Preliminary Results of Effective Microorganisms (EM) Application in Vietnam

Nguyen Quang Thach, Cao Anh Long, Vu Van Liet, Nguyen Van Trung, Nguyen Xuan Thanh, Tran Van Dich, Nguyen Duong, Nguyen Khac Tuan, Le Thi Hong Xuan and Pham Van Dan
Hanoi Agricultural University, Vietnam

Abstract

To study the effect of EM and to demonstrate its applicability to the users in farming and farm-related activities in Vietnam, a number of experiments were conducted. Two rice cultivars treated with EM at planting with 5 replications exhibited more vigorous growth and no leaf yellowing at high temperature as compared to the control. Although orchids are slow-growing plants, treatment with EM exerts pronounced effect: larger stem, darker green leaves and accelerated flowering response. The most distinct effect of EM that has been found is its effect of removing the stinking odor from sewage systems in human settlements, pigsty , chicken house, dog breeding station and feather and bone processing factory. The effect of EM on physical and chemical properties of soil and soil microorganisms has been also studied.

Introduction

The Hanoi Agricultural University (HAU) has established a working team to implement applications of EM in all areas of agronomy, animal husbandry and veterinary, soil science, environment etc. The team is led by Dr. Nguyen Quang Thach and consists of top experts. There are four centers at HAU that absorb advanced technologies and develop models/pilots pertaining to Vietnam's conditions. It is these centers that conduct experiments on and dissemination of EM technology. We have given guidance to hundreds of students at HAU and to about 200 participants, including scientists, leaders of the provinces, districts and communes, and farmers of five EM training courses. HAU has assisted several provinces in applying EM technology such as Quang tri, Nghe an, Vinh yen, Phu tho, Tuyen quang, Hai phong.

Materials and Methods

1. Rice

Experiment with rice was carried out on cv. CR 203 with 3 treatments (on hectare basis)

Table 1. Treatments on Rice Experiment

Treatment 1	Treatment 2	Treatment 3
No EM	6 Liters EM_1	6 liters EM_1
6 tones of animal manure	6 tones animal manure	6 tones animal manure
100 kg N, 60kg $P_2O_5$and 40kgK	50 kg N, 30kg $P_2O_5$and 20kgK	

EM solution was diluted to secondary solution and it was applied every week from seedling, transplanting to heading. For treatments 2 and 3, experimental land has not been prepared (ploughed and harrowed) and no pesticides were used.

Results

Results are presented in Tables 2, 3, 4 and 5

Table 2. Effect of EM on Seedling of CR203 Rice Variety, Experimental Station (ES), HAU, 1997 Vietnam

Treatment	Seedling Vigor (Score)	Seedling Height (cm)	No. Leaf/ Seedling	No. Tillers/ Seedling
T1 (Control)	5	26.5	6.5	1.5
T2	3	27.0	6.5	1.8
T3	5	24.5	6.0	1.8

Table 3. Effect of EM1 on Resistance of CR 203 Rice Variety at the ES, HAU, 1997 Vietnam

Treatment	BYS	BL	BS	BB	LF
T1	9	3	7	4	7
T2	5	1	5	2	3
T3	1	0	3	1	1

BYS – Bacterial yellowing stripe, BL – Blast, BS – Brown spot,
BB – Bacterial blight, LF - Leafolder

EM treatments increased the level of resistance of CR203 rice variety to diseases and insects, from August 4th, 1997 to August 11th 1997. On the field appearance of bacterial yellowing stripe disease (*Pseudomonas sataviad*), the control was seriously infected while plants treated with EM1 (T2 & T3) did not show any damage. Also EM1 treatment improved resistance to other pests such as leaf blast (*Magnaporthe grisea*) bacterial blight (*Xanthomonas oryzae*), brown spot (*Cochliobolus miyabeanus*), sheath blight (*Thanatephorus*) and leaf folder (*Cnaphalocrosis medinanis*) of CR 203 rice variety.

