

# PA ADOPTION BY A KOREAN RICE FARMING GROUP: CASE STUDY OF PYEONGTAEK CITY

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## ABSTRACT

Research on precision agriculture (PA) has been conducted in Korea for about 10 years since 1999. Most of the research was focused on rice paddy fields that were flooded, flat, and small sized (e.g., 30 m x 100 m). Accomplishment during the period includes investigation on spatial variability in soil, crop growth, and yield properties, application of imported sensors and variable rate applicators, and development of Korean version of these sensors and variable rate applicators. PA technologies have been applied to single fields and effects on fertilizer reduction and yield increase were evaluated. Considering size of Korean rice fields, cost, and practicability, application and evaluation of PA concept for big-sized field or multiple fields would be necessary to promote adoption of PA by farmers. This paper reports PA adoption by a rice farming group in Pyeongtaek city, Korea, in 2009.

The site was about 50 ha, composed of 97 fields owned by 10 farmers. Main operation on this rice field complex was field-by-field nutrient management by fertilizer recommendation based on soil sampling and analysis before transplanting, and close-range reflectance of rice canopy during growing season. Variability of soil properties, rice growth, and yield and quality was investigated, and effects of nutrient management on rice yield and quality were evaluated. For each field, 5 to 9 soil samples were taken in April, depending on the size of the fields, mixed, air-dried, 2-mm sieved, and analyzed in the laboratory for fertilizer recommendation. Laboratory soil analyses showed that nutrient levels were quite different by field. Especially, variations of electrical conductivity, organic matter content, nitrate, effective phosphorous and silicate were greater than 10 times between the fields. Overall nutrient amounts were much less than optimum levels.

Rice was transplanted in May, and slow-release granular fertilizer was applied simultaneously using a side dressing applicator attached to the rice transplanter. Recommended nitrogen fertilizer application levels varied by about 1:3, depending on the soil analyses results, with maximum of 231.4 kg/ha and minimum of 77 kg/ha. Farmers tended to apply less amounts of fertilizer than recommended levels, and averaged difference was 47.3 kg/ha. This might reduce potential growth and yield.

Additional fertilizer application was recommended based on close-range reflectance of rice canopy during growing season. Using a commercial remote sensing unit detecting reflectance of 880 nm and 590 nm input bands, 1000 to 1,500 measurements were obtained from each field. Recommended additional nitrogen fertilizer amounts were also quite variable by field ranging from 0 to 347 kg/ha. Recommended and applied nitrogen amounts were different and the values were less than 50 kg/ha at 41% of the total field. Actual nitrogen application levels were lower than recommended levels for 4 farmers (13% of the total field) and greater for 6 farmers (46% of the total field).

Based on recommended and applied nitrogen rates, 31 fields were selected for yield comparison. For the selected fields, 45 stalks were harvested, threshed, and plant and grain weights were measured. Wet and dried plant weights showed about 1:2 variation over the fields. Variations were about 1.6 for raw grain and brown rice, and from 2 to 4 for nutrient contents, depending on component. Quality analyses of brown rice and milled rice showed that protein contents were less than 9% and amylase contents were in a range of 12 to 21%. Based on comparison between over-application rates and rice yield, it was concluded that over-application of nitrogen did not increase rice yield, and these variations in rice yield and quality might have been decreased if recommended nitrogen rates were applied.

Although these results were based on experience of single year and single site, they would provide guide to a better application and extension of PA technology to Korean rice fields.

**Keywords:** Precision agriculture, Rice field, Soil sampling, Remote sensing, Fertilizer recommendation