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Composting of Japanese Cedar Wood Chips and Sawdust

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To evaluate different methods for composting Japanese cedar woodwaste, two types of three-month composting studies were carried out. In the first study, garbage decomposer was used for composting cedar wood chip. In the second study, heat treated sawdust was used. In this case sawdust was mixed with chicken manure. The nitrogen content increase was less than 1% during three months. Heat treated sawdust showed strong inhibition to germination of plant seed before composting but after composting this inhibition disappeared completely. Wood chip from garbage decomposer was applied to the field test of cucumber growth. Plant growth was a little bit higher in the applied section compared to the control section.

Key words: compost, garbage decomposer, Japanese cedar, sawdust,wood chip

1. Introduction

Composting is a very important technique in dealing with woody waste materials. In composting not only woody waste materials but also cattle droppings can be used effectively. They are finally used in agricultural production. Softwoods are usually difficult to deal with in composting since the process takes a long time.[1)2)] To shorten this process, some treatment were tried in this study. One was heat treatment of sawdust, and the other is utilization of garbage decomposer. To degrade wood chips rapidly garbage decomposer is a useful machine. Usually sawdust is used in garbage decomposer and used sawdust has been reused as fertilizer or improving soil quality.[3)4)] Small size chips can be also used in this type of machines and wood chips are rapidly degraded during the machine running. In this study wood chips from garbage decomposer were used in plant growth test to see the validity as fertilizers or soil improvement materials.

2. Materials and methods

Composting: Sawdust consisted of various kind of wood species was used. Sawdust(300kg) and chicken manure(66kg) were mixed and the moisture content was adjusted to 60%. The mixture was heaped in the shape of 1.5m cubic. Sawdust(300g) of Sugi (*Cryptomeria japonica* D. Don) and heat treated sawdust were put into nylon stockings and inserted into the heap of compost. In the heat treatment, sawdust was heated in an oven at 300 ℃ for 3 minutes.

Garbage decomposer: Vertical rotating type garbage decomposer (Shimadzu ECOFRIEND OWD-50) was used for this experiment. Wood chips of Sugi were used for this garbage decomposer. After three months run, wood chips were taken out and screened with 10 mesh screen and separated fine fraction from coarse residual wood chips. The yield

of fine fraction was 60% and coarse fraction was 40%.

Analyses: Carbon and nitrogen were analyzed by CN cordor. Minerals were determined by atomic absorption analysis and colorimetric method with commercially available reagents for soil analyses. Cation exchange capacity (CEC) was determined by Schollenbewrger's method.[5)]

Plant growth test: Cucumber seeds were used for plant growth seeds. In the test field ,four sections were made for control soil ,untreated wood chips, garbage treated fine fraction and coarse fraction. Each section was repeated four times. In each test section, mixture of soil and wood compost was used in the same proportion by volume. After one month growth, the plants were recovered and their dry weight and size of stalk, leaf and root were determined.

3. Results and discussion

Table 1 shows the results of atomic absorption analyses. After composting three months calcium ,potassium, magnesium and sodium cations are incorporated into sawdust. Heat treated sawdust showed slightly higher values in their content. Table2 shows the results of analyses of water soluble fractions of compost. Heat treated sample contained potassium oxide three times higher than control. Nitrogen content in ammonium and nitrate type was also higher in heat treated sample.

Table 3 shows the C,N content and cation exchange capacity of the samples. Nitrogen incorporated into sawdust was higher in heat treated sample and C/N ratio decreased remarkably. The increase of cation exchange capacity was not so high. During the composting the color of heat treated sample turned to black while untreated sample was brown. The original wood meal has strong inhibition against germination of plant seeds but after composting this inhibition was completely removed in both heat treated sample and untreated sample. Heat treatment would be useful to increase the nitrogen and mineral content in the sawdust during the composting. In this test it was difficult to prepare enough amount of wood meals from the specific kind of wood spices. The amount of samples of pure Sugi wood meal were so small that large scale plant growth test could

Table 1 Cation analyses of the samples.

Sample	Ca (me/100g)	Mg (me/100g)	K (me/100g)	Na (me/100g)
Original sawdust	3.49	1.23	1.99	1.92
After composting	8.44	16.35	28.75	3.46
Heat treated	9.84	21.86	32.79	3.60

Table 2 Analyses of potassium, phosphorus, ammonium and nitrate in the water soluble fractions.

Sample	K_2O (mg/100g)	P_2O_5 (mg/100g)	$N\text{-}NH_4$ (mg/100g)	$N\text{-}NO_3$ (mg/100g)
Original sawdust	-	-	-	-
After composting	45	20	3	10
Heat treated	120	20	10	25

Table 3 C,N ratio and cation exchange capacity of the samples.

