有機物マルチ及びトウモロコシの植栽が土壌水分、地温のプローファイルに与える影響について

Soil Moisture and Temperature Profile under Crop Residues Mulching and Maize Canopy

コマリア、榎本絵里、伊藤健吾、千家正照

○Komariah[1)], Eri Enomoto[2)], Kengo Itou[3)], Masateru Senge[3)]

INTRODUCTION **Organic Mulching is one promising technology that is an integral component of conservation farming and is increasingly seen in the light of integrated soil management as an essential building stone for sustainable agriculture (Erenstein, 2003). Rice husk, straw and bran are the crop residues that widely available and highly produced, especially in Asian countries. The investigations of those organic matters' role for improving soil properties and nutrients for plants are widely done. However, the study of crop residues for soil amendment should keep on running to more well understands and arouses more innovations of their contribution in ameliorating soil and environment. The objective of this study is to investigate the profile of soil moisture, temperature and selected soil physical properties under rice husk, rice straw and rice bran, with and without maize canopy.**

MATERIAL AND METHOD **Two experiment fields were prepared, one was planted with maize and other was an empty field, without any crop. Then, 5 mulching treatments were applied on each field, namely: rice husk, rice bran, rice straw, black polyethylene and control. Therefore, this investigation consisted of 10 treatments. Beside climate components (rainfall, evaporation rate, air temperature, solar radiation and albedo), soil moisture of average 30cm depths (using Time Domain Reflectometer), soil temperature of 2.5cm and 7.5cm depths (using thermocouple) were also observed.**

RESULTS AND DISCUSSION **Figure 1 shows that without plants canopy, soil temperature and the fluctuation tended to be high. Generally, soil temperature under rice husk and rice straw mulching was lower. Due to the increasing of air temperature in June 2004, without canopy, soil temperature of unmulched soil was the highest, perhaps because of the direct contact of solar radiation and soil. Logically, the soil temperature will be lower under maize canopy. But, figure 1 shows that under maize canopy, soil temperature under rice bran mulching was the highest, probably due to the fermentation process of rice bran that occurred in soil, especially in the beginning of experiment until about the next 40 days after mulching. What could be noted from this experiment, is that, in spite of**

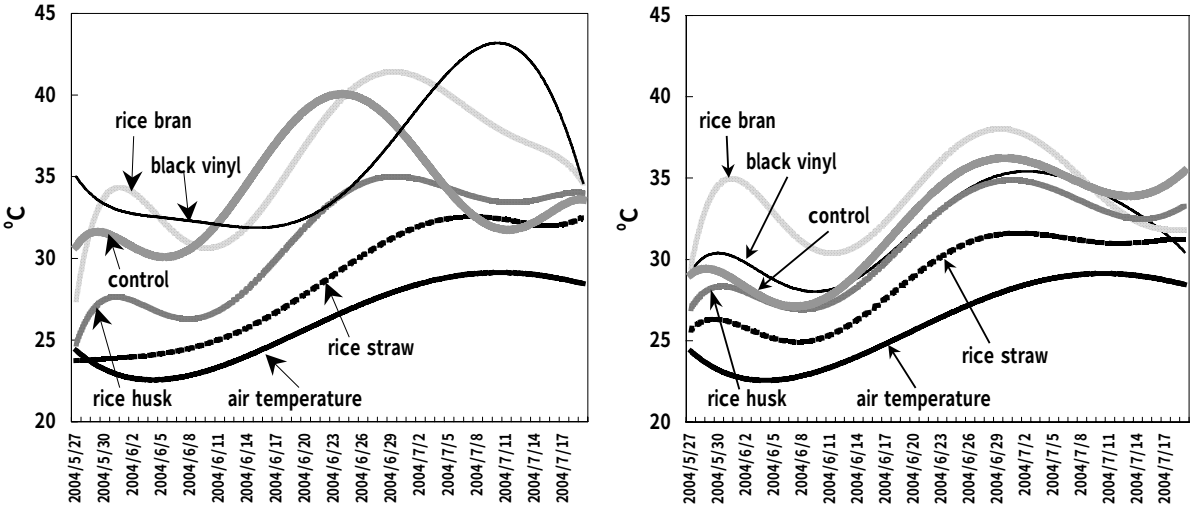

Figure 1. The trend of soil temperature fluctuation without canopy (left) and under maize canopy (right) at 0-10cm average depths

1) United Graduate School of Gifu University, Yanagido 1-1, Gifu-shi, Gifu Prefecture, Japan
2) Alumnus of Agriculture Faculty, Gifu University, Yanagido 1-1, Gifu-shi, Japan
3) Faculty of Applied Biological Science, Gifu University, Yanagido 1-1, Gifu-shi, Japan
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organic mulch, the influence of rice bran on soil temperature was significantly different to those of rice husk and rice straw. Generally, maize canopy decreased soil temperature up to 2.6ºC and 4.1ºC under organic mulching and black vinyl mulching, respectively.

