Effects of Organic Composts on Soil and Yield Characteristics of Boxthorn(*Lycium chinense* Mill.) Organic Cultivation

Bo-Hee, Lee[1], Young-Chun Park[2], Sox-Su Lee[3], Byung-Joo Lee[4], Yeong-Guk Kim[5] and Yeong-Seob An[6]

Key words: Boxthorn, Organic cultivation, Organic Compost, Rain shelter

Abstract

For the development of Boxthorn organic cultivation techniques, we investigated effect of several organic compost as a foundation fertilizer and growing plant fertilizer. And we adopted partly opening rain shelter greenhouse to protect anthracnose. In organic compost applying test yield characteristics of 'Mixed organic compost' treatment was the best but in betaine content measurement of dried fruit, 'Mixed organic compost and nitrogen guano' treatment was the best and it's chlorophyll and 100 fruit weight were also better than the other treatments.

Introduction

The Boxthorn is one of the prominent herbal crop in Korea. It can take every day for healthcare according to traditional remedy. In Taxonomic classification Boxthorn cultivars in Korea is *Lycium chinense* Mill.(lee, 1998) but *Lycium barbarum* L. is widely cultivated in China. And it can be used as a medicine for human almost every part of plant like fruit, leaf, root cortex, flower, sprout.

There are five diseases on Boxthorn, among them Anthracnose was the most sever one(lee *et al.*, 1986). The predominant species of it's Anthracnose was *Colletotrichum acutatum* by 86.7% of isolation rate and the second place was *C. dematium* (Pers.) Grove by 10% isolation rate. And there were the other miner species like *C. gloeosporioides* and *Glomerella cingulata*(lee, 2004). Rain shelter greenhouse can protect outbreak of Anthracnose(Choi *et al.*, 1996) but there are some must be solved technical subjects like ventilation methods for enhanceing growth of Boxthorn and designs good to avoid natural disaster like heavy snow and typhoon.

In korea there are about forty pesticide-free Boxthorn cultivating farmers and about three organic Boxthorn farmers. Most of pesticide-free farmers are going to turn to

[1] Cheongyang Boxthorn Experiment Station, CNARE, Cheongyang, Republic of Korea E-Mail: marslbh@korea.kr

[2] Cheongyang Boxthorn Experiment Station, CNARE, Cheongyang, Republic of Korea E-Mail: pyc1117@korea.kr

[3] Cheongyang Boxthorn Experiment Station, CNARE, Cheongyang, Republic of Korea E-Mail: lss56@korea.kr

[4] Chungcheongnam-do Agricultural Research & Extension Services, Yesan 365-503, Republic of Korea E-Mail: byungjoo@korea.kr

[5] National Institute of Horticultural & Herbal Science, RDA , Eumseong 369-873, Republic of Korea, E-Mail: kimyguk@korea.kr

[6] National Institute of Horticultural & Herbal Science, RDA , Eumseong 369-873, Republic of Korea, E-Mail: ay21cay@korea.kr

organic cultivation but they have to consider of yield decrease. So we need to find a new compost method to recover the yield decrease.

Materials and methods

Tested Cultivars and Composts

At first year 'Jang-myeong' and 'Cheong-un' Boxthorn cultivars were planted on 'Mixed organic compost(organic matter : 58%, oil seed hull : 25% and micro-organisms *etc.*, NPK:3-2-1)', 'Oil seed hull compost(NPK:3.7-2.2-1.1)' and 'Nitrogen guano(NPK:9-9-6)' treated field. But according to yield and growth analysis oil seed hull and nitrogen guano single treatments were worse than mixed organic compost so we combine two treatments at next two years. So the treatments were 'Non-treat', 'Mixed organic compost(10ton/ha)', 'Mixed organic compost(10ton/ha) for foundation and Oil seed compost(1.6ton/ha) for growing plant compost' and 'Mixed organic compost(10ton/ha) and Nitrogen guano(0.7ton/ha)'. We have investigated characteristics of yield and growth and analyzed content of Betaine, Fructose and Glucoses in Boxthorn fruits.

Cultivation method

Rain shelter greenhouse is essential cultivation technique in Boxthorn organic farm to avoid anthracnose. There are generally three ventilation types at rain shelter greenhouses among them we adopted partly opening rain shelter greenhouse which is superior to other types in ventilation efficiency and natural disaster resistance. It had partly opened roof which Plastic film was fastened upper 1/3 part of each side and could be opened over 1/2 of it. We let it opened all the times except rainy day of fruit setting and ripening seasons. According to previous Research tree type cultivation can produce more yield by 20~30% than traditional method. So we cultivated boxthorn tree type.

Results

Effects of compost on Boxthorn organic cultivation

At first year the yield of 'Mixed organic compost' treatment was better than the other treatments. So we changed two inferior single foundation compost treatments into double treatments of foundation and growing plant composting. At second year, yield characteristics of 'Mixed organic compost' treatment was the best but according to dried fruit betaine content analysis measurement, 'Mixed organic compost and nitrogen guano' treatment was the best and it's chlorophyll and 100 fruit weight were also better than the other treatment.

