The Study on the Plant Growth Hormones in EM-A Case Study

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Abstract

Experiments were carried out to determine the presence of endogenous hormones in EM and their activity on the physiology of selected crops and associated effects on plant growth. The solutions of EM contained many hormones, and their effects varied. Laboratory experiment with rice, corn and Chinese cabbage showed that the EM promoted root growth significantly. The impact of EM was not evident in leaf and shoot development. The results suggest the potential of using EM to promote root growth in crops commonly grown in DPR Korea.

Key words: EM, plant growth hormones, endogenous hormones

INTRODUCTION

An important way for increasing the yields of the crops is the scientific and rational use of EM, which was for developed recently. EM is effective not only in fertilizing, but also in improving soil quality, stimulating of crop, increasing tolerance and other functions.

Out of such functions of EM we tried to clear up the growth-stimulation function which had hardly been studied. From this point of view, we measured the contents of IAA, 6BA and GA, contained in EM and examined its growth stimulation, activity.

Materials and Methods

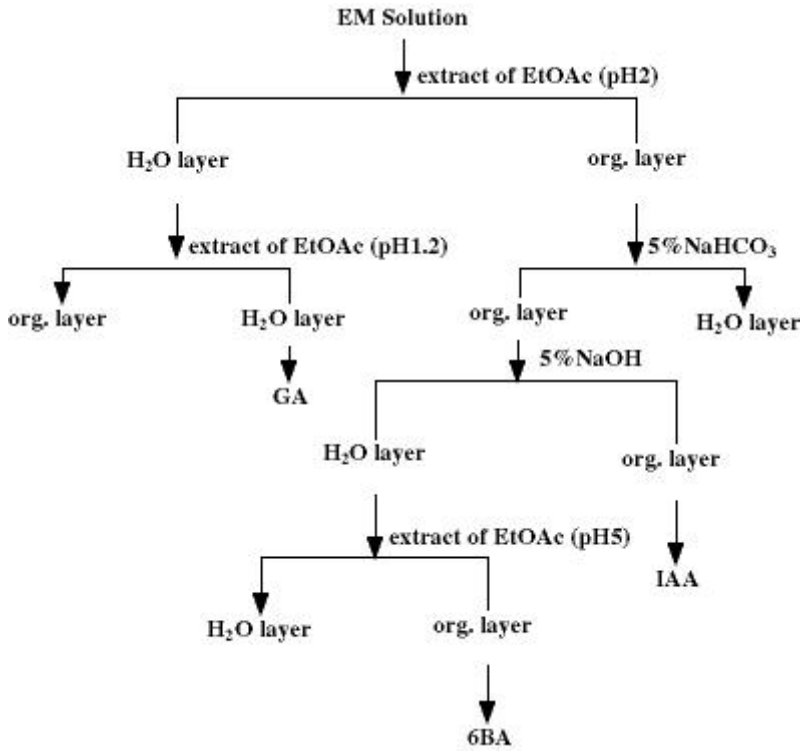

Fig. 1. Separation procedure of plant growth hormones from EM

In experiment, we used EM, which was produced at the EM Research Center.

We separated pure IAA, 6BA, and GA from EM, using acetic ethyl and measured their contents by biological test method (Fig1).

The growth-stimulation activity of IAA was proved by the growth of cucumber stems, the physiological activity of 6BA by the amount of biosynthesis of chlorophyll in etiolated cucumber cotyledon and the destruction of chlorophyll in maize leaves, and that of GA by the growth of rice stalks treated by pp33.

And the efficiency of EM for growth stimulation was examined by following methods without separating IAA, 6BA and GA from EM.

The seeds of rice, maize and Chinese cabbage were soaked in EM diluted of times, and then the diluted EM was sprayed on their leaves.

And added to the medium, following by examining the height of terrestrial stem and the length and number of roots.

All plants were cultivated in the sterilized sand medium.

Every experiment was repeated three times and individuals under examination were 10 plants in each replication.

Result and Discussion

The contents of IAA, 6BA and GA in EM may be different according to products, so several products were analyzed and the results were shown in following table.

As shown in the Table 1, the content of P.G.H. contained in EM is different according to the products.

Table 1. Contents of Plant Growth Hormone in EM

sample*	contents (x 10^{-3} ppm)		
(EM)	**IAA**	**6BA**	**GA**
1	45.2	68.7	49.3
2	42.8	77.1	63.6
mean	44.0	72.9	56.5

*EM diluted with water of 500 times

The difference is greater in GA and the next is 6BA.The difference is title for IAA. The average content is 45x10^{-3} ppm in IAA, 70x10^{-3} ppm in 6BA and 55x10^{-3} ppm in GA.

