EFFECTS OF MULTIPLE-PURPOSE MICROORGANIC COMPOST B2006-32-21 ON PADDY RICE IN DEGRADED AND ALLUVIAL SOIL IN THE NORTH OF VIETNAM

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SUMMARY

Multiple-purpose Microorganic Compost (MMC) has a significant effect on paddy rice, such as increases of height, increases of number of ears, and reduction of pest and disease infections compared to chemical fertilizers alone. In particular, applying MMC increased the yield of rice in the alluvial soil of the Red River Delta in Gia Lam (Hanoi) by 0.35 ton/ha and in degraded soil in Hiep Hoa (Bac Giang province) by 0.43 ton/ha. MMC also contributes to soil reclamation, improves soil fertility, and increases the micro-organism population in areas. However, MMC showed a higher effect on rice that was planted in degraded soil in Hiep Hoa compared to alluvial soil in Gia Lam.

Keywords: Multiple-purpose Microorganic Compost, alluvial soil, degraded soil, paddy rice, Gia Lam, and Hiep Hoa

1. INTRODUCTION

In the world, products of microorganic compost have been increasingly used as fertilizer for crops since the begining of the XX century.

In Vietnam, microorganic compost had been studied since 1960s.

However, it was only paid attention by the central government from 1984 with a research project No. 52D-01-04. The subsequent projects were KC 08-01; KC 08-20; KHCN 02-06 A, B; KC 04-04. Beside these, there were a number of ministerial level projects such as project No. B99-32-46; No. B2001-32-09; and No. B2003-32-66.

Thus several new microorganic composts that applied to agriculture were found. Those composts significantly contribute to improvement of agricultural productivity and sustainability in Vietnam.

This paper presents the effects of MMC on paddy rice planting in alluvial and degraded soil during the two-year experiment (2006-2007).

2. MATERIALS AND METHODS

The experiment was conducted is rice variety Khangdan in alluvial soil (Gia Lam - Hanoi) and degraded soil (Hiep Hoa - Bac Giang).

Several biophysical and chemical characteristics of the soil befor and after planting paddy rice.

Research methodology

Several biophysical and chemical characteristics of the soils were analyzed by commonly used methods in the JICA labs and Soil Microorganism labs at the Hanoi University of Agriculture.

Treatments were designed randomly including 3 treatments and 3 replications. Each treatment was 20 m^2 in area and surrounded by a protection range.

Control (C): 100 kg of N + 90 kg of P_2O_5 + 75 kg of K_2O

Treatment 1 (T1): 0 kg of N + 90 kg of P_2O_5 + 75 kg of K_2O + 500 kg of MMC

Treatment 2 (T2): 50 kg of N + 90 kg of P_2O_5 + 75 kg of K_2O + 500 kg of MMC

Treatment 3 (T3): 100 kg of N + 90 kg of P_2O_5 + 75 kg of K_2O + 500 kg of MMC

3. RESULTS AND DISCUSSION

Soil analysis before the treatment

Table 1. Some biochemical characteristics of the soils before the treatment (spring 2006).

Criteria	Soil type	
	Alluvial soil (Gia Lam)	*Degraded soil (Hiep Hoa)*
pH_{kcl}	6.20	4.84
OM (%)	3.17	2.25
P_2O_5(%)	0.10	0.07
Available P_2O_5 (mg/100g)	16.20	9.80
K_2O(%)	0.12	0.09
Exchangeable K_2O (mg/100g)	21.50	19.10
Total aerobic bacteria (x 10^4CFU/gram of soil)	6,786.00	3,189.00
Total anaerobic bacteria (x 10^4CFU/gram of soil)	5,032.00	2,245.00
Total fungus (x 10^4CFU/gram of soil)	15.82	16.27
Actinomycetes (x 10^4CFU/gram of soil)	36.2	28.22

Data in Table 1 show that the biochemical characteristics of alluvial soil in Gia Lam are relatively higher than the degraded soil in Hiep Hoa.

Treatment of MMC B2006-32-21

Table 2. Quality of MMC B2006-32-21.

Criteria	Analyzed result	Vietnamese standard TCVN134B.1996
pH_{kcl}	7.2	6 - 8
OM (%)	19.6	>17
Moisture (%)	31.5	25 -35
Azotobacter chrococcum (10^6CFU/gram of compost)	293.0	>10^7CFU/gram of compost
Bacillus subtilis (10^6CFU/gram of compost)	27.0	>10^7CFU/gram of compost
Enterobacter sp (10^6CFU/gram of compost)	31.0	>10^7CFU/gram of compost
Impurity (%)	<1.0	<5

Table 2 shows that the quality of MMC is with following criteria: pH = 7.2; OM = 19.6%; moisture = 31.5%; *Azotobacter chrococcum* = 293 x 10^6CFU/gram of compost; *Bacillus subtilis* = 27 x 10^6CFU/gram of compost; *Enterobacter sp* = 31 x 10^6CFU/gram of compost; and impurity <1 %. All of these criteria are higher than the Vietnamese standard TCVN134B.1996.

