10

Decomposition Rates and Chemical Components of Waste Materials under the Different Soil Moistures and Temperatures

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異なる土壌水分と温度環境下における農産廃棄物の分解速度並びに全窒素全炭素濃度の変化

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Introduction: Apparently, chemical fertilizers are rare and expensive, thus, farmers in tropical areas must apply wastes from crop production to maintain crop productivity and soil fertility. However, there have been a few studies that researching on decomposition rates of waste materials under the conditions of different levels of soil moisture and temperature. Thus, this study was conducted on the weight decreases of waste materials to evaluate the rates of decomposition and chemical components of waste materials that were buried under the ground in various environmental conditions.

Materials and Methods: Four waste materials (i.e. rice chaff, bagasse, rice straw, and coir dust) were utilized in this study. Each waste material was put in a mesh bag and buried in the ground for 2 months under 3 levels of soil moisture: dry, field capacity, and submerged. This experiment was conducted in natural temperatures: a) high temperature (August – October); b) moderate temperature (October – December); c) low temperature (January – February), and the averages of temperatures were shown in the figures. Each treatment had 3 replications. Decomposition rates were estimated through percentages of the decreased weight of each waste material after finishing each experiment of different temperatures.

Results and Discussion: The study revealed that percentages of decreased weights were different among materials and treatments (Fig.1). Further, it was found that each temperature level and soil moisture effected on weight decrease, i.e. the percentage of weight decrease of rice straw was the highest and the second one was bagasse. Noticeably, the percentages of weight decrease of materials were more dominant in field capacity soil than submerged soil. Significantly, when levels of temperature were higher, percentages of weight decrease were also increased. In contrast, dry soil was not significantly different effecting on weight decrease of materials in all levels of temperature. In short, it was found that these interactions under different soil moistures and levels of temperatures were significantly different only effecting on percentages of weight decrease of rice chaff, rice straw, and coir dust. At the end of the experiment it was obviously found that soil moistures and levels of temperatures that effecting on changing chemical components, such as total N (Fig.2), total C (Fig.3), and C/N ratio (Fig.4) of rice straw. Further, it was found that field capacity soil under low temperature tended to increase total N comparing with such a high temperature whilst the amounts of total C of waste materials was changed a little. However, C/N ratio of bagasse and coir dust tended to decrease when temperatures were high.

Conclusion: Each level of temperature and soil moisture effected on weight decrease of waste materials, specifically, rice chaff and rice straw, and they also effected on chemical components of waste materials, particularly, coir dust and rice straw.

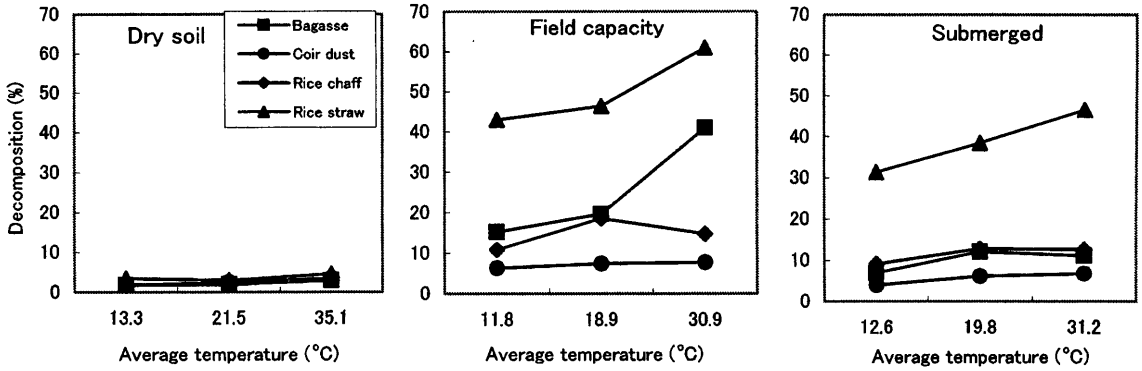

Fig.1 The percentages of weight decrease of waste materials under the different soil moistures and temperatures.

