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99

Effects of C-N ratio adjustment on the decomposition rate of bagasse and coir dust in different soil moisture and temperature

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バガスとココヤシ繊維の土壌中での分解に関する尿素添加の効果

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Introduction: It is accepted that there is a limitation of the study of decomposition of waste materials that are difficult to be decomposed. Considering on the main point of these waste materials, it is beneficial to use these matters to improve soil in the tropical area since it is resistance to be decomposed. Last year, we reported already the extremely difficulty of decomposition of coir dust comparing with bagasse in various environments. Their C-N ratio of 572 in the former and 312 in the latter might control the decomposition. Thus, this study was conducted on the weight decreases of bagasse and coir dust to evaluate the rates of decomposition, and these wastes were same C-N ratio of 5 adjusted by nitrogen fertilizer that were buried under the ground in various environmental conditions.

Materials and Methods: Each waste material (4 g) was put in a mesh bag and buried in the ground (1 kg) for 2 months under: a) 3 levels of soil moisture [i.e. 1/2field capacity, field capacity, and submerged]; b) 2 levels of temperature (i.e. 20 and 35°C); and c) 2 proportions of chemical fertilizer (urea, 46%N) [i.e. 0 and 0.81 g (for bagasse) or 0.84 g (for coir dust)]. Each treatment had 3 replications. Decomposition rates were estimated through rates of the decreased weight of each waste material. At the end of treatment chemical components of each waste material were analysed, e.g. total N, total C, and C-N ratio, respectively.

Results and Discussion: There was no effect of the adjustment on the decomposition of coir dust, while the decomposition of bagasse was enhanced by the adjustment at 1/2field capacity and field capacity at 35°C (Fig.1). The results suggest that there is other factor to control the decomposition of coir dust than higher C-N ratio of material. And C-N ratio adjustment is not so effective in low temperature even though bagasse. On the other hand, the adjustment did not significantly effect on chemical components of each waste material (Table 1). However, it was revealed that the treatment that had adjustment at 1/2field capacity and field capacity at 35°C tended to make total N higher because those moisture and high temperature effected each waste material on releasing more nitrogen. Further, both waste materials had pith or binding materials as components, thus nitrogen from fertilizer was absorbed into those structures while C-N ratio of each waste material decreases comparing with the treatment that had no adjustment comparing with the same moisture at 20°C.

Conclusion: There was no effect of the adjustment on the decomposition of coir dust, while the decomposition of bagasse was enhanced by the adjustment at 1/2field capacity and field capacity at 35°C. On the other hand, the adjustment did not significantly effect on chemical components of each waste material.

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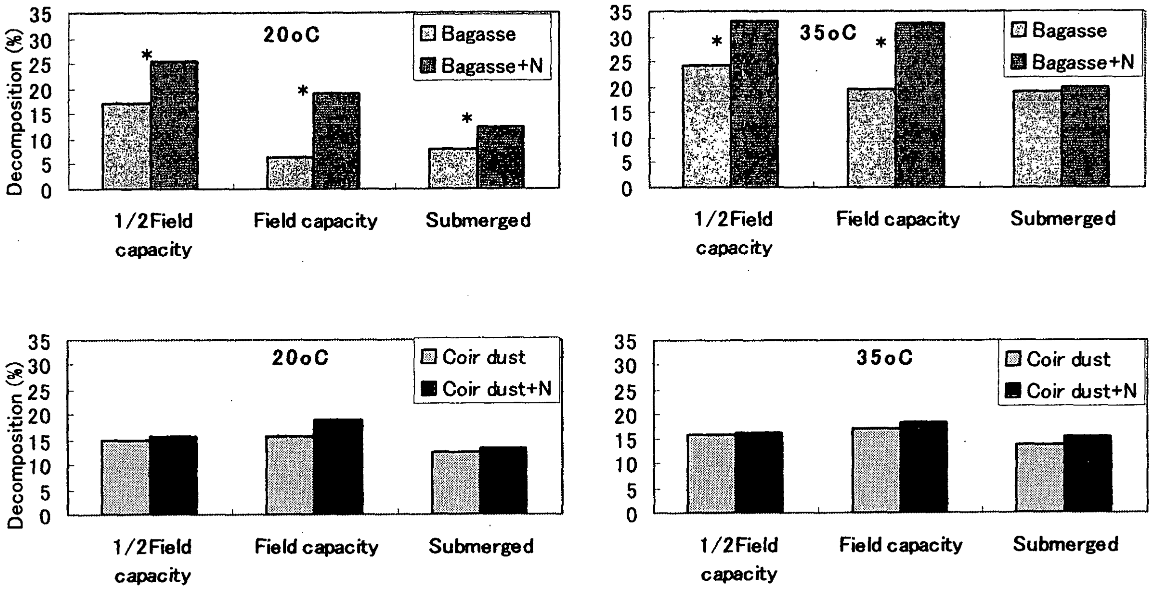

Fig.1 The rates of weight decrease of bagasse and coir dust under the different soil moistures and temperatures

Table 1 Comparison of chemical components of bagasse and coir dust before and after decomposition period.

Treatments	Total N (%) 20°C	Total N (%) 35°C	Total C (%) 20°C	Total C (%) 35°C	C-N ratio 20°C	C-N ratio 35°C
Before experiment	0.1593 c*	0.1593 c	47.32	47.32	312 a*	312 a
Bagasse, 1/2field capacity	0.3304 b	0.3558 b	45.77	44.99	140 b	135 b
Bagasse, field capacity	0.3105 bc	0.3109 bc	45.72	44.64	148 b	144 b
Bagasse, submerged	0.1624 c	0.1666 c	46.16	45.18	300 a	298 a
Bagasse+N, 1/2field capacity	0.5133 a	0.5236 a	45.14	45.12	90 b	89 b
Bagasse+N, field capacity	0.5253 a	0.5902 a	45.56	45.37	87 b	84 b
Bagasse+N, submerged	0.2983 bc	0.3138 bc	46.46	46.14	159 b	147 b

Treatments	Total N (%) 20°C	Total N (%) 35°C	Total C (%) 20°C	Total C (%) 35°C	C-N ratio 20°C	C-N ratio 35°C
Before experiment	0.0872 d*	0.0872 c	48.94	48.94	572 a*	572 a
Coir dust, 1/2field capacity	0.1921 abc	0.2007 b	48.52	47.11	256 bc	244 b
Coir dust, field capacity	0.1990 abc	0.1978 b	48.73	47.13	247 bc	239 b
Coir dust, submerged	0.1459 cd	0.1952 b	49.14	48.22	338 b	274 b
Coir dust+N, 1/2field capacity	0.2325 ab	0.2477 ab	47.58	47.43	205 c	194 b
Coir dust+N, field capacity	0.2584 a	0.2768 a	47.18	47.28	187 c	171 b
Coir dust+N, submerged	0.1739 bc	0.2162 ab	48.23	48.32	285 bc	226 b

*Means within a column followed by the same letter are not significantly different at the 5% probability level by LDS.

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