Role of Effective Microbes in Integrated Pest Management Programmes in Vietnam

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Abstract *: EM (Effective Microorganisms) were used to assess and evaluate its efficacy in controlling insect pests and diseases of rice, tomato, cucumber, cabbage, maize, soybean. Laboratory and field trials of EM products have been conducted since early 1997 with the aim to include as one alternative measure in IPM programme in Vietnam. Methods of EM application were basically based on the technical guidelines for the EM preparation and application with a little modification. The EM products EM1, EM5, EM-FPE, and EM Bokashi were applied for pest management. In order to verify EM's effectiveness several in-vitro tests were conducted prior to do the field trials. Results indicate that EM. EM5-FPE separately sprayed in rice and EM5 + EM-FPE in mixture can reduce bacterial leaf blight (BLB) and sheath blight disease incidence about 30%. As the result the rice yield was increased nearly 8% compared to untreated plot. Though having no significant difference in insect pests density, the use EM-Bokashi, EM, and EM-FPE positively effect plant growth of cucumber, giving 3.9-10.1% yield higher than untreated plot. For watermelon crop the EM is able to enhance the field resistance level to the pests such as collar rot disease, caterpillar insect pest Heliciverpa armigera, etc. EM products sharply decrease density of Diamond Back Moth (DBM) of cabbage, from 206.7 adults per plant down to 81.3 and 15.3 in the EM5 and EM-based IPM plots, respectively. The yield of cabbage grew up nearly twice in EM treated plot. In a large scale of 16.6 ha the EM was used in six crops and show good results in pest management, keeping pest threshold at lower economic level. The net income for EM use in cabbage against DBM has achieved about 4.099.000 Vietnam dong per ha, significantly reducing labor cost and chemical pesticides. EM can be used in IPM practices as one alternative measure to minimize chemical pesticides sprays, subsequently saving input cost, protect environmental pollution and food health.*

Introduction

Since 1996 EM has been introduced to Vietnam and undergone a series of screen house and field testing. It revealed that EM can be used as one alternative control measure in the increasingly IPM programme in Vietnam. Results obtained from these experiments have being used widely in Vietnam, particularly in crop protection. This paper is aimed to contribute research results in the field of insect pests and diseases control of agricultural importance.

Materials and Methods

Agricultural crops including rice, tomato, cucumber, cabbage, maize and soybean were cultivated according to the designed treatments with 3 replications and used for EM application in various formulations. The stock EM has been prepared in EM, EM, EM-FPE and EM-Bokashi, which were used at different times according to each experimental design. Field monitoring and observation have been done based on the agricultural field research guidelines and standard methods of crops protection. Data sampling and analysis were recorded and processed with a statistical method.

Results and Discussion

Rice

The experiment was laid out in Kim bang (Hanam) and Van giang (Hung yen) with rice variety Khang dan.

Table 1. Effect of EM on the Height of Rice Plant

Treatment *	Plant Height after Transplanting cm		
	30 DAT**	45 DAT	60 DAT
1	61.3	75.9	88.6
2	62.7	81.0	89.5
3	65.4	78.6	90.0
4	64.7	79.4	91.0

Note : * 1 - Control plot with manure 300 kg + 6 kg urea + 10kg Super Phosphate + 3kg Potassium sulfate per 360 M^2 as one sao unit; 2- Replaced manure by Bokashi 150 kg sao^{-1}; 3- As control plot plus EM5 and EM-FPE spays beginning at 10 DAT with interval 10 days; 4- As control plot plus the secondary EM (500^{-1}) sprays weekly beginning at 10 DAT.
** DAT - days after transplanting

In all treatments with EM the rice plants have a little taller plant height, leaf blade larger; more healthy and greener than control plot. Subsequently, some insect pest density and disease incidence were low, reducing about 30% of damage (table 2).

Table 2. Impact of EM on Reducing Insect Pest and Disease Incidence

Treatment	Sheet Blight Leaf Infected %	BLB* Leaf Infected %	Leaf Folder Number of Folders in M2	Stem Borer White Heads at Milky Stage,%
1	19.6	10.4	4.0	0.91
2	14.7	10.5	3.9	0.85
3	9.75	6.2	1.6	0.40
4	10.05	6.25	0.90	0.35

Note : * BLB- Bacterial Leaf Blight

Among insect pests and diseases the EM showed a good result in reducing the disease incidence, especially for bacterial leaf blight as one major and difficult target disease to manage by other chemical pesticide.