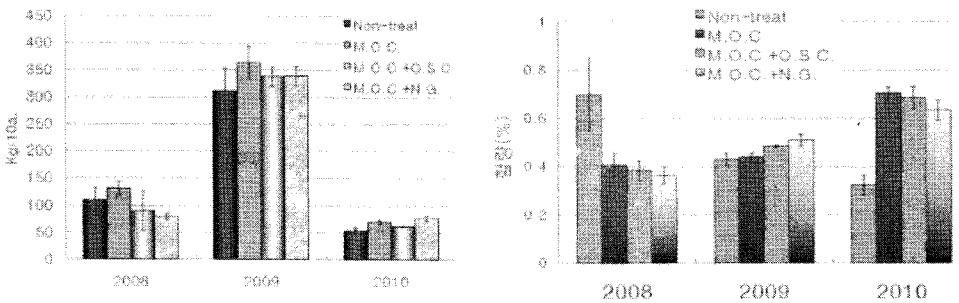

Fig. 1. Annual changes in yields of treatment(left) and content of betaine in fruits(harvested in September, right).

And the last year we could harvest just one time because of typhoon 'Kompasu' and bad weather conditions. So yield of all the treatment decreased sharply but 'Mixed organic compost and nitrogen guano' treatment was the best in yield, chlorophyll content and 100 fruit weight. Betaine content of dried fruit was increased year by year in all the organic compost treatments.

Tab. 1. Yield and growth Characteristics of three compost treatments in 2009

Treatment	Chlorophyll content	100 fruit weight	Number of fruits	Yield (Kg/10a)	Yield Index(%)
Non-treat	54.2 b	24.0±0.86	868.5±169.02	310.3±43.36	100
Mixed compost	58.3 a	24.2±0.46	1,069.9±49.24	363.3±30.22	117
Mixed compost + Oil seed hull compost	58.0 a	23.9±0.03	967.6±99.77	337.7±18.37	109
Mixed compost + Nitrogen guano	59.8 a	25.2±1.10	947.0±106.61	338.6±17.84	109

* Chlorophyll content : Minolta SPAD-502 measured value(-9.9~199), DMRT 5%

Tab. 2. Yield and growth Characteristics of three compost treatments in 2010

Treatment	Chlorophyll content	100 fruit weight	Number of fruits	Yield (Kg/10a)	Yield Index(%)
Non-treat	40.2±1.8	9.3±0.4	198.3±36.7	54.1±4.8	100
Mixed compost	45.6±1.8	9.4±2.1	359.4±103.1	68.8±4.1	127
Mixed compost + Oil seed hull compost	49.1±2.2	11.0±1.9	298.4±71.9	61.1±1.3	113
Mixed compost + Nitrogen guano	49.5±1.9	11.3±0.8	316.0±41.6	76.2±4.7	141

* Chlorophyll content : Minolta SPAD-502 measured value(-9.9~199)

Changes in Soil after application of composts

According to soil analysis of second year soil pH value was neutral in most of organic matter treatment but Mixed compost + Nitrogen guano treatment was about 6.4. In the content of organic matter all treatment was about 20mg/kg, the available phosphorus content was significantly exceeds and the content of exchangeable cations was slightly greater than the optimum value.

Tab. 3. Organic matter, pH, exchangeable cations of four compost treated soils in 2009

Treatment	pH (1:5)	EC (dS/m)	Organic matter (mg/kg)	available phosphate (Kg/10a)	Exchangeable cation(cmol/kg)		
					Ca	K	Mg
Non-treat	7.0±0.26	2.7±1.34	21.3±2.65	888.5±92.96	8.4±0.52	0.6±0.16	2.3±0.17
Mixed compost	7.0±0.03	2.6±0.86	19.3±2.35	980.1±48.47	8.4±1.17	0.55±0.14	2.7±0.24
Mixed compost + Oil seed hull compost	7.0±0.07	1.3±0.55	20.8±1.10	980.1±48.47	6.5±0.54	0.5±0.05	2.3±0.12
Mixed compost + Nitrogen guano	6.4±0.27	3.3±0.82	21.8±3.35	909.9±44.74	7.8±0.58	0.9±0.15	2.5±0.14

At third year's soil analysis pH value was higher than that of previous year but EC levels was decreased greatly. In non-treatment organic matter content decreased but in organic compost application treatment had a tendency to increase. Available phosphorus content of the organic compost application was greatly excessive and increasing. Exchangeable cations as a whole showed a slight increase in the pattern.

Tab. 4. Organic matter, pH, exchangeable cations of three compost treated soils in 2010

Treatment	pH (1:5)	EC (dS/m)	Organic matter (mg/kg)	available phosphate (Kg/10a)	Exchangeable cation(cmol/kg)		
					Ca	K	Mg
Non-treat	7.6±0.12	0.9±0.14	19.8±3.09	859.7±85.8	8.3±0.66	0.5±0.12	3.1±0.12
Mixed compost	7.5±0.07	1.4±0.43	21.1±2.35	1100.0±115.6	7.6±0.60	0.63±0.12	3.9±0.28
Mixed compost + Oil seed hull compost	6.9±0.30	1.3±0.37	21.8±3.10	1025.7±123.9	5.8±0.42	0.8±0.17	3.5±0.11
Mixed compost + Nitrogen guano	7.3±0.10	1.3±0.61	22.9±1.30	1044.3±156.1	6.4±0.23	0.7±0.27	3.6±0.41

Discussion

According to this study we had better use 'Mixed organic compost' as a foundation compost and 'Nitrogen guano' as a growing plant fertilizer. But by the soil analysis available phosphorus content was greatly excessive and increasing so we have to find out available phosphorus reducing method. And Betaine content of dried fruit was increased year by year in all the organic compost treatments.

Conclusions

Mixed organic compost as a foundation fertilizer and Nitrogen guano as a growing plant fertilizer were useful materials and technique for Boxthorn organic farmers. But excessive available phosphorus reducing program was need to be developed.

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