Effect of Organic Materials on Seedling Growth and Yield of Red Pepper

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Abstract

In this study, growth of pepper seedlings was testedby treating organic materials in a plastic green house in Ssangok-ri Dogok-myeon, Hwasun-gun, Jeollanam Province from February 3, 2010 to April 19, 2010. The raised seedlings were planted to the organic planting area with an interval of 70cm×55cm on April 20 in Deogam-ri Gogeum-myeon Wando-gun and red peppers were harvested at 7 times from July 22 to September 29. Before planting, the plant length of the overgrowth of seedlings was reduced by 26.8% using plant powder treatment as compared to the control group. The red pepper yield was 27% higher than in the control group when 20g of bone ash powder and 20g of plant powder were mixed. The yield tended to increase in other treatments compared to the control group.

Introduction

Generally, seedling transplanting cultivation method is used by raising seedlings and transplanting them to the field. Thus, raising seedlings is a critical part of cultivating peppers. With regard to organic cultivation, the use of chemical fertilizer and pesticides is strictly prevented. Consequently, the management of bed soil, nutrients and pests are required. As plug seedlings are widely used, spindly growth prevention using DIF (difference between day and night temperature) method (Lim, et al., 1997), moisture, nutrient, ultraviolet light control (Bae, et al., 1998), *light* quality and temperature control, spindly growth prevention using growth regulator (Liberth, 1990), growth retardant and salt (Zang, 2002) and watering using deep ocean water have been used in nursery for solving the overgrowth problem. Currently, triazole compounds which are produced and sold as antimicrobial agents are mostly used in Korea. Triazole compounds are used for sterilizing and inhibiting growth (Bae, et al., 1998). Such agents are known to be effective in inhibiting the length of the embryonal axis, uprooting, reducing leaf size, increasing leaf thickness and stem diameter, increasing root thickness and reducing length. However, as these such as plant powder and bone ash powder to find out the appropriate treatment for avoiding overgrowth of organic seedlings and to investigate the impact on yield.

Materials and methods

In this study, growth of seedling was studied by treating organic materials in a plastic green house dedicated for seedling growth in Ssangok-ri Dogok-myeon, Hwasun-gun, Jeollanam Province from February 3, 2010 to April 19, 2010. The raised seedlings were placed in experimental plots with 4 times of randomized block design and planted to the organic planting area with an interval of 70cm×55cm on April 20 in Deogam-ri Gogeum-myeon Wando-gun and red peppers until September 29. PR Mujeok was used for the experiment and the organic bed soil (moisture 45%, capacity

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to retain water 38%, bulk density 0.15mg/m³, pH(1:5,v/v) 6.4, EC(1:5,v/v) 0.32ds/m, P_2O_5 265 mg/l, NH4-N 227 mg/l, NO3-N 127 mg/l, CEC 27cmol+/kg) was provided by Seoul Bio. Bed soils were filled with 50 nursery boxes and one pepper seed was planted to each cell and covered with soil. Then, the green house temperature was maintained at 26-28℃ during the day and 15-16℃ during the night. T1 was control group, and treatment groups were T2 plant powder 20g/box, T3 bone ash powder 20g/box, T4 activated carbon powder 20g, T5 plant powder 20g+ activated carbon powder 20g/box, T6 bone ash powder 20g+ activated carbon powder 20g/box, and T7 plant powder 20g+ bone ash powder 20g+ activated carbon powder 20g/box. The treatment groups were distributed 7 days after seeding when no water was added. Watering was carried out daily or every other day according to the condition of the soil. Sufficient amount of organic liquid fertilizer were added once in 2-5 days from 2 weeks after seeding. The seedling quality was tested by looking at plant height, leaf length, leaf width, leaf number, stem diameter and dry weight. The yield of pepper was estimated by harvesting red peppers at 7 times from July 22 and drying them with investigation according to the research standard of the Rural Development Administration. The experiment arrangement did with randomized block design 4 repetitions, the statistical analysis did with SAS methods.

Results and considerations

The plant height of pepper was reduced by 26.8% in plant powder, 12.8% in bone ash powder, 14.4% in activated carbon powder, 10.4%in plant powder + activated carbon powder, and 18.8% in bone ash powder + activated carbon powder as compared to the control group. This result shows that when the seedling box was treated with 20g of plant powder, the overgrowth was the most efficiently prevented. It can be assumed that less nitrogen is absorbed by plants during the seedling raising stage, thus the plant height was decreased (Navetiyal, et al., 1989; Chartzoulkis, 1992). Plug seedlings overgrow as they are cultivated with 5-10 times higher density than conventional seedlings and tend to lose quality such as aging of leaf and root. Therefore, growth management techniques are very important.