Soybean

The experiment done in vitro against *Rhizictonia solani* as pathogen for wide range of host plants indicated that the EM can antagonize the growth ability of the pathogen. The EM-FPE is the best to antagonize the pathogen among EM1, EM5 and its efficacy was the same of Bavistin 0.2%, reducing about five times as compared to untreated control. The field experiment was set up to examine the EM effect on soybean yielding characteristics and showed that TM is very sensitive to soybean growth, enhancing vigorously plant size, healthy and tolerant to key pests and diseases. The soybean yield was increased 37-48% higher than control plot.

Cabbage

The experiment was aimed to assess the EM's ability to diminish population of Diamond Back Moth (DBM) and plant stimulatory.

Table 3. Effect of EM on Reduction of DBM and Yield Cabbage

Treatment*	10 DAT	36 DAT	58 DAT	Yield, ton ha^{-1}
1	16.0	23.7	125.0	4.72b
2	19.0	17.7	81.3	4.69c
3	18.3	17.7	107.0	4.57c
4	24.3	72.3	026.7	2.36a

* Note: 1- Bokashi + EM5 + EM-FPE; 2-Manure + EM5; 3- Manure + Spray EM-FPE; 4-Manure + no chemical spray

In all EM's treatment the DBM density was lower compared to control plot at all monitoring times. Treatment number 2 and 3 showed better results than of number 1 and 4. The treatment 1 gave twice the yield than in treatment number 4.

Cucumber

One sensitive crop for EM application is cucumber, which showed very potential result in managing anthracnose and damping-off diseases.

Table 4. Impact of EM on Reduction of Pest Occurrence in Cucumber

Treatment*	Leaf Miner, Leaf Injured %	Powdery Mildew Disease Incidence %	*Helicoverpa armigera plant*	Damping off Diseases Plants Died %	Yield ton ha^{-1}
1	61.3	17.3	2.7	30.3	2.23
2	64.0	18.7	2.9	29.2	2.35
3	56.0	16.0	2.8	27.4	2.47
4	44.0	13.3	2.3	26.7	2.58
5	66.7	10.7	3.0	29.5	1.29

Note : * 1- spray EM-FPE; 2- use EM5; 3- Bokashi + spray EM5 and EM-FPE; 4- Chemical sprays; 5- Untreated. Plot.

Although data obtained from the experiment were not differentiated among treatments, in all EM used plots the figures of pests were lower and subsequently good yields were achieved with high quality.

Economic Analysis of EM Use

In order to make farmers aware about EM in IPM implementation a large field trial of EM use in cabbage was established with the total area 16.6 ha.

Table 5. Economic Efficacy of EM-used Demonstration Model in IPM Against DBM of Cabbage

No.	Item	Unit	EM-used Demonstration Model	Farmer Practice
1	General input	VNDong	9,200,000	9,200,000
2	Crop protection cost, of which	VND	3,636,900	6,048,000
	EM and related cost	VND	1,368,900	1,728,000
	Pesticides Labour cost	VND	648,000	4,320,000
3	Total expenses per one ha	VND	1,620,000	15,248,000
	(3=1+2)	VND	12,836,900	
4	Yield value	VND	39,474,000	37,786,000
5	Production income (5=4-3)	VND	26,637,100	22,538,000
6	Increase by IPM	VND	4,099,100	

The cost for chemicals and labour sprays were very high in the farmer practice field, meanwhile the EM products were low. This resulted in high net income in the EM-based IPM fields.

Conclusion

In an integrated pest management programme the EM products including EM1, EM5, EM-FPE and EM Bokashi showed very promising results in reduction of insect pests and diseases damages of such crops as rice, cabbage, tomato, cucumber, maize and soybean.

Effective microbes can be used in IPM practices as one alternative measure to minimize chemical sprays and providing healthy crops, which lead to safe and clean agricultural production and environmentaly safe.

Acknowledgements

Authors wish to thank the Vietnam’s government funded project on EM research and also the Vina-Nitchi Centre for their kind support and cooperation for this paper and attending the Conference.

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