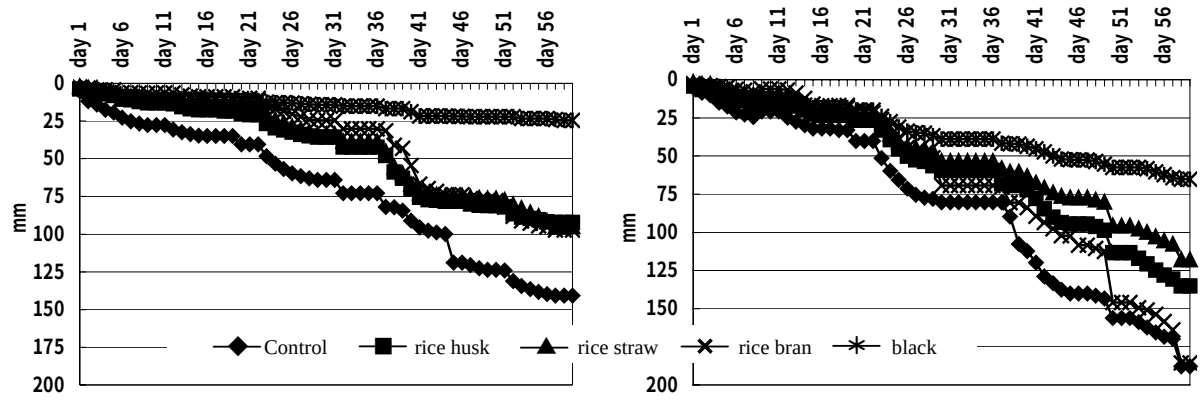

Figure 2. Cumulative soil moisture depletion of each organic mulching without canopy (left) and under maize's canopy (right)

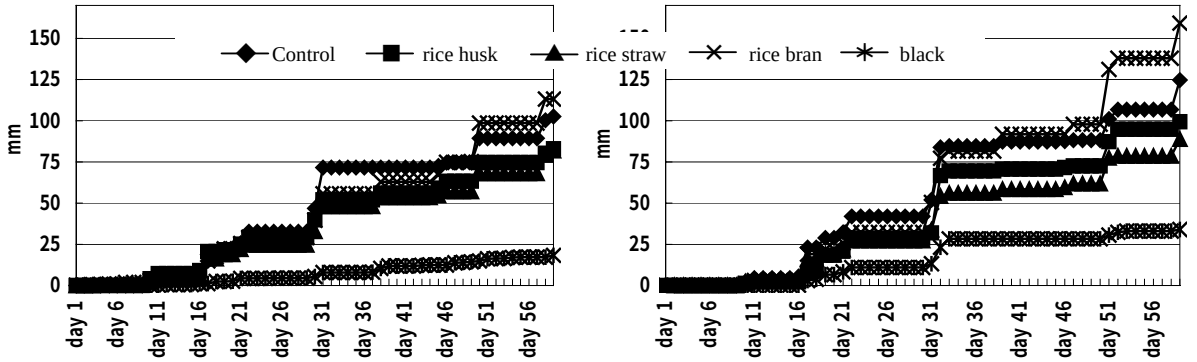

Figure 3. Cumulative soil moisture repletion of each organic mulching without canopy (left) and under maize's canopy (right)

Cumulative soil moisture depletion and repletion that are presented in figure 2 and 3 were measured in 0-30cm depths (average). Figure 2 and 3 show that under maize canopy, cumulative soil moisture repletion and depletion were high. The leaves, stem and roots of maize played role in receiving and conserving precipitation up to 20%. But, since the evapotranspiration was also high, soil water loss under maize canopy was 30% higher than without maize canopy. Rice bran mulching significantly conserved soil moisture at field without maize canopy, since cumulative soil moisture repletion was higher than depletion. Compare to control, by using the cumulative soil moisture depletion and repletion ratio, rice bran mulching suppressed soil moisture loss up to 19% in the maize-planted field, while it was only 6% and 8% under rice husk and rice straw mulching, respectively. Furthermore, soil moisture depletion was 11% higher when maize is planted on the rice husk mulching soil, where it would be 9% higher under that of rice straw mulching soil. But, when a rice bran mulching soil is planted with maize, the soil moisture depletion would be 30% higher, probably due to the abundant available soil moisture that could be used by maize for transpiration. In other words, because rice bran could maintain high soil moisture, plant's transpiration became high, too.

CONCLUSION Without or under maize canopy, rice husk and straw mulching could lower the soil temperature, except rice bran. Rice bran mulching could maintain high soil moisture, and affected to high plant's transpiration.

REFERENCES Erenstein, Olaf. 2003. "Smallholder conservation farming in the tropics and sub-tropics: A guide to the development and dissemination of mulching with crop residues and cover crops". Agriculture Ecosystems and Environment 100: 17-37.