Research of Non-integeral Spatial Interpolation for Precise Identifying Soybean Location under Plastic Mulching

Yongjin Cho[1] Yeji Yun[1] Kyou-seung Lee[1] Jong-woo Oh[2] DongHoon Lee[2*]

[1]Department of Bio-mechatronics, Sungkyunkwan University, Suwon, Korea

[2]Department of Biosystems Engineering, Chungbuk National University, Cheongju, Korea

Abstract

Most crop damages have been occurred by vermin(e.g., wild birds and herbivores) during the period between seeding and the cotyledon level. In this study, to minimize the damage by vermin and acquire the benefits such as protection against weeds and maintenance of water content in soil, immediately vinyl mulching after seeding was devised. Vinyl mulching has been generally covered with black color vinyl, that crop seeding locations cannot be detected by visible light range. Before punching vinyl, non-contact and non-destructive methods that can continuously determine the locations are necessary. In this study, a crop position detection method was studied that uses infrared thermal image sensor to determine the cotyledon position under vinyl mulch. The moving system for acquiring image arrays has been developed for continuously detecting crop locations under plastic mulching on the field. A sliding mechanical device was developed to move the sensor, which were arranged in the form of a linear array, perpendicular to the array using a micro-controller integrated with a stepping motor. The experiments were conducted while moving 4.00 cm/s speed of the IR sensor by the rotational speed of the stepping motor based on a digital pulse width modulation signal from the micro-controller. The acquired images were calibrated with the spatial image correlation. The collected data were processed using moving averaging on interpolation to determine the frame where the variance was the smallest in resolution units of 1.02 cm. For this study, the spline method was relatively faster than the other polynomial interpolation methods, because it has a lower maximum order of formulation when using a system such as the tridiagonal linear equation system which provided the capability of real-time processing. The temperature distribution corresponding to the distance between the crops was 10 cm, and the more clearly the leaf pattern of the crop was visually confirmed. The frequency difference was decreased, as the number of overlapped pixels was increased. Also the wave pattern of points where the crops were recognized were reduced.

Keywords

Infrared thermal image sensor, Moving system for image measurement, Spatial image correction, Non integeral interpolation

Acknowledgement

This work was supported by the Korean Institute of Planning and Evaluation for Technology in Food, Agriculture, Forestry and Fisheries (IPET) through the Advanced Production Technology Development Program, funded by the Ministry of Agriculture, Food and Rural Affairs (MAFRA) (114053-3).

* 교신저자 : DongHoon Lee(leedh@chungbuk.ac.kr)