

Improvement of Tomato Cultivation by Effective Microorganisms

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Abstract : *Since 1998 environmental agriculture has been reviewed and approved for recommendation in Korea. We are expecting much benefits of environmental agriculture by EM. As a part of implementation research on tomato cultivation with EM was carried out. The results of research was good and will be very useful assistance for government policy. After fermenting by using rice bran 80%, fish meal 15%, sesame dregs 5%, before 20 days of seeding. 200 kg per 0.1 ha was sprayed. Again 200 kg was sprayed at the middle period of growing and late period of growing, respectively. During growing period we sprayed EM and molasses of 500 times liquid every 10 days. Comparing with standard fertilized area, growing was good, and yield increased by 12 %. In the aspect of the insect and disease control the whitefly occurred a little but blossom end rot and bacterial wilt did not occur in EM plot. It occurred only in the standard fertilizer plot. So it was known to effect in the protection of insect and disease control.*

Introduction In 1996 Sekaikyo in Japan invested about US \$ 1.5 million in a Limited company Korin Korea. Its building was set up on the scale of 500 pyong (about 1,650 m²) on the site of 2,000 pyong (about 6,600 m²). Korin Korea officially was registered for supplying microorganism, as a high degree of new technology admired by Korean government. The company began to produce EM from May 1997 and since then has supplied them to farmers. The supply is increasing every year.

In 1998 30 MT were supplied. Also in the same year it was officially registered as a single ingredient of livestock, with a trade mark name Bm-2. It showed that the responses from feeding poultry, swine, milk cow were good, when it was combined with 0.5-1 percent of livestock feed. It has supplied at the rate of 50 MT per month.

Korean government tried to reduce the various negative features of over application of chemical fertilizers, to produce the fresh farm products. The Ministry of Agriculture and Forestry declared the first year of environmental agriculture in December, 1998 and began to review the policy for it, and the method to reduce the level of chemical fertilizer and agricultural chemicals by half every year. To use EM adequately, they showed that some farmers can produce higher than before, with good quality without chemical fertilizers and agricultural chemicals. There are many farm households whose yields are very high with good quality from various farm crops such as a rice, vegetables, fruits, and flowers. Thus, it is expected that these will make a good contribution toward government policy of environmental agriculture.

The impact of EM on tomato yields in Korea, which is our presentation title for this conference is a research result of Professor, J. M. Sung, Department of Biology, Kang Won National University. The experiment was carried out in two plots with different soil characteristics. From both of two pilots experiment with EM the yield

per 0.1 hectare showed that it was higher than that of standard cultivation method with application of chemical fertilizer and agricultural chemicals, in the pilots with 200 kilograms or 400 kilograms of Bokashi. On occurrence of disease and insect pest it also showed the same good results. We think that these will make a great contribution towards government policy of environmental agriculture too.

But some farm households that are beginning to use it are unskillful in the way of making EM Bokashi, and to spray on the ground. Thus some farmers who do not get great effects give up on the way. In the future it is expected that they need thorough training and advice through the mass media.

Materials and Methods

Tomato (*Lycopersicon esculentum*) was tested from May-August 1998 in the experimental field of Kang Won National University. The treatments used are given in Table 1. The area of each plot was 33 m². The pots were replicated thrice. The design of the trial was a RBD. Treatment quantity of the EM Bokashi was 400 kg per 0.1 ha with 300 kg of EM applied one month before planting. For the treatment plot No. 4 (200 kg per 0.1 ha) a spray of 100 kg was used.

In one month, tomato seedlings were planted after dipping the roots with EM diluted 1000 times with molasses for 30 minutes before planting. An additional application of EM Bokashi was made on July 6th during the mid period of growth by spraying the balance 100 kg per 0.1 ha in both plots 3 and 4. After rooting of tomato, EM including the diluent with molasses 500 times was sprayed every 10 days up to harvest- To protect against diseases and insect pests EM 5 was sprayed twice.

Tomato fruits were harvested first at 69 DAP and thereafter every 5 days to five pickings.

