STUDY THE EFFECT OF FERTILIZER COMPOUND ON VEGETATIVE GROWTH OF MANDARIN SWEET SEEDLESS (*Citrus unshiu* Marc) CULTIVAR AT BASIC DESIGN PERIOD

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ABSTRACT

This study was conducted to evaluate the effects of fertilizer compound on vegetative growth of mandarin sweet seedles one year old at Dai Tu distric, Thai Nguyen province in 2017. The experiment consisted of four treatment was design in Randomized Complete Block Design with three replicated. Plant height, plant diameter, number of branch level 1 and 2, shoot length, diamter and leaf number per shoot were recorded. Results indicated that T_2 treatment (8 kg Song Gianh micro organic fertilizer/tree + foliar Dau Trau 501) had the best results in plant height, plant diameter, shoot length, diameter and leaf number per shoot than the other treatments. It was concluded that application of T_2 treatment have positive improved vegetative growth of mandarin sweet seedles under field conditions.

Keywords: *Micro organic fertilizer; foliar fertilizer, mandarin sweet seedless*

INTRODUCTION

Mandarin is one of the most popular citrus fruits in the world, and are widely used for culinary purposes, good source of vitamins and minerals; also lemon is an important export crop for foreign markets and source for cash currency. Citrus requires sixteen essential elements for normal growth, production and quality. Adequate supply of nitrogen, phosphorus and potassium are important for citrus tree growth and productivity [6]. Although the chemical fertilizers are an indispensible in fruit crop nutrition, however using enormous amounts of mineral fertilizers can accumulate harmful nitrate in food causing hazardous effects [2]. It had also adversely affected the soil fertility, water quality, yield and quality of the products [7]. Several researcher reviewed the significant role of organic manures, micro organic fertilizer and biofertilizers in influencing the soil properties and enhancing the growth, yield and quality of citrus [4]. Thus, using organic fertilizer, micro organic fertilizer and biofertilizers in the farm is a good alternative to reduce uses of chemical fertilizers [5], and it has also assumed great importance for sustainable production and to improve the soil physical, chemical and biological properties [3]. Although there are many reports on the effect of different fertilizers on various mandarins cultivars in Vietnam, however additionally the information about respose of mandarin sweet seedless (*Citrus unshiu* Marc) by applied fertilizer compunds on vegetative growth so far lacking. Therefore, the aim of this study was to evaluate vegeative growth of mandarin sweet seedless in response to fertilizer compound under field conditions.

MATERIALS AND METHODS

Experiment treatment

The experiment was carried out in mandarin sweet seedless (*Citrus unshiu* Marc) cultivar 1 year old from January to December 2017 at Dai Tu district, Thai Nguyen province. The experiment consists of four treatments including the control was design in Randomized Complete Block Design (RCBD) with three replicated and three uniform trees were taken as an experiment unit. The experiment included eleven treatments as follows:

Treatment 1: without micro organic fertilizer + foliar Dau Trau fertilizer 501 (control)

Treatment 2: 8 kg Song Gianh micro organic fertilizer/tree + foliar Dau Trau 501

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Treatment 3: 12 kg Song Gianh micro organic fertilizer/tree + foliar Dau Trau 501

Treatment 4: 16 kg Song Gianh micro organic fertilizer/tree + foliar Dau Trau 501

Mineral fertilization were applied as 0.5 kg/tree ammonium sulphate, 0.5 kg/tree super phosphate and 0.3 kg/tree potassium sulphate. Nitrogen and potassium fertilizer was added on two doses, at Ferbruary, and at the end of August. Whereas, super phosphate was applied on three doses, at the Ferbruary, May and at the end of August. For the micro organic fertilizer was applied on four doses, at the Ferbruary, May, August and at the end of Octorber. Foliar Dau Trau 501 was applied on windless mornings with a truck-mounted monitorized sprayed until drip of and subsequently in 1 month intervals.

Data Collection

Number of shoot per tree was determiner by choosing randomly 3 trees and the number of shoot were counted. Later shoot maturite (leght and diameter) also were measured weekly with vernier calipers. Leaf number per shoot was evaluate by choosing randomly 4 shoots on each tagged tree and the number