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Study on Sonic Influence upon Crop Yield and Insect Pest Damage

Yuchuan Qin, Won Chu Lee[1] and Young Cheol Choi[1,*]

Department of Entomology, China Agricultural University, Beijing 100094, P. R. China.
[1]Department of Sericulture and Entomology, National Institute of Agricultural Science and Technology, Suwon 441-100, Korea.

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Seven vegetables were planted in green houses to compare their yields and damages by insect pests based on three treatments, green music (GM), ultra sonic (US) and control. The vegetable yields of GM treatment were increased by an average of 17.81% than that of control for two years. There was a remarkable statistic difference in the yield between GM and respective controls such as radish, young radish, cucumber, spinach and *Brassica oleracea* var. *acephala*. There was no notable yield difference between US and controls for the seven vegetables within two years. The population densities of the insect pests in GM and US treatments were lower than controls. Only a few insect pests of some vegetables in GM and US treatments injured more seriously than in control.

Key words : Green music, Ultra sonic, Yields, Insect pests

Introduction

Generally specking, crop yields can be affected by many factors such as strain, water, fertilizer, insect pests, etc. In resent years, people began to look for some other factors which can also affect plant growth and productivity. Carlson (1999) found that "sonic bloom" together with special fertilizers could promote plants growth (Yon, 1997). Lately he and his collaborators have developed a method called Sonic Bloom Plant Growth Systems. They claimed that by the system the plants grow better, fruiting productivity dramatically increases (Carlson, 1999; Wilson and Hones, 1982).

Lee (1997) developed "Green Music" in 1994 and he also found that the green music is very effective in bringing about larger growth in most greenhouse vegetables (Yon, 1997; Lee, 1997; Taiz and Zeiger, 1991). Although inspiring, an absence of the related supporting data hampers our understanding on the conclusion. To fill this gap and illuminate the relationship between music, plant growth and insect pest injury is the main motive force for this research, in addition, considering music is a kind of vibration, ultra sonic is also introduced to the study for the comparison.

Materials and Methods

Components of treatment system

The system was composed of a tape recorder (KGM-600F, Greenteko Co., Korea), ultra sonic generator (KW-506, Greenteko Co., Korea) and green houses with sound insulators. Plant materials were radish (*Raphanus sativus*), Chinese cabbage (*Brassica campestris* subsp. *napus* var. *pekinensis*), young radish (*Raphanus sativus*), spinach, carrot (*Daucus carota*), B. dera (*Brassica oleracea* var. *Acephala*) and Cucumber (*Cucumis sativus*).

Treatments of sonic and music

The seedlings of each vegetable were divided into three parts separately and transplanted to the three green houses (one plot is 0.6 m × 2.3 m, each variety occupied 2 plots) and engaged in three treatments (one green house carried one treatment). Under the following conditions: A, Ultra sonic wave (20 kHz, 3 hrs/day from 6:00 to 9:00 a.m); B, Green music (3 hrs/day from 6:00 to 9:00 p.m); C, Control.

*To whom correspondence should be addressed.
Department of Sericulture and Entomology, National Institute of Agricultural Science and Technology, Suwon 441-100, Korea.
Tel: 82-31-290-8464; FAX: 82-31-295-2176;
E-mail: ycchoi@rda.go.kr

Transplant and harvest

In 1999, radish, Chinese cabbage, B. dera, carrot and cucumber were transplanted on September 5 and harvested on November 23; young radish and spinach were transplanted on October 3 and harvested on November 23. In 2000, radish, Chinese cabbage, B. dera, carrot and cucumber were transplanted on April 16 and harvested on June 5; young radish and spinach were transplanted on April 16 and harvested on May 17.

Investigation of insect pests

The investigation began after the genuine leaves came out. For every five days, six individual plants per variety were counted for number of insect pest. The insect pests considered are as follows: Mustard aphid, *Lipaphids erysimi* Kaltenbach; Green house white fly, *Trialeurodes vaporariorum* Westwood; Cabbage butterfly, *Pieris rapae* L.; Diamond-back moth, *Plutella xylostella* L.; Striped flea beetle, *Phyuotreta vittata* Fabricius; Leaf beetle, *Chrysomela* sp.; and Lady bird skinner, *Epilachna vigintioctopunctata* Motschulsky.

Results

Yield comparison based on different sonic treatments in the seven vegetables

The vegetable yields of GM treatment were higher than that of control in the two-years experiment: 6.81% - 6.65% higher in 1999, 0.65% - 41.13% higher in 2000, and the average was 17.81%. There was a remarkable statistic difference between GM and control for radish, B. dera, cucumber, young radish and spinach. There was no notable yield difference between US and control for the seven vegetables within the two years (Table 1).

Comparisons of insect pest density by GM treatment in the seven vegetables

The value of 22 data out of 42 in Table 2 is less than 1 generally means the population densities of seven insect pests in GM treatment were lower than control. And only a few insect pests (Table 2) of some vegetables in GM treatment injured more seriously than in control.

