

Characterization of circadian rhythms through a bioluminescence reporter assay in *Lactuca sativa* L.

T. Higashi, H. Murase, H. Fukuda

Acta Horticulturae 1011: 459-464. 2013.

Abstract

The circadian clock that exists in terrestrial organisms, triggers various physiological phenomena within a period of approximately 24 hours. This approximate time range of 24 h periodicity is called the “circadian rhythm”. Recently, the studies of circadian rhythms suggest that the control of circadian rhythm can contribute to improvement of the productivity of plant growth (circadian resonance). Therefore, it is necessary to investigate the features of circadian rhythm and to search for optimal light conditions that best suit plant cultivation. In this study, we analyzed the characterization of circadian rhythms through a luciferase luminescence assay in *Lactuca sativa* L. We have investigated the following three basic characteristics of the circadian rhythm: first of all, it is an inherent rhythm with about a 24 h period (free-running period). It can oscillate self-sustainably even if there is no external periodic change such as light or dark cycles. Secondly, the circadian rhythm can completely synchronize to environmental daily cycles. The period of the circadian rhythm can change to fit external conditions. Finally, the free-running period usually does not change even if the temperature does (temperature compensation). The results can be applied and utilized in a completely-controlled plant factory. A plant factory is a cultivation facility which enables the annually planned production of plants, such as lettuce under advanced climate control by monitoring plant environment and growth. This study will be one step forward towards the practical use of plant factories.