Table 4. Effect of EM1 on Yield and Yield Components of CR 203 Rice Variety at the ES, HAU, Summer Season 1997 Vietnam

Treatment	Day to 50% Flowering (day)	Plant Height (cm)	Effective Tillers (No/Hill)	Spikelets Fertility/Hill (No.spike)	1000 Grain Weight (gr)	Add. Grain Yield (t/ha)
T1 (Control)	99	89.0	4.1ab	96b	24.0	4.73
T2	94	88.3	4.5b	112a	24.8	5.57*
T3	90	89.3	3.8a	110a	24.2	4.51^{NS}
cv(%)			9.1	7.9	8.0	
LSD(5%)			0.68	15.02		0.68

Table 5. Yield of Rice After Harvest (Ton/Ha)

	R1	R2	R3	R4
T1	4.50	4.20	4.15	4.28
T2	4.70	4.30	4.25	4.42
T3	4.60	4.30	4.45	4.45
Rep totals	13.80	12.80	12.85	13.15
Rep means	4.60	4.27	4.28	4.38

2. Orchids (Dendrobium)

Materials and Methods

The experiment consisted of three treatments : No EM as control; EM1 + EM5 and EMFPE plus EM5. Secondary solutions were diluted 1: 200 and applied every ten days.

Results

Results are given in Tables 6, 7, 8 and 9.

Table 6 Effect of EM on Growth of Plant lets

				Leaf Growth			
		Plant Height (cm)		Length (cm)		Width (cm)	
Treatment	Survival (%)	5 Aug.	5 Sept.	5 Aug.	5 Sept.	5 Aug.	5 Sept.
Control	92.2	1.88	2.22	5.18	6.50	0.90	1.22
EM_1+EM_5	96.5	2.86	3.46	6.84	7.69	1.24	1.54
Em_{fpe}+EM_5	95.5	2.48	3.06	6.90	8.26	1.30	1.60

Table 7. Effect of EM on Growth of 5 Month Old Plants

	Plant Height (cm)		Leaf growth			
			Length (cm)		Width (cm)	
Treatment	**30 May**	**30 Jun**	**30 May**	**30 Jun**	**30 May**	**30 Jun**
Control	3.36	4.50	9.45	11.00	1.31	1.41
EM_1+EM_5	3.35	4.89	9.42	12.25	1.30	1.49
Em_{fpe}+EM_5	3.36	4.88	9.47	12.05	1.30	1.51

Table 8. Effect of EM on Growth of Mature Plants

	Plant Height (cm)		Leaf Growth				Percentage of Flowering Plants	
			Length (cm)		Width (cm)			
Treatment	**15 Jul**	**15 Sept.**	**15 Jul.**	**15 Sept.**	**15 Jul.**	**15 Sept.**	**30 Jun.**	**16 Sept.**
Control	18.1	27.4	13.4	14.8	2.85	3.37	19.9	22.2
EM_1+EM_5	17.5	30.8	13.5	16.9	2.87	3.65	40.0	50.7
Em_{fpe}+EM_5	18.0	31.3	13.3	16.2	2.84	3.58	37.6	46.6

Table 9. Effect of EM on Yield and Quality of Flowers

Treatment	Length of Flower Branch	No. of Flowers per Branch	Flower Diameter (cm)
Control	36.0	5.2	7.85
EM_1+EM_5	39.8	7.2	8.50
Em_{fpe}+EM_5	40.7	7.1	8.40

3. Rootstocks of Fruit Crops

Materials and Methods

500 x dilution of secondary solution was applied on rootstocks of Litchi, longan, custard apple every 10 days.

Results

Results are presented in Tables 10,11 and 12.

Table 10. Effect of EM on Growth of *Litchi* Rootstocks

	Plant Height (cm)			Stem Diameter (mm)			No. of Leaves		
Treatment	**Prior to Spray**	**30 d. after Spray**	**60 d. after Spray**	**Prior to Spray**	**30 d. after Spray**	**60 d. after Spray**	**Prior to Spray**	**30 d. after Spray**	**60 d. after Spray**
Spraying	22.0	25.3	33.5	3.2	3.9	4.8	5.9	7.7	9.3
No spray	22.3	23.7	27.3	3.3	3.8	4.3	6.1	7.5	8.6

