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Estimating Rice Height Using Three-Dimensional (3D) LiDAR

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[Introduction]
Various components such as temperature and solar radiation, cultivation method have an impact on the crop growth and production, and monitoring the current status of crop growth is essential for the optimum growth. To monitor the crop growth on the field with a non-destructive way, it is necessary to develop an algorithm that can estimate the height of rice canopy using 3D LiDAR.

[Materials and Methods]
Two rice cultivars ('Nampyeong' and 'Dongjin1') were planted in experimental field that located at National Institute of Crop Science (NICS; Wanju, Jeollabuk-do). The twenty rice heights at 3 points by cultivar were measured by ruler at 3~6 day intervals before heading date, and then they were scanned by LiDAR. The 3D point cloud data for twenty plants were extracted from scanned LiDAR data using SCENCE and CloudCompare program. The extracted data were calculated on a histogram of height, and the shape of histogram were fitted to Gumbel distribution. Finally, the rice height was estimated by simple linear regression using parameter of Gumbel distribution.

[Result and Discussion]
The estimated heights using simple linear regression were similar to measured heights. The correlation between the measured and estimated rice height for each cultivar showed significant result ('Nampyeong': $R^2 = 0.97$, 'Dongjin1': $R^2 = 0.98$), and the result for both cultivars was also similar as well ($R^2 = 0.97$). In addition, it is necessary to develop an algorithm for estimating related to the other growth components.

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