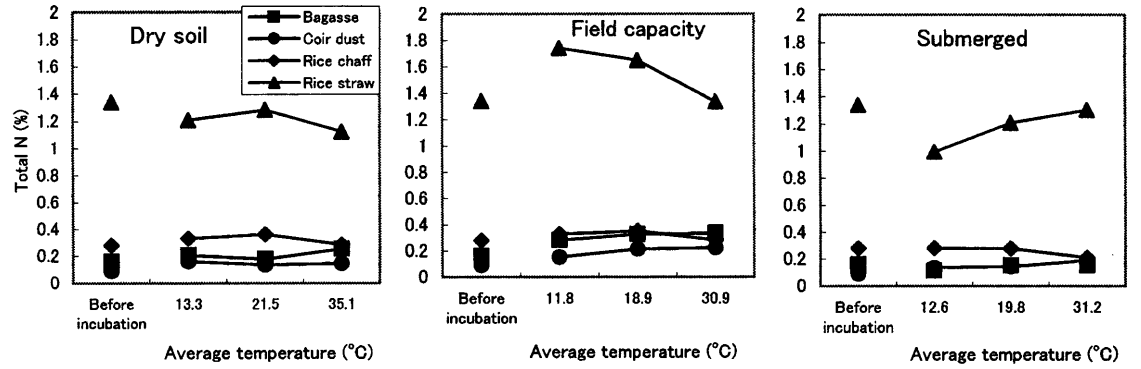

Fig.2 The total N of waste materials after decomposition period.

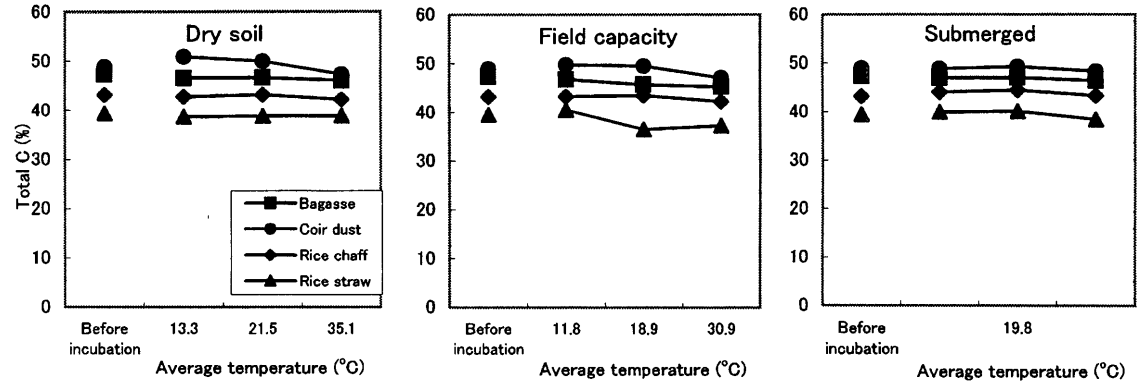

Fig.3 The total C of waste materials after decomposition period.

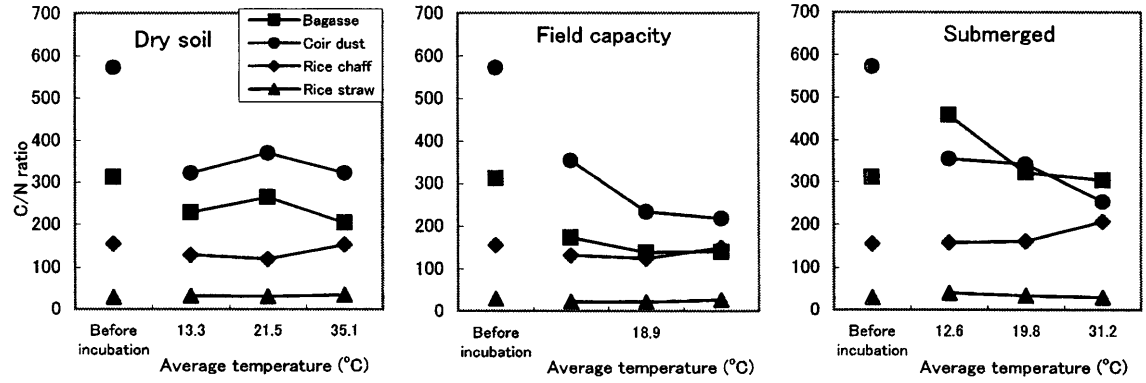

Fig.4 The C/N ratio of waste materials after decomposition period.