The Basic Study for Real-Time Measurement of Soil Electrical Conductivity in Paddy Field

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I. Introduction
For the efficient site-specific management of paddy field, soil diagnosis technique is necessary. Until now soil analysis or diagnosis of field has been conducted in laboratory after sampling soil on field by manpower. But soil electric conductivity(EC) diagnosis technology for PF was developed in the USA, now. For quick measurement of the EC within field, we introduced the soil EC sensor(Veris 2000XA). The objective of this study it proves an electric conductivity measurement possibility of the soil at real-time in paddy field.

II. Material and Method
1. Measurement principle
The electric conductivity sensor with it sees from Fig. 1 was composed with 4 coulter-electrodes. One coulter-electrode injects electrical current into the soil, while three coulter-electrodes measure the voltage drop.

2. Structure and Specification
The implement was designed to fit on draw-bar with 2 wheel tire and 4 pcs of coulter-electrode which spacing was adjustable to allow operation in variable crops raw from 76 to 128cm. Minimum horsepower required in operation is 8.95 to 14.9kW, and coulter-electrode disk diameter is 43cm, disk thickness is 4mm. Electrical power requirement is 10 to 15 volts DC. Instrument flash memory capacity is 26 hours of EC data can be stored. RS 232 serial port installed to communicate with DGPS.

3. Inner test
The soil EC sensor was tested in the soil-bin for the check of output frequency from each coulter-electrode. Fig. 2 shows the results.
4. Field test
Field test was carried out two paddy fields Dec. 7, 2001 in NAMRI(National Agricultural Mechanization Research Institute) and Nov. 14, 2001 in NHAES(National Honam Agricultural Experiment Station).

III. Results and Discussion
1. Descriptive statistics
The CV was 34.66% in NAMRI and 13.15% in NHAES field, indicating spatial variability even in the paddy field.

2. Kriged map
Fig. 3 shows the Kriged map based on the results of the semivariogram. Considerable spatial variability was distinctly observed in the EC parameter. In NHAES field, the spatial variability pattern of EC shows the similarity with yield data and shows the contraries to relief data.

IV. Conclusion
To prove measurement possibility of the soil EC using EC sensor in paddy field, the EC sensor was tested two fields. The average value shows 4.11mS/m in NAMRI, and 17.35mS/m in NHAES. The CV was 34.66% in NAMRI and 13.15% in NHAES field. EC map was generated by the combines DGPS and EC sensor. Measurement the soil electric conductivity of paddy field using the EC sensor was conclude as useful methods in understanding soil characteristics for precision agriculture.