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**Establishment of spatial information for soybean cultivation complex
through drone image analysis**

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ABSTRACT

This study demonstrates that time-series drone imagery can effectively monitor crop growth in large-scale soybean paddy complexes. Additionally, spatial data were constructed for each field, including geographic coordinates, parcel numbers, area, crop type, sowing date, and growth information.

Keywords: soybean, drone, cultivation area

INTRODUCTION

The South Korean government is encouraging the cultivation of alternative crops in paddy fields to prevent a decline in rice prices caused by overproduction, and is promoting the expansion of soybean cultivation area to improve the soybean self-sufficiency rate. As a result, the soybean cultivation area increased from 50,638 ha in 2018 to 67,671 ha in 2023, and the self-sufficiency rate rose from 25.3% to 34.7% during the same period. Meanwhile, the rural population is projected to decrease by 54%, from 4.03 million in 2000 to 1.87 million in 2030, and the aging rate is expected to rise from 21.7% to 59.7%. These demographic shifts highlight the need for effective management of large-scale crop production complexes to ensure a stable food supply. This study aims to provide crop growth information derived from time-series drone imagery and to establish spatial data for a large-scale paddy soybean cultivation complex.

MATERIALS AND METHODS

The study area is Juksan-myeon, Jongsin-ri, Gimje-si, Jeollabuk-do—a drainage improvement site managed by the Korea Rural Community Corporation—covering a total area of 190 ha. Of this, 14.2 ha has been equipped with subsurface drainage infrastructure. The main winter crops in the area are barley, wheat, and Italian ryegrass (IRG), while summer crops include soybean and rice. Drone imagery was acquired ten times between January and September 2024 using a fixed-wing drone (eBee, Switzerland) equipped with RGB and multispectral sensors.

RESULTS & DISCUSSION

Winter crop classification and area estimation were performed using imagery from January and April, identifying 31 ha of IRG, 27 ha of barley, and 23 ha of wheat. Imagery from May enabled the analysis of lodging damage, with 6.6 ha of wheat (31.0%) and 5.3 ha of barley (23.5%) affected. July imagery was used to assess summer crop distribution, revealing 154

ha of soybean, 20 ha of rice, and 16 ha of other crops out of the total 190 ha. Drone images from May to June enable analysis of the soybean sowing status, allowing for the determination of the sowing completion date in time series. 8.6% of sowing was completed on May 24, 86.2% on June 11, 99.3% on June 20, and on June 28.

Fig.2 Study area and drone

Fig.1 Crops analysis using drone imagery

CONCLUSIONS

This study demonstrates that time-series drone imagery can effectively monitor crop growth in large-scale soybean paddy complexes. Additionally, spatial data were constructed for each field, including geographic coordinates, parcel numbers, area, crop type, sowing date, and growth information. Further field surveys on crop growth and yield will be conducted to enhance the spatial database and support effective management strategies for large-scale agricultural zones.

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