We studied how active these growth hormones were in stimulating growth.

WE examined the growth of cucumber stems (Fig. 2), and found that the activity is 5.2%, the length in the control being 0.130 mm VS 0.1367 mm in treated plot.

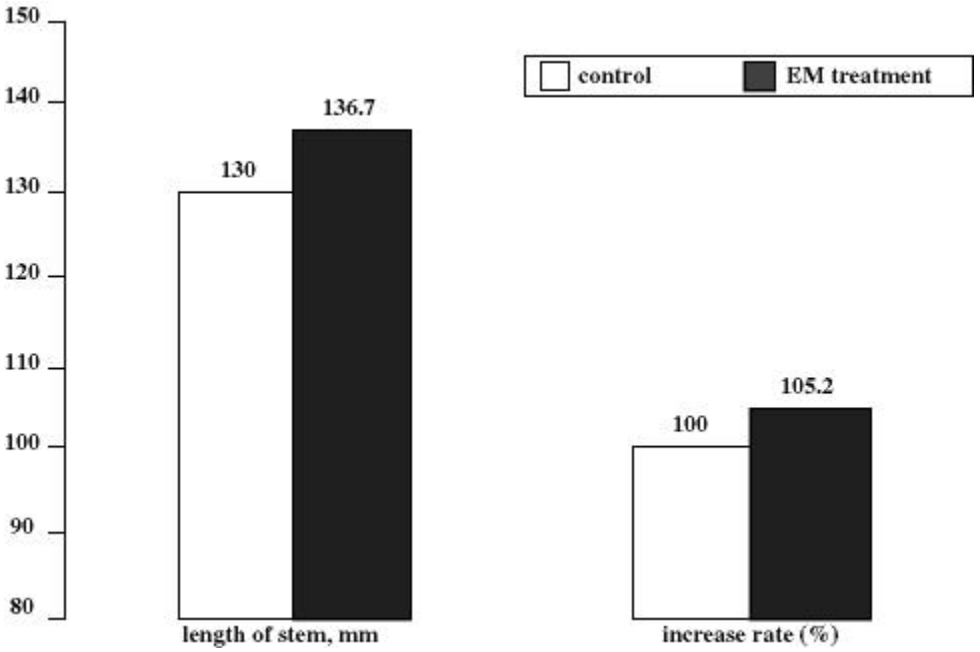

Fig. 2. Influence of EM on the growth of cucumber
*EM diluted with water of 500 times

The next was the examination of the activity of 6BA. The amount of biosynthesis of chlorophyll in the etiolated cucumber cotyledon was 27.6 mg/kg fresh in control plot and 28.8 mg/kg fresh plot. So its activity was 5.7% (Fig. 3).

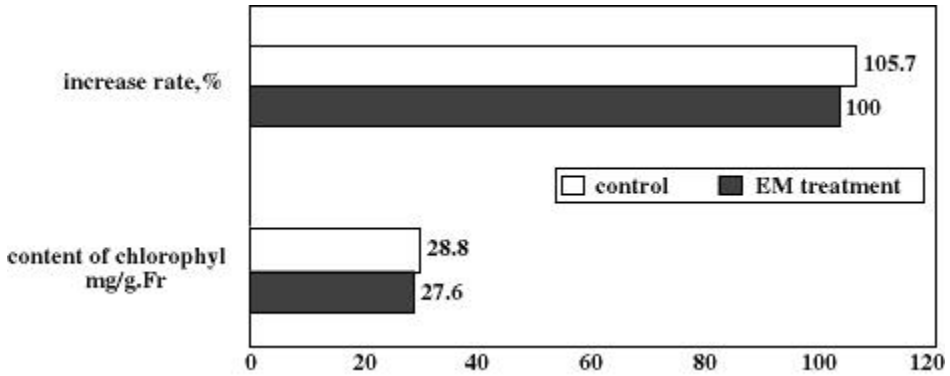

Fig. 3. Influence of EM on biosynthesis of chlorophyll
*EM diluted with water of 500 times

By examining chlorophyll in maize leaves, as shown in Fig. 3. We found that out of 30 fragments of maize leaves, the number of etiolated leaf fragments were 19 in control and 14 in the plot of EM treatment (Fig. 4).

