THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 696294

Development and performance experiment on grain yield monitoring system of combine harvester based on photoelectric diffuse reflectance

Title	Development and performance experiment on grain yield monitoring system of combine harvester based on photoelectric diffuse reflectance
Title (native language)	
Category	
	Development of remote sensing (RS), geographical information system (GIS) and global positioning system (GPS) has provided new methods for obtaining field grain yield information, which allows better description of spatial variability for grain yield. Monitoring grain yield has become an essential component in precision agriculture, which provides better guidance for grain growth and management such as variable fertilizing, irrigating and spraying. In order to further improve the monitoring accuracy of grain combine harvester, a new real-time grain yield monitoring system based on photoelectric principle was developed in this study. The system was composed of sensor module, grain yield data acquisition module, GPS module and grain yield display terminal. The sensor module included diffuse reflectance grain volume senor as key component of the system and rotating speed sensor of elevator. A model of grain mass on the scraper was established based on optical principle of photoelectric diffuse reflection effect and grain kinematic principle. Prediction model and diffuse reflectance grain yield monitoring software were embedded in the grain yield display terminal. When the elevator scraper of the combine harvester with the grain passed the diffuse reflectance grain volume sensor, the light path would be blocked intermittently. As a result, the corresponding pulse signal would be generated and meanwhile the elevators rotating speed sensor would output the rotating speed signal. According to photoelectric principle, the size of pulse signal was proportional to the thickness of grain on the scraper. Subsequently the grain yield data acquisition module converted sensor signals into standard signals, and grain yield information including real-time grain yield and

Short summary for practitioners (Practice abstract) in English)	total yield, elevator rotating speed, combine harvester speed, harvest area, and longitude and latitude would be obtained and displayed on the terminal. In order to evaluate the performance of the grain yield monitoring system, both laboratory platform experiment and field dynamic experiment were conducted. For the platform experiment, an experiment platform was designed, which was composed of LED (light-emitting diode) terminal, diffuse reflectance grain volume sensor, grain inlet, elevator, elevators rotating speed sensor and motor. The result of platform experiment showed that the rotating speed sensor of elevator had the maximum error of 1.87%, which was less than 2.00%, and the maximum standard deviation of 2.33 r/min, which indicated the sensor had a small discrete degree; the diffuse reflectance grain volume sensor had the maximum error of 3.14%, which was less than 3.50%, and both the accuracy and the stability satisfied the requirements. Field dynamic experiment included 3 parts: field experiment without loading, model calibration experiment and field experiment of wheat yield. The field experiment without loading showed that the pulse signal intensity of diffuse reflectance grain volume sensor decreased with the elevators rotating speed increasing, the determination coefficient (R2) of output curve was 0.941 1, and the measurement error was within 4.00%. For the model calibration experiment, domestic TB60 type combine harvester was calibrated to obtain the calibration factor of 0.071, and the relationship between grain mass and thickness was gotten. The field wheat yield experiment showed that the grain yield monitoring system based on photoelectric principle was maximum error of 3.51%, which was smaller than the double-plate differential method. The system offered a wide range of grain feeding quantity and satisfied the need of field grain yield monitoring. The research provides a new method to monitor real-time grain yield, and the system is applicable to domestic mainstream models of combine harvester in China.
Short summary for practitioners	
Website	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85017299081&doi=10.11975%2fj.issn.1002-6819.2017.03.004&partnerID=40&md5=02dd53f4bb31d8da0b01621692ae95bd
Audiovisual material	
Links to other websites	
Additional comments	
Keywords	
Additional keywords	Combine harvester; GRAIN; Photoelectric devices; sensors; Yield monitor system
Geographical location (NUTS)	
Other geographical location	
Cropping systems	
Field operations	
SFT users	
Education level of users	
Farm size (ha)	

Scientific article

Title	Development and performance experiment on grain yield monitoring system of combine harvester based on photoelectric diffuse reflectance
Full citation	Fu, X; Zhang, Z.; An, X.; Zhao, C.; Li, C.; Yu, J. (2017). Nongye Gongcheng Xuebao/Transactions of the Chinese Society of Agricultural Engineering, Volume 33, Issue 3, pp 24-30, DOI:10.11975/j.issn.1002-6819.2017.03.004

Effects of this SFT

Productivity (crop yield per ha)	
Quality of product	
Revenue profit farm income	
Soil biodiversity	
Biodiversity (other than soil)	
Input costs	
Variable costs	
Post-harvest crop wastage	
Energy use	
CH4 (methane) emission	

CO2 (carbon dioxide) emission	
N2O (nitrous oxide) emission	
NH3 (ammonia) emission	
NO3 (nitrate) leaching	
Fertilizer use	
Pesticide use	
Irrigation water use	
Labor time	
Stress or fatigue for farmer	
Amount of heavy physical labour	
Number and/or severity of personal injury accidents	
Number and/or severity of accidents resulting in spills property damage incorrect application of fertiliser/pesticides etc.	
Pesticide residue on product	
Weed pressure	
Pest pressure (insects etc.)	
Disease pressure (bacterial fungal viral etc.)	

Information related to how easy it is to start using the SFT

This SFT replaces a tool or technology that is currently used. The SFT is better than the current tool	
The SFT can be used without making major changes to the existing system	
The SFT does not require significant learning before the farmer can use it	
The SFT can be used in other useful ways than intended by the inventor	
The SFT has effects that can be directly observed by the farmer	
Using the SFT requires a large time investment by farmer	
The SFT produces information that can be interpreted directly	

View this technology on the Smart-AKIS platform

This factsheet was generated on 2018-Apr-03 11:57:21.