Effects of MMC B2006-32-21 on paddy rice planting in alluvial soil in Gia Lam (Hanoi)

Table 3. Effects of MMC B2006-32-21 on paddy rice grown in alluvial soil in Gia Lam (Hanoi).
(Average of treatments in three crops)

Treatment	Criteria			
	Height of plant during stem elongation (cm)	Number of ears / clump	Pest and disease infection (%)	Harvest (ton/ha)
C	75.42	4.53	100	5.72
T1	72.93	4.61	48	5.48
T2	77.34	4.90	51	6.34
T3	80.37	4.75	59	6.07
LSD 5%	3.22	0.13	11	0.23

Effect of MMC is highest in T2, with height of the plant at 77.34 cm (stem elongation stage); 4,9 ears/clump, and pest and disease infection reduced to 51% of the C (control). In T2, rice yield was 6.34 ton/ha which is 0.62 ton/ha (or roughly 11%) higher than that of the control. Similarly, rice yield of T2 is 0.86 ton/ha (or 15%) and 0.27 ton/ha (or 4%) higher than that of T1 and T3, respectively. Rice yield of T3 is 0.35 ton/ha higher than that of C. This means that one kg of MMC helps generate 0.7 kg of rice. With the total input of 500 kg of MMC for one ha of rice, additional 350 kg of rice is expected. Taking into account the price of MMC and of rice, financially one VND invested on MMC generates 2.1 VND in return.

Effects of MMC B2006-32-21 on rice grown in degraded soil in Hiep Hoa (Bac Giang)

Table 4. Effects of MMC B2006-32-21 on paddy rice planting in degraded soil in Hiep Hoa (Bac Giang).
(Average of treatments in three crops)

Treatment	Criteria			
	Height of plant at breeding stage (cm)	Number of ears / clump	Pest and disease infection (%)	Harvest (ton/ha)
C	64.20	4.21	100	5.15
T1	60.51	4.50	61	4.87
T2	66.87	4.65	57	5.72
T3	69.25	4.62	66	5.58
LSD 5%	2.88	0.11	9	0.18

Data in Table 4 show that the effect of MMC is positive in infertile soil. For instance, rice yield of T3 is 0.43 ton/ha higher than that of C. This means that one kg of MMC helps generate 0.86 kg of rice. With the total input of 500 kg of MMC for one ha of rice, an additional 430 kg of rice is expected. Taking into account the price of MMC and of rice, financially one VND invested on MMC generates 2.6 VND in return.

Effects of MMC B2006-32-21 on soil biochemical characteristics

Table 5. Effects of MMC B2006-32-21 on soil biochemical characteristics.
(Average of C and treatment 3 in three crops)

Criteria	Soil type			
	Alluvial soil (Gia Lam)		Degraded soil (Hiep Hoa)	
	C	T3	C	T3
pH_{kcl}	5.90	6.40	4.55	5.30
OM (%)	3.20	3.28	2.31	2.40
P_2O_5 (%)	0.10	0.11	0.08	0.08
Available P_2O_5 (mg/100g)	16.80	17.30	10.50	12.10
K_2O (%)	0.11	0.13	0.09	0.10
Exchange K_2O (mg/100g)	20.50	21.70	19.20	19.60
Total aerobic bacteria (x 10^4CFU/gram of soil)	5,432.00	6,896.00	2,987.00	3,245.00
Total anaerobic bacteria (x 10^4CFU/gram of soil)	4,898.00	5,123.00	2,413.00	2,657.00
Total fungus (x 10^4CFU/gram of soil)	9.88	17.42	12.50	16.97
Actinomycetes (x 10^4CFU/gram of soil)	18.64	41.06	15.75	31.27

Data in Table 5 shows that values of biochemical characteristics of soils are lower in C than T3.

4. CONCLUSIONS

Compared to chemical fertilizers, Multiple-purpose Microorganic Compost (MMC) has a significant effect on paddy rice. It would increase the height of rice, increase the number of ears, and reduce pest and disease infection. In particular, yield of paddy rice planting in alluvial soil in Gia Lam (Hanoi) (T3) is 0.35 ton/ha higher than that of C (the control). This means that one kg of MMC would generate 0.7 kg of rice. In this case, the return on the financial investment is 2.1 times. Similarly, in degraded soil in Hiep Hoa (Bac Giang) paddy rice yield of T3 is 0.43 ton/ha higher than that of C. This means that one kg of MMC would generate 0.86 kg of rice and the return on the financial investment is 2.6 times.

MMC contributes also to improvement of soil fertility and the increase of micro-organism populations in both the alluvial soil of Gia Lam and the degraded soil of Hiep Hoa. However, MMC showed a higher effect on rice grown in degraded soil in Hiep Hoa compared to alluvial soil in Gia Lam.

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