The population density of mustard aphid in GM treat-

Table 1. Yield (g/plant) comparison based on different sonic treatments in the seven vegetables

	Chinese cabbage	Young radish*	Radish	B. dera	Cucumber	Spinach*	Carrot
1999							
GM	3575.00a	1687.50a	1724.50a	934.38a	388.06A	121.32A	86.35a
US	3396.67a	1668.75a	1631.50a	893.75a	306.77AB	102.68B	83.10a
Control	3347.50a	1556.25a	1488.00a	796.25a	284.00B	92.00B	78.86a
2000							
GM	3538.18a	638.95a	1096.67A	645.00a	-	437.57a	169.17a
US	2925.00a	543.86b	748.75B	594.00ab	-	373.66a	168.85a
Control	2998.33a	575.56b	777.08B	480.00b	-	435.12a	143.70a

The data is mean; small letter (a): $\alpha = 0.05$; capital letter (A): $\alpha = 0.01$.
*g/10 plants.

Table 2. Comparisons of insect pest density by green music treatment in the seven vegetables

	Chinese cabbage	Young radish*	Radish	B.dera	Cucumber	Spinach*	Carrot
Mustard aphid	1.33 (0.49)	0.04 (0.33)	7.93 (0.80)	10.09 (19.11)	0.06 (3.05)	0.50 (#)	*Φ*
Green house white fly					0.68		
Cabbage butterfly	0.84	0.26	0.69	1.09 (5.33)	# (*Φ*)	1.00 (*Φ*)	
Diamond back moth	0.13 (0.10)	(#)	1.00	1.00			
Striped flea beetle	3.50 (1.67)	#	# (*Φ*)				
Leaf beetle	*Φ* (0.80)	1.00 (0.50)	(1.00)	#	(*Φ*)		
Lady bird skinner	*Φ*		*Φ*				

The data and signs without parenthesis are from 1999; and those with parenthesis are from 2000.
Each datum was obtained by dividing the number of one insect pest in green music by the number of the same insect pest occurred in the control. "#" means the insect pest appeared only in green music treatment and "*Φ*" means the insect pest appeared only in control.
* g/10 plants.

Table 3. Comparisons of insect pest density by ultra sonic treatment in the seven vegetables

	Chinese cabbage	Young radish*	Radish	B.dera	Cucumber	Spinach*	Carrot
Mustard aphid	0.06 (0.49)	1.58 (1.00)	3.65 (1.50)	0.17 (4.14)	0.11 (2.45)	Φ (#)	Φ
Green house white fly					0.96		
Cabbage butterfly	0.45 (#)	0.27	0.46	1.10 (10.67)	(0.04)	(Φ)	
Diamond back moth	0.38 (0.17)	(#)	1.00	1.00			(#)
Striped flea beetle	2.00 (1.67)	#	4.00 (Φ)	#			
Leaf beetle	Φ (0.93)	Φ (Φ)	(5.00)	#	(1.00)		
Lady bird skinner	Φ		Φ				

The data and signs without parenthesis are from 1999; and those with parenthesis are from 2000.
Each datum was obtained by dividing the number of one insect pest in ultra sonic by the number of the same insect pest occurred in the control. "#" means the insect pest appeared only in ultra sonic treatment and "Φ" means the insect pest appeared only in control.
* g/10 plants

ment was much higher than that of control for radish and B.dera in 1999, and for cucumber in 2000. The population densities of cabbage butterfly of B. dera and striped flea beetle of Chinese cabbage in GM treatment were much higher than that of control.

The value of 21 data out of 43 in Table 3 is less than 1 generally means the population densities of seven insect pests in US treatment were lower than control. And only a few insect pests (Table 3) of some vegetables in US treatment injured more seriously than in control. The population densities of mustard aphid in US treatment were much higher than that of control for radish and B. dera in 1999, and for B. dera and cucumber in 2000. The population densities of cabbage butterfly of B. dera and Striped flea beetle of Chinese cabbage in US treatment were much higher than that of control.

Discussion

This research has showed some relationship between sonic (green music and ultra sonic), plant growth and insect pest injury. Sonic especially green music can indeed appear to promote crop growth and increase its yield, but the increase is not obvious as expected. As to the relationship between sonic and insect pest injury, we can see this is very complicated. A factor such as sonic kind, crop kind, and insect kind can damage the crop. So it is worth to continue the research to screen out the best or better "sonic-crop-combination" under which crops can growth better and the damage by insect pests is lighter.

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References

Carlson, D. (1999) Sonic bloom plant growth system. bloom@iname.com

Lee, W. C. (1997) The plants growing with music. *Korea Agrafood* **6**, 41-43.

Taiz, L. and E. Zeiger (1991) Plant Physiology. pp. 282-283, The Benjamim Cummings Publishing Company Inc.

Yon, S. H. (1997) Nature Listens to Music. *Korea Times* **10**.

Wilson, D. and J. G. Jones (1982) Effect of selection for dark respiration rate of mature leaves on crop yields of *Lolium perenne* cv.S23. *Ann. Bot.* **49**, 313-320.