selected 10 individuals for each cultivar for transplanting (n=10).

The environmental data in greenhouse, including air

temperature (AT), photosynthetic active radiation (PAR) density, soil temperature (ST), soil water content (SWC), and electrical conductivity (EC), were measured using a wet and dry bulb thermometer (directly made), a quantum sensor (LI-190R, Campbell Scientific, UT, USA), and ST, SWC, and EC sensor (CS650, Campbell Scientific, UT, USA) and stored in a data logger (CR1000, Campbell Scientific, UT, USA) at intervals of 10 minutes, one hour, and one day (Fig. 2). The environmental sensors were installed many parts of the strawberry community (Fig. 3).

Fig. 1. Inside the greenhouse (A), "Seolhyang" (B), "Altaking" (C), and "Keumsil" (D) of strawberry growth images.

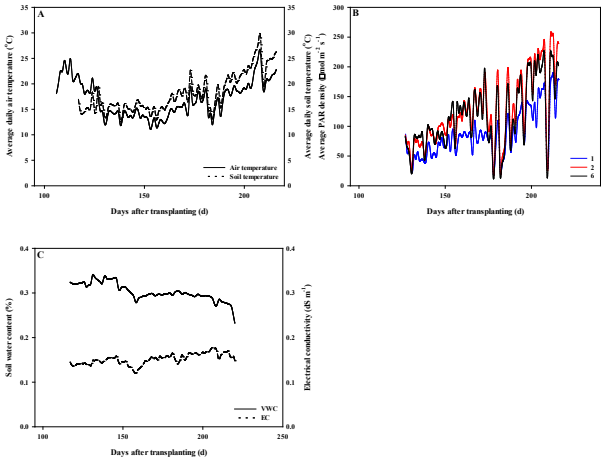


Fig. 2. Environmental data including daily average air and soil temperature (A), average PAR density (B), and soil water content and electrical conductivity (C).

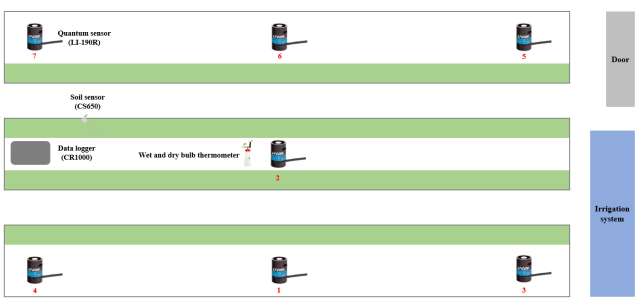
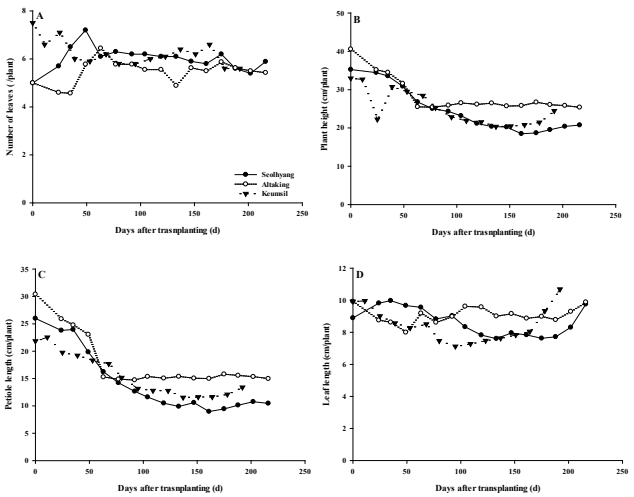


Fig. 3. Environmental data sensor location map.

Graphs were presented by SigmaPlot program (SigmaPlot 12.5, Systat Software Inc., CA, USA).

3. Results and Discussion

Environmental parameters in greenhouse, including air temperature, photoperiod, light intensity [2], and soil temperature [3], affect the growth of strawberry plants. During experiment, the average AT and ST were 17.1 and 18.1°C, respectively and average PAR density and total PAR density were 329.8 and 27542.0 μmol $m^{-2}s^{-1}$, respectively. The SWC and EC were 30% and 0.15 dSm^{-1}, respectively. The number of leaves, plant height, petiole length, leaf length, leaf width, and crown diameter during cultivation are represented Fig. 4. The number of leaves were the highest at early growth stage in "Keumsil" and at late growth stage in "Seolhyang" (Fig. 4A). The plant height and petiole length were the greatest during most growth stage in "Altaking" than the other cultivars (Fig. 4B–C). In all cultivars, it continued to decrease from early to late growth stage. From 160 DAT, the leaf length and width were increased in "Seolhyang" and "Keumsil" (Fig. 4D – E). In all cultivars, the leaf length and width represented similar increase-decrease patterns. The crown diameter was increased by 50 DAT, and then gradually decreased until late growth stage in all cultivars (Fig. 4F).



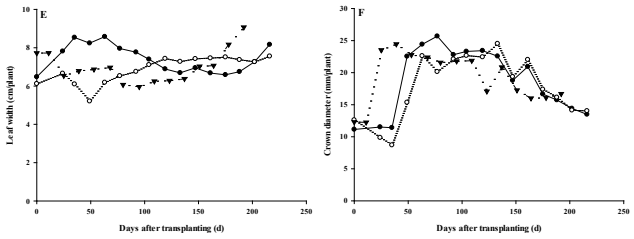


Fig. 4. The number of leaves (A), plant height (B), petiole length (C), leaf length (D), leaf width (E), and crown diameter (F) of strawberry (n=10).

Acknowledgements

This work was supported by an Institute of Information Communications Technology Planning Evaluation (IITP) grant funded by the Korean Government (MSIT) (No. 2021-0-01578).

References

[1] Korean Statistical Information Service (2022). https://kosis.kr

[2] Anita Sønsteby, Knut A.Solhaug, and Ola M.Heide (2016). Functional growth analysis of 'Sonata' strawberry plants grown under controlled temperature and daylength conditions. Scientia horticulturae 211:26-33. doi.org/10.1016/j.scienta.2016.08.003

[3] Jun Ha-Joon, Hwang, Jin-Gyu, Son, Mi-Ja, and Choi Dong-Jin (2008). Effect of Root Zone Temperature on Root and Shoot Growth of Strawberry. Journal of Bio-Environment Control 17:14-19.