Table 1. Plot Number and Treatments

No.of Treatment Plot	Treatment Contents	Remark
T ₁	Untreated control plot	Weeding by hand 2 times
T ₂	Standard fertilization and chemical plot (fertilization application by farm traditional method, and chemical application 3 times)	-do-
T ₃	EM fermentation matter 400 kg per 0.1ha and EM liquid plot during the growing period	-do-
T ₄	EM fermentation matter 200 kg per 0.1ha and EM liquid plot during the growing period	-do-

Table 2. Yield of Tomato in the Four Treatments

Treatment No.	Yield (No. of fruit/33.3m ²)			Average	Test of Significance
	R ₁	R ₂	R ₃		
T ₁	1433.2	1367.2	1484.7	1428.33	C
T ₂	1462.6	1506.7	1428.5	1465.93	C
T ₃	1705.2	1742.0	1675.8	1707.67	A
T ₄	1609.7	1572.9	1536.2	1572.93	B

CV 2.798

Table 3. Weight Survey of Inter-EM Treatments

Treatment No.	Yield (Kg /33. 3m ²)			Average	Test of Significance
	R ₁	R ₂	R ₃		
T ₁	213.2	220.5	264.6	232.77	C
T ₂	242.6	220.5	264.6	242.57	BC
T ₃	294.3	308.7	301.4	301.47	A
T ₄	272.0	257.3	286.7	272.0	AB

CV 7.452

Results and Discussion

As shown in Tables 2 and 3 there was an increasing trend of number of fruits and weight in the 400 kg and 200 kg Bokashi treatments.

They were significant increases based on the Duncan Multiple Range test of significance.

Table 4. Plant Height of Tomato at Four Periods of Growth

Treatment No.	Plant Height(m)			
	33 DAP	45 DAP	60 DAP	75 DAP
T ₁	46.5	81.6	119.2	149.2
T ₂	55.0	90.4	120.8	151.4
T ₃	60.7	99.2	120.4	168.0
T ₄	56.5	97.8	122.6	160.0

Table 5. Number of Flower Cluster of Tomato Between Inter-EM Treatments

Treatment No.	Number of Flower Clusters			
	33 DAP	45 DAP	60 DAP	75 DAP
T ₁	0	2.8	3.8	7.0
T ₂	0	3.2	4.4	7.2
T ₃	0	3.4	4.8	7.8
T ₄	0	3.2	4.6	7.6

- For the growth survey the plant height of experiment crops, the number of flower clusters, and number of fruits were determined. As shown in Tables 4 and 5, EM Bokashi treatments indicated that the number of units and weight were increasing trend in 400kilograms , 200 kilograms EM treatment per 0.1 hectare. But they were similar in EM treatment plot of 400 kilogram and 200 kilogram per 0.1 hectare.

- The survey on major disease and insect pest showed that blossom end rot has occurred in the only standard fertilization application plots, but it didn't appear in the EM treatment plots. Bacterial wilt occurred on only two trees in the untreated control plot on 69th day after planting but it didn't appear in the other treatment plots.
- The pest whitefly occurred a little on all four treatment plots in the second half of growing period. No impact of yield was evident.

Conclusion This experiment was carried out in two different places, but results of both were similar. Thus, only the results from the experiment plots of Kang Won National University are presented.

In Korea, organic farming study club without using chemical fertilizers and agricultural chemicals was organized firstly in 1978 to keep good soil conditions. But yield was reduced by 30-40 percent, and on quality too it was so poor that we couldn't see great progress.

Since we have used EM including diluent with organic to keep good soil conditions, we could see various research data which were higher than those of chemical farming in the aspect of yield and quality. In practice farmers are applying EM to various enterprises and enjoying great benefits. So it is a present situation that the effects are diffused through out the village and rural area at speed.

Also government policies in order to switchover from chemical farming to environmental agriculture from 1999 are speeding up the practical experiments at farm level including research organizations. But there are increasing number of companies to produce various microorganism because of good results from effective microorganism. Thus, farmers are facing a difficulty to choose. On the other hand for the activation of EM fermentation, and to keep the persistence tendency it is necessary to study how to keep the original microorganisms.

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