

## **Rice cultivation using organic farming system with organic input materials in Korea**

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### **Abstract**

Organic farming, which is responsible for material circulation in agricultural ecosystem and crop production with a minimal environmental load, has played a crucial role from two points of view i.e. ecological protection and agricultural production. Since no chemical fertilizers and minimal inputs are allowed in organic farming, nutrients for the crop production are mostly supplied with organic fertilizer such as compost containing different organic materials. Therefore, the management of soil fertility in organic farming should be differentiated with other conventional farming. For this purpose the soil chemical and physical properties and crop productivity were determined on organically managed rice paddy soil to manage soil fertility in a proper way for long-term rice cultivation. Organic materials used were compost, rice straw, and hairy vetch and compared with conventional farming. K and Ca contents of soil were increased by application of organic materials compared to those of conventional farming while P content in soil was decreased in organic farming with application of compost and hairy vetch. Crop productivity was higher in application of hairy vetch compared to those of compost or rice straw. In conclusion, organic farming was more beneficial for the improvement of soil properties and the use of hairy vetch as green manure was more effective than compost or rice straw for the maintenance of crop yield and enhancement of soil properties.

### **Media summary**

Rice cultivation using organic farming system might be useful tool for improvement of soil chemical and physical properties in view of sustainability of agriculture.

### **Key Words**

Rice, organic farming, organic materials, crop productivity, soil properties

### **Introduction**

Modern agricultural techniques, which have been emphasized for high crop productivity, caused environmental stress such as soil erosion, salt accumulation, and contamination of ground water and so on. In spite of technological improvement of agricultural production, they have played a detrimental role in the environment.

Organic farming, which is responsible for material circulation in agricultural ecosystem and enhanced crop production with a minimal environmental load with keeping ecological balance, contains the general meaning of the holistic production and management system for enhancing health of agricultural ecosystem (Otto, 2003). Since the CODEX guidelines is an international standard for food production, specific agricultural techniques for organic production have been developed and applied in Korea based on CODEX guidelines (CODEX Alimentarius Commission, 1999).

The aim of this study was to investigate both the changes of soil chemical and physical properties and crop productivity in organically managed paddy soil and thereafter to manage soil fertility in a proper way for the long-term rice cultivation using organic farming.

### **Methods**

*Plant culture*

The rice (*Oryza sativa* cv. Hwasung) was cultivated continuously for two years (May ~ Oct. 2002, May ~ Oct. 2003) on experimental station in Suwon. Rock phosphate, powder of lime magnesia and ash was applied as base fertilizers for the purpose of P, Ca, Mg, K supplements at the beginning of transplanting. Compost, rice straw, and hairy vetch were used as organic material sources in organic farming with amounts of 12t compost ha<sup>-1</sup>, 5t rice straw ha<sup>-1</sup>, and 20t hairy vetch ha<sup>-1</sup>, respectively and compared with those of NPK application (100 N-30 P-30 K kg ha<sup>-1</sup>) and no fertilization plots.

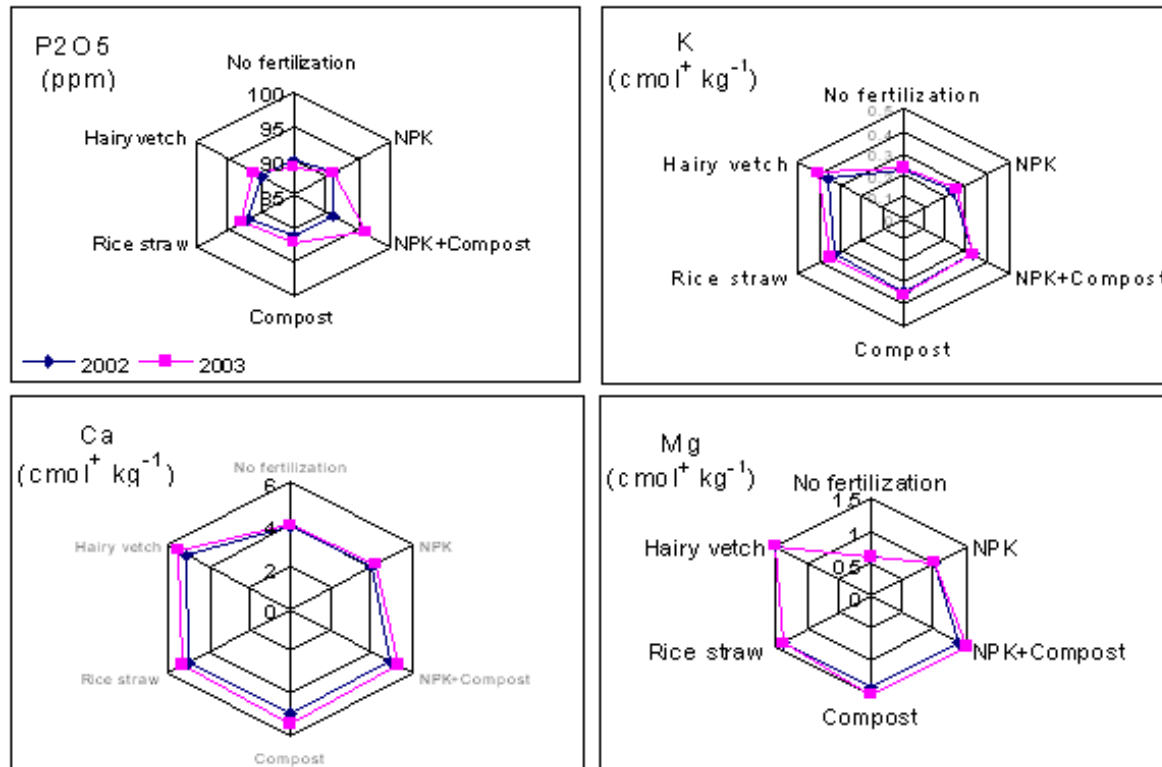
## Results

Crop productivity was decreased slightly in organic farming compared to that of conventional farming (Table 1). However, the application of hairy vetch compensated the low nutrient input in organic farming up to high level (approximately 93%) maybe due to fast decomposition of dried hairy vetch in soil.

In contrast to the crop productivity, bulk density and porosity rate of soil had no significant differences by application of organic materials compared to those of NPK application (Table 1). Soil K contents were increased slightly by application of hairy vetch compared to that of NPK application while soil Ca contents were increased by both hairy vetch and compost application (Fig. 1). In contrast to K and Ca contents, soil P contents had no large differences compared to that of NPK application with compost, which increased drastically (Fig. 1).

**Table 1. Crop productivity and soil physical properties depending on organic materials supplied in organic farming system.**

Organic materials	Crop yield (t ha <sup>-1</sup> )	Bulk density (g cm <sup>-3</sup> )	Porosity (%)
Rice straw	4.09 d <sup>†</sup>	0.93 c	65.0 a
Hairy vetch	5.29 c	0.98 c	63.2 a
Compost	4.38 d	1.08 ab	59.3 b
NPK + compost	5.23 b	0.96 c	63.7 a
NPK	5.69 a	1.01 bc	62.0 ab
No fertilization	3.02 d	1.17 a	55.8 c



**Figure 1. Chemical properties of organically managed rice paddy soil depending on organic materials supplied.**

## Conclusion

The organic farming was more beneficial for the improvement of soil properties and the use of hairy vetch as green manure was more effective considering in two points of view i.e. maintenance of crop yield and enhancement of soil properties than compost or rice straw.

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