Tab. 1: Comparison of treatment by dry red pepper yield

Treatment	Stem diameter (mm)	Plant length (cm)	Dry weight (g/Plant)		
			Shoot	Root	Total
T1. Control group	3.35	25.0	0.364	0.220	0.584
T2. Plant powder 20g/box	2.75	18.3	0.312	0.185	0.496
T3. Bone ash powder 20g/box	2.92	21.8	0.295	0.190	0.484
T4. activated carbon powder 20g/box	3.10	21.4	0.332	0.142	0.474
T5. Plant powder 20g+activated carbon powder 20g	2.97	22.4	0.341	0.150	0.491
T6. Bone ash powder20g+activated carbon powder 20g	2.84	20.3	0.282	0.161	0.443
T7. Plant powder 20g+Bone ash powder20g+activated carbon powder 20g	3.32	24.7	0.330	0.160	0.490
CV (%)		5.78			2.62
LSD (1%)		2.25			0.23

The analysis on the mineral elements in the seedling plant showed that T-N content was low in the plant powder and bone ash powder treatment and high in the activated carbon powder (which was treated both separately and together with other materials). That was the same for P_2O_5 content. Except for activated carbon powder treatment, K_2O content was higher than in the control group in all treatments. The content of CaO was higher than in the control group when plant powder was used. MgO content was the same for the control group and plant powder treatment but lower in other treatments.

Tab. 2: Comparison of treatment by red pepper seedling mineral element content (%)

Treatment	T-N	P_2O_5	K_2O	CaO	MgO
T1. Control group	3.39	0.56	4.14	1.45	1.06
T2. Plant powder	3.24	0.45	4.50	1.51	1.06
T3. Bone ash powder	3.11	0.45	4.47	1.31	0.97
T4. activated carbon powder	4.08	0.61	3.93	1.29	0.90
T5. Plant powder +activated carbon powder	3.31	0.57	5.83	1.67	1.03
T6. Bone ash powder +activated carbon powder	3.57	0.47	4.32	1.47	0.88
T7. Plant powder+Bone ash powder+activated carbon powder	3.78	0.54	5.96	1.43	0.92

The red pepper yield was 27% higher in T6 (Bone ash powder + activated carbon powder) than in the control group and tends to increase in the other treatments compared to the control group. Shin (2001) reported that the higher the fertilizer concentration is during the seedling raising stage, the higher the yield of red pepper, which is consistent with the result of this study.

Tab. 3: Comparison of treatment by red pepper seedling quality (Harvesting duration: Jul. 22-Sept. 29)

Treatment	Harvested fruit (No./plant)	Avg. fruit weight (g/ No)	Red pepper yield (kg/10a)
T1. Control group	92.6	12.5	2199
T2. Plant powder 20g/box	98	10.9	2138
T3. Bone ash powder 20g/box	101.3	9.1	1967
T4. activated carbon powder 20g/box	107.2	10.6	2187
T5. Plant powder 20g+activated carbon powder 20g	95.4	11.3	2122
T6. Bone ash powder 20g+activated carbon powder 20g	**109.1**	**11.5**	**2,444**
T7. Plant powder 20g+Bone ash Powder 20g+ activated carbon powder 20g	94.8	11.5	2161
CV (%)			3.53
LSD (1%)			156

Conclusions

To summarize, when 22g of plant powder or bone ash powder was added to each nursery box during the seeding raising stage (7 days from seeding) of organic pepper, plants did not overgrew. Rather, the plants grew relatively well. Therefore, such organic materials can be used for plug seedling production of organic peppers.

The plant height of pepper was reduced by 26.8% in plant powder, 12.8% in bone ash powder, 14.4% in activated carbon powder, 10.4%in plant powder + activated carbon powder, 18.8% in bone ash powder + activated carbon powder as compared to the control group. This result means that when the seedling box was treated with 20g of plant powder, the overgrowth was the most efficiently prevented.

The analysis on the mineral elements in the seedling plant showed that T-N and P_2O_5 content was low in the plant powder and bone ash powder treatment and high in the activated carbon powder (which was treated both separately and together with other organic materials). Except for the activated carbon powder treatment, K_2O content was higher in all treatments as compared to the control group. The content of CaO was higher than in the control group when plant powder was used.

The red pepper yield was 27% higher in the treatment of 20g of bone ash powder and activated carbon powder each than control group and tends to increase in other treatments as well.

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