UNIVERSITI TEKNOLOGI MARA

EVALUATION OF PRECISION OPERATION OF TRACTOR - MOUNTED NITROGEN ACTIVE LIGHT SENSOR USING AUTOPILOT STEERING MODE ON IMMATURE OIL PALM FIELD

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ABSTRACT

Precision agriculture has been developed for assisting farmers in precise fertilizer application in Malaysia. The tractor-mounted N-sensor with Active Light Sensor (ALS) has been introduced to utilization for monitoring N-status at the Malaysian paddy field. However, the application of this smart technology for other major crops such as oil palm has not been yet studied. Thus, the study was conducted to evaluate the precision operation of tractor-mounted Nitrogen ALS with manual and autopilot steering on the immature oil palm field in Malaysian oil palm plantation. In this study, the Nitrogen status on immature palms was identified and visualized by using tractor-mounted sensor "on-the-go" at every second while the tractor moving in the field. The data from N-sensor was analyzed based on Nitrogen uptake at 46 % for a normal requirement for immature oil palm. The interpolation maps of the Nitrogen status were developed by using the kriging method in ArcGIS 10.3 software and successfully shown the spatiality and variability of N-status on the immature oil palms. The maps can be used as a reference in applying variable rate application (VRA) to optimize the fertilizer usage for the oil palm. Besides that, the performance of manual and autopilot steering modes of the tractor-mounted N-sensor was also evaluated from the aspects of heart rate and human energy expenditure of the operator. The heart rate of the operator in driving with autopilot mode was 91 beats/min or 11.65% reduction as compared to 103 beats/min with manual steering mode. A similar reduction also occurred for the human energy expenditure of the operator in driving the tractor with autopilot mode. It was recorded that the human energy expenditure of the operator was 11.27 kcal/min when driving with autopilot steering mode or 33.27% lower than that manual steering mode of 16.89 kcal/min. The differences showed the autopilot steering mode can save energy of tractor operators or lighten the job during handling tractor. Generally, the findings can promote a real-time method in assessing Nitrogen status in Malaysian oil palm plantations and encourage variable rate application (VRA) to save fertilizer costs for strengthening the competitiveness and the sustainability of the oil palm plantation industry about 0.7 kg/ha @ 1.62% on field.

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