

Multispectral imaging unlocks genetic secrets of Phedimus plants for rooftop gardening

December 18 2023



Plant appearance of P_1 , P_2 , and 1 plant of F_1 population. Credit: *Plant Phenomics*

Ornamental plants, valued for their varied morphological characteristics, are increasingly used in urban greening initiatives such as rooftop greening. But this application presents challenges like limited soil depth and no irrigation, requiring plants such as the Phedimus species, known

for their resilience to these conditions.

Current research focuses on understanding the genetic and seasonal morphological changes in these plants, with a particular interest in their variations in color and patterns of dormancy. However, there is a lack of progress in genetic and breeding research, and the methods for evaluating [morphological traits](#) are still in the early stages of development. While recent advancements in multispectral image analysis provide promising solutions for non-destructively evaluating plant traits, their application in assessing [ornamental plants](#) is still limited.

In June 2023, *Plant Phenomics* published a research article titled "[Multispectral Phenotyping and Genetic Analyses of Spring Appearance in Greening Plant, *Phedimus* spp.](#)"

In this study, researchers utilized multispectral image analysis to assess the color of *Phedimus* spp., a critical attribute for ornamental plants, aiming to enhance breeding techniques. The study generated an F_1 population by crossing two *Phedimus* types: P_1 (evergreen) and P_2 (winter dormant).

The F_1 population exhibited traits leaning more towards P_2 , showing significant diversity in leaf color, size, shape, and plant height. Multispectral image capture and [principal component analysis](#) (PCA) of the reflected wavelengths from the plant body identified two major components, explaining over 95% of the variations.

PC1 primarily indicated the contrast between green visible light and other colors, while PC2 represented the reflection of near-infrared (NIR) light. Notably, the F_1 plants clustered closer to P_2 , suggesting that P_1 was distinguishable due to its higher reflection of green wavelengths. The study also investigated the relationship between plant color and covered area.

A negative correlation was found between PC1 values and plant cover area, indicating that lower PC1 values (indicating green color) corresponded to larger covered areas. Annual phenotypic correlations revealed that green wavelengths and vegetation indices related to biomass and pigments were positively correlated.

Contrastingly, non-green visible light and indices related to anthocyanins exhibited a positive interrelation, but a negative correlation with the green light set. RAD-seq and Quantitative Trait Loci (QTL) analysis identified significant QTLs on two linkage groups, LG-34.P2 and LG-7.P1, associated with various traits including leaf color and dormancy. The QTL on LG-34.P2 showed a strong association with multiple traits and remained consistent across two measurement years, suggesting its significant influence on leaf color.

In conclusion, the research demonstrated the effectiveness of multispectral imaging in capturing not only leaf color variations but also genetic variations influencing dormancy.

This method provides a more objective and comprehensive evaluation compared to traditional techniques. These findings offer new insights into the genetic analysis of leaf color and dormancy in *Phedimus* spp., with potential implications for breeding programs targeting ornamental plants.

More information: Taeko Koji et al, Multispectral Phenotyping and Genetic Analyses of Spring Appearance in Greening Plant, *Phedimus* spp., *Plant Phenomics* (2023). [DOI: 10.34133/plantphenomics.0063](https://doi.org/10.34133/plantphenomics.0063)

Provided by NanJing Agricultural University

Citation: Multispectral imaging unlocks genetic secrets of Phedimus plants for rooftop gardening (2023, December 18) retrieved 27 April 2024 from <https://phys.org/news/2023-12-multispectral-imaging-genetic-secrets-phedimus.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.