Table 11. Effect of EM on Growth of *Longan* Rootstocks

	Plant Height (cm)			Stem Diameter (mm)			No. of Leaves		
Treatment	**Prior to Spray**	**30 d. after Spray**	**60 d. after Spray**	**Prior to Spray**	**30 d. after Spray**	**60 d. after Spray**	**Prior to Spray**	**30 d. after Spray**	**60 d. after Spray**
Spraying	38.2	41.1	57.3	4.6	6.7	7.5	9.7	13.8	16.7
No spray	36.1	38.2	52.7	4.2	6.0	6.9	9.2	12.2	13.4

Table 12. Effect of EM on Growth of Custard Apple Rootstocks

Treatment	Plant Height (cm)			Stem Diameter (mm)			No. of Leaves		
	Prior to Spray	30 d. after Spray	60 d. after Spray	Prior to Spray	30 d. after Spray	60 d. after Spray	Prior to Spray	30 d. after Spray	60 d. after Spray
Spraying	26.2	29.0	31.1	3.1	3.9	4.3	17.7	19.2	21.5
No spray	25.2	31.2	35.7	3.0	4.1	5.0	16.8	20.0	25.2

4. Soil Microorganisms

Materials and Methods

The experiment was carried out to examine the change in composition of microorganisms in the soils planted with rice and soybean. Two EM treatments were used: one and two litres for 1000 m^2.

For soybean: EM was applied twice, one month after emergence and 10 days after the first application.

For rice: EM was sprayed one and 11 days after transplanting.

Results

Results are given in Tables 13 and 14.

Table 13. Number of Microorganisms

Treatment	Aerobic Bacteria	Actinomycetes	Fungi	Number of Nodules per Soybean Plant
Control	22.23×10^6	1.17×10^4	1.17×10^6	6.25
1 litre/1000m^2	28.67×10^6	2.42×10^4	1.20×10^6	7.75
2 litre/1000 m^2	29.80×10^6	4.60×10^4	3.36×10^6	8.50

Table 14. Number of Microorganisms in Red River Alluvial Soils

Treatment	Aerobic Bacteria	Actinomycetes	Fungi	Height of Rice (cm)
Control	1.3×10^8	3.7×10^5	32.0×10^6	37.81
1 litre/1000m^2	1.4×10^8	6.8×10^5	41.0×10^6	42.20
2 litre/1000 m^2	14.6×10^8	6.0×10^5	89.0×10^6	45.38

5. Chicken Production

Materials and Methods

Number of Hens: 200

Age: 30 weeks old

EM_1 1/1000 applied to drink water and was also sprayed on floor and walls of chicken house.

Hens infected with diarrhea were given EM_1 0.5ml per hen. Diarrhoea of these hens was removed.

Table 15. Effect of EM on the Hen Production

	Prior to EM Application (Control)	After Using EM
Egg yield	100%	110%
Diarrhea	1-%	Disappear
Smell of cage	Very bad	No smell
Abnormal eggs	5%	0

NH_3,H_2S, Valeric acid, Butyric acid, etc. of the air in chickenhouse will be analyzed in future experiments.

Cleaning of Professional Dog House

Professional dog centre has 100 male and female dogs. Before using EM, the smell was very bad. We applied EM secondary solution 1:300 at 1 litre/m^2 dog cage. Bad smell was lost.

Many farmers used EM : Spraying EM secondary solution 1:300 (1 litre/m^2 pig cage): the air of pigsty was clean, pig waste decomposes very fast.

We helped many farmer families and feather and bone processing factory to remove the bad odor and obtained very good results.

Conclusions

- Preliminary results on EM at Hanoi Agricultural University and in some localities have confirmed the positive and diverse effects of EM technology on a wide range of studied objects.
- Use of EM might substitute for chemical fertilizers, enhanced plant growth and increased resistance to insect pests and diseases, shortened growth duration of several agriculturally important crops: rice, flower and fruit crops. Moreover, the use of EM reduced production cost of rice.
- Use of EM in livestock husbandry increased resistance of animals to disease infection and growth and removed the stinking odor from animal house (pigsty, chicken house).
- Treatment of soils with EM increased the number of aerobic bacteria, actinomycetes and fungi. However, the increase in number of nodules in soybean roots was not significant.