OC1. Boundary line analysis of rice yield response to soil chemical properties and its application to the analysis of spatial yield variability

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Objective

This research was carried out to investigate the causal factors of yield spatial variability in direct-seeded and transplanted rice culture in Korea.

Materials and Methods

A direct-seeded of 59m×110m (divided into 65 plots with 10m×10m) and transplanted paddy rice field of 60m×110m (divided into 66 plots with 10m×10m) located in Suwon, Korea were used for the research. Soil samples for each corresponding plot at planting and harvest were collected for the analysis of soil chemical properties. Grain yield for each plot was also measured. Boundary line analysis was applied to identify soil variables that significantly influenced the spatial variability of grain yield.

Result and Discussion

Table 1. Boundary line formulation for the grain yield response to soil variables at planting

Parameter	Index formulation	R^2
OM	I_{OM}=[1-11.9EXP(-0.184OM)]	0.994
Ava.P	$I_{A.P}$=[1-61EXP(-0.058A.P)]	0.985
N tot.	I_{TN}=[1-3017EXP(-78.2TN)]	0.983
Ava.Si	$I_{A.S}$=727[1-347EXP(-0.087A.S)]	0.993
Ex.Ca	I_{Ca}=[1-13.1EXP(-0.95Ca)]	0.994
Ex.Mg	I_{Mg}=[1-1547EXP(-6.56Mg)]	0.993
Ex.K	I_{K}=[1-28.4EXP(-9.47K)]	0.994
Ex.Na	I_{Na}=[1-35.1EXP(-10.1Na)]	0.990
CEC	I_{CEC}[1-5.12EXP(-0.4789 CEC)]	0.988

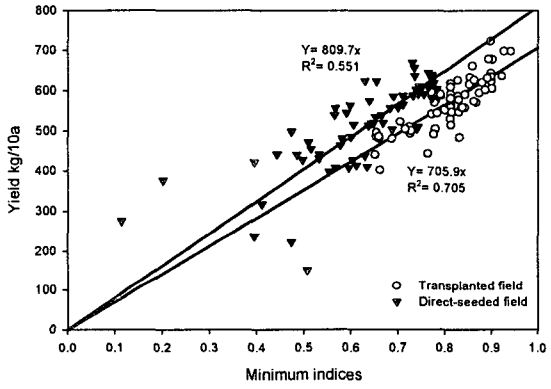

Fig. 1. Relationship of grain yield with minimum indices of soil variables at planting in transplanted and direct-seeded paddy field

Boundary line analysis (Table 1) was carried out for the grain yield response to soil variables at planting. These index formula describe the grain yield response to the variation in the test parameter, where all other factors are close to non-limitting level in terms of grain yeild. The limitting factor that has the lowest index value was selected for each plot, and regressed to the respective grain yield. That is, $Y = a \min[I_{OM}, IA_{.P}, I_{TN}, \ldots I_{CEC}]$. This regression equation that was formulated according to the Law of Minimum of the limiting factors explained about 71% and 55% of the spatial yield variability in transplanted and direct-seeded field, respectively.

Conclusion

Once other factors such as mineral N, soil texture, plowing depth etc. are taken into account for this analysis, the predictability of the model could be improved enough to be utilized for the site-specific fertilizer prescription for maximizing grain yield and minimizing the nutrient loss to the environment.

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