Sample	C %	N %	C / N	CEC (me/100g)
Original sawdust	50.73	0.03	1648.89	27.3
After composting	48.42	0.55	88.16	33.9
Heat treated	46.69	0.72	64.65	36.0

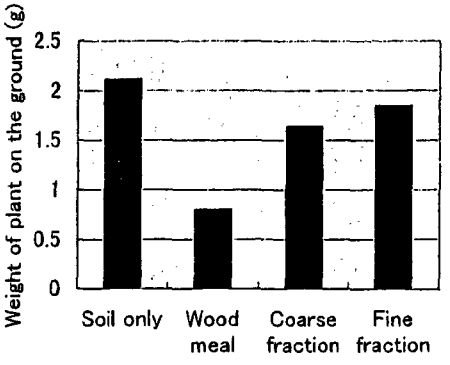

Fig. 1 Weight of plant on the ground.* (* Dry weight)

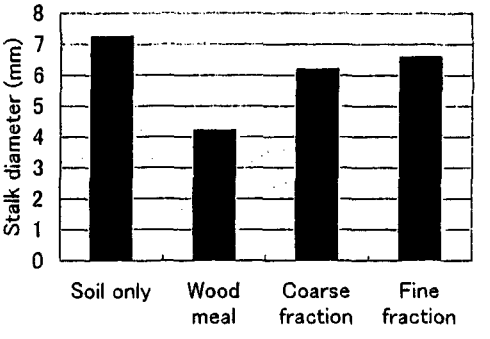

Fig. 2 Stalk diameter.

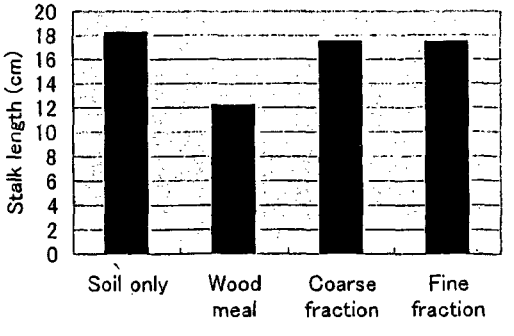

Fig.3 Stalk length.

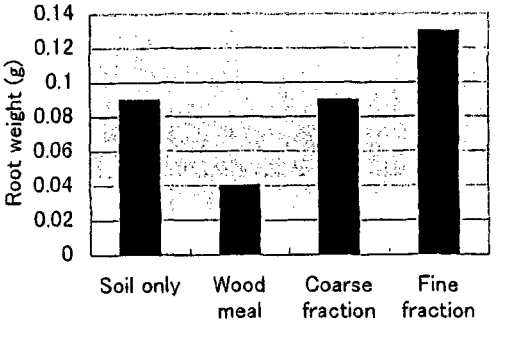

Fig.4 Root weight. * (* Dry weight)

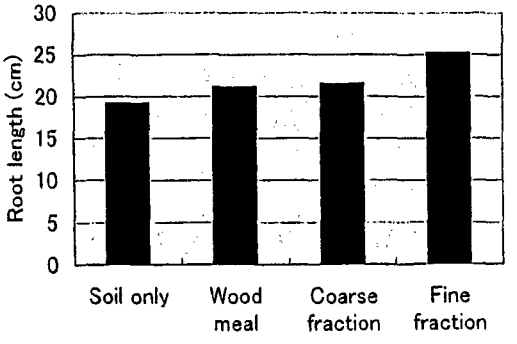

Fig.5 Root length

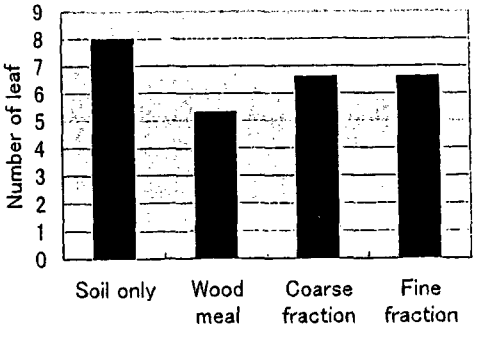

Fig.6 Number of leaf.

Table 4 Analyses of wood chips from garbage decomposer.

Sample	C %	H %	N %	C/N	Ash %
Untreated	50.07	6.18	0.00	-	0.31
1 month	48.82	6.17	0.08	610	6.63
3 months	47.69	6.13	0.11	434	7.08

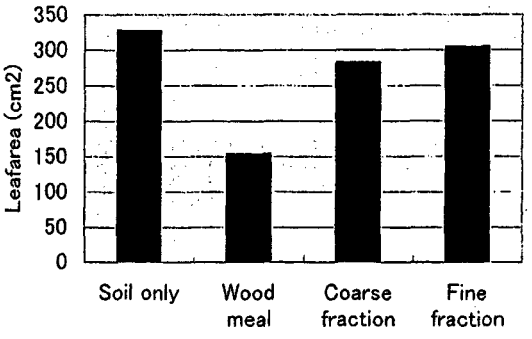

Fig.7 Leaf area.

not carried out. To accelerate the composting process and to obtain enough amount of sample, garbage decomposer was used in the next study. During the decomposition of garbage, wood chips were partially degraded by mechanical mixing and by microorganisms into fine particles. The average size of the wood chips was 10.2mm in length, 5.8mm in width, 1.8mm in thickness. After three months run, the chips were pulverized and 60% of the chips passed 10mesh screen. The color of the chips turned to dark brown. In the plant growth test the section of wood meal showed the tendency of soil surface drying. This is not good for plant seed germination. Wood meal section showed the poor results in this test because of nitrogen shortage. Other sections were not so different from the control soil only section. The results of plant growth test showed from Fig.1 to Fig.7. The weight and size of the plant on the ground were almost the same results except the wood meal section. On the other hand the root growth showed a little improvement in the sections of garbage treated chips. Table 4 shows the analyses of C, N. In the garbage treated chips nitrogen did not accumulate so much even after three months and C/N ratio was not so low to use them as fertilizers. But high ash content indicated that they have much minerals.From these results garbage treated chips have not enough properties as fertilizers but can be used as soil improvement materials.

References

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