김제 벼논의 토양호흡 특성

민성현[1], 심교문[1], 김용석[1], 이재석[2*]
[1]국립농업과학원 농업기상실, [2]건국대학교 생명과학과

Characteristics of Soil Respiration in Rice Paddy-field in Gimje, Korea

S. Min[1*], K. M. Shim[1], Y. S. Kim[1], and J. S. Lee[2*]
[1]Division of Agro-Climate Change & Ecology, National Academy of Agricultural Science
[2]Department of Biological sciences, Konkuk university, Korea
(Correspondence: jaeseok@konkuk.ac.kr)

1. Introduction

Crop and ecosystems have received less research attention, due to their relatively low productivity (Cole, 1996; Glenn *et al.,* 1993). Agricultural systems are one of the important carbon source and sink in global ecosystem. To quantify the net effect of these systems on atmospheric CO_2 concentration, the amounts of carbon fixed in primary production and that respired by the soil must be known. To monitor soil respiration in rice-barley double cropping paddy-field during the full growing season, the rice paddy had been consistently cultivated with double cropping of rice (Jun.~Oct. in 2011) and barley (Nov. in 2010~May in 2011). We newly designed "floating" automatic opening /closing chamber (AOCC) system based on closed dynamic method and conducted on field plots measuring with planted to rice. The "floating" AOCC system was newly designed to minimize disturbances to cultivate environmental factors, and also allowed for real-time monitoring of soil respiration.

2. Material and method

To monitor soil respiration in rice-barley double cropping paddy-field during the growing season (the rice paddy had been consistently cultivated with double cropping of rice (Jun.~Oct. in 2011) and barley (Nov. in 2011~May in 2012). The automated chamber system used a flow-through steady-state design. In brief, the system comprised six automated chambers, a six-channel gas sampler, one infrared gas analyzers (LI-820), and a data logger

(CR1000, Shu *et al.* 2005). The chamber systems have an elongated octagonal shape (20(W) x 30(L) x 15(H) cm) and were designed to avoid the stagnation of circulation in any part of the chamber. Between measurements, lid was positioned to allow precipitation and free circulation of air between in/out of chamber, to reach the enclosed soil surface, thereby keeping the soil conditions as natural as possible (Fig. 1). There were six chambers - three chambers were for Rs (include root and heterotrophic respirations) and the other three chambers for heterotrophic respiration in trenching plot.

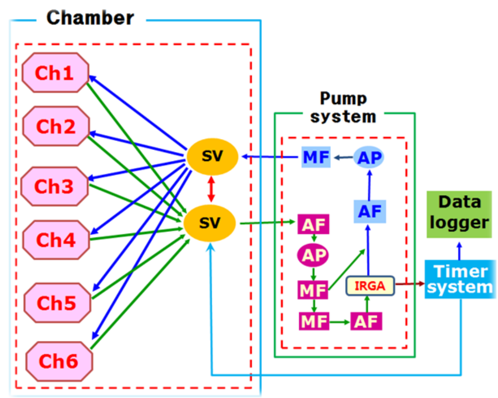

Fig.1. AOCC (Automatic Open / Closing Chamber system) and controller.

3. Results

During cultivating season from Jun to Oct. in 2011, daily mean Rs was 98 mg CO_2 m^{-2} h^{-1} and the diurnal variations were not closely related to soil temperatures. At day time (temperature increase), Rs was decreased, however, it was increased at night time (temperature decrease) (Fig. 2).

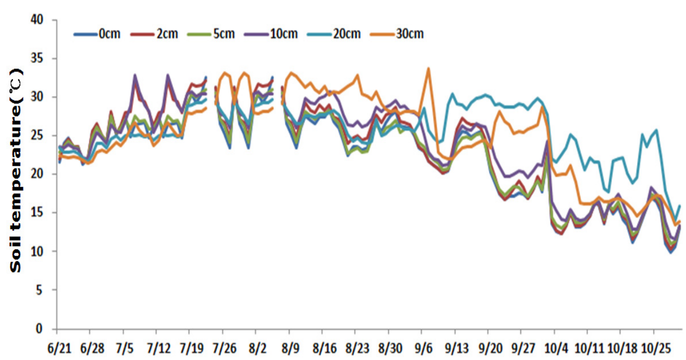

Fig.2. Daily variation of soil temperature

Rs was shown very low value (< 200 mg CO_2 m^{-2} h^{-1}) from transplanting of rice to midsummer drainage. During midsummer drainage, Rs was increased with decreasing water level (>400 mg CO_2 m^{-2} h^{-1}). After than Rs was rapidly decreased with supply of water (Fig. 3).

Rs was shown lower value in high water level condition than that in low water level. Over all, Rs was high in autumn season (ripening stage) compared with early summer (vegetative stage), although soil temperature was similar value.

As a result, Rs in rice paddy field was fluctuated by change of environmental factors such as temperature and soil water contents, greatly influenced by cultivation practices and field management (e.g. stable manure amendment, seeding or transplanting of rice, water management, harvest, treatment of harvest residuals and plowing). We will continuously monitor Rs and find characteristics of Rs in double cropping rice and barley paddy-field.

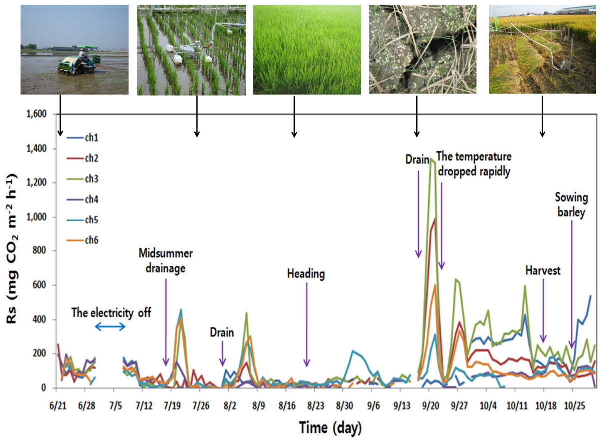

Fig.3. Daily variation of soil respiration.

Reference

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