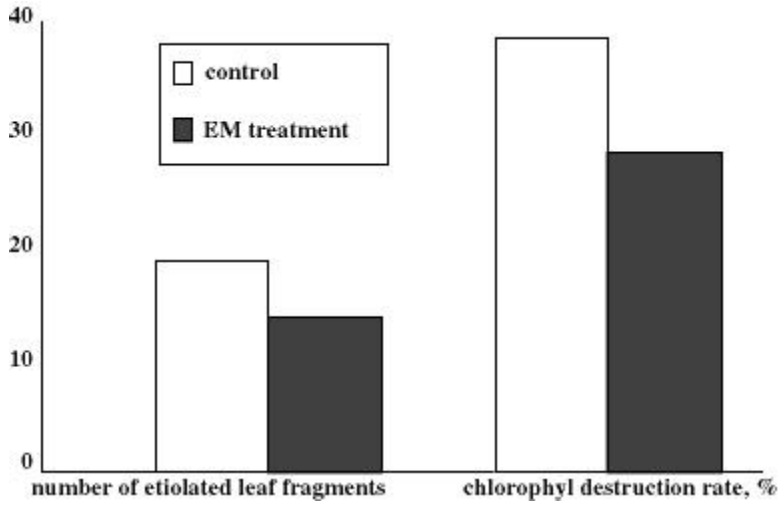

Fig. 4. Influence of EM on chlorophyll destruction
*EM diluted with water of 500 times

The ratio of chlorophyll destruction was 38% in control and 28% treatment plot, so the activity of 6BA was 10 percent. The activity of 6BA proved by the biosynthetic amount and destruction chlorophyll was 8 percent on an average.

This shows that the amount of GA contained in EM is not enough to stimulate the growth of rice.

On the basis of detailed analysis of the growth-stimulation activity of IAA, 6BA,and GA, understood what influence the EM on the early growth of rice, maize and Chinese cabbage when applied to such plants Table 2, 3, 4)

Table 2. Influence of EM on early growth of Rice

Treatment	**Plant height (cm)**	**Root length (cm)**	**Number of roots (plant^{-1})**
T1 control	18.2 ± 1.5	7.2 ± 0.7	7.4 ± 0.7
EM	17.6 ± 1.6	8.9 ± 0.3	7.5 ± 1.2
T2 control	17.7 ± 1.4	9.0 ± 0.8	7.5 ± 0.7

EM	17.6 ± 1.1	9.8 ± 1.1	7.1 ± 0.6
T3 control	14.3 ± 0.6	6.9 ± 0.8	7.5 ± 0.6
EM	14.5 ± 0.7	8.7 ± 0.7	7.5 ± 0.4

$P \leq 0.05$

T1: When seeds were soaking in water or EM
T2: When water or EM was spraying on the leaves
T3: When water or EM was applied to medium

Table 3. Influence of EM on early growth of maize

Treatment	**Plant height (cm)**	**Root length (cm)**	**Number of roots (plant^{-1})**
T1 control	24.0 ± 0.9	12.9 ± 0.2	7.4 ± 1.5
EM	23.7 ± 0.9	15.0 ± 1.8	7.1 ± 1.8
T2 control	30.0 ± 1.3	14.4 ± 1.0	7.5 ± 0.8
EM	30.8 ± 1.4	15.8 ± 1.3	7.3 ± 0.8
T3 control	21.1 ± 1.7	14.3 ± 1.6	7.3 ± 0.9
EM	22.8 ± 1.4	16.5 ± 1.7	7.8 ± 1.3

$P \leq 0.05$

T1: When seeds were soaking in or EM
T2: When water or EM was spraying on the leaves
T3: When water or EM was applied to medium

Table 4. Influence of EM early growth of Chinese Cabbage

Treatment	**Plant height (cm)**	**Root length (cm)**	**Number of roots (plant^{-1})**
T1 control	6.5 ± 0.3	1.4 ± 0.2	7.3 ± 0.4
EM	6.6 ± 0.4	2.4 ± 0.4	7.5 ± 0.7
T2 control	6.5 ± 0.5	2.2 ± 0.8	6.2 ± 0.7
EM	6.6 ± 0.4	3.6 ± 0.6	6.6 ± 0.5
T3 control	6.0 ± 0.4	2.9 ± 0.7	6.7 ± 0.5
EM	6.1 ± 0.5	4.1 ± 0.5	6.2 ± 0.7

$P \leq 0.05$

T1: When seeds were soaking in water or EM
T2: When water or EM was spraying on the leaves
T3: When water or EM applied to medium

These results indicate that EM little influenced the growth of above ground part but stimulated the growth of roots. Such an action effect of EM on the growth of root seems caused by function of lAA. However, more study is necessary for this question, it is evident from above-mentioned results that the rational use of EM may encourage the growth of roots.

CONCLUSION

1. EM contains certain amount of IAA, 6BA and GA, and the growth stimulation activity of IAA and 6BA is 5 and 8 percent respectively, except GA.
2. As EM stimulates the growth of roots, it may be used effectively in encouraging the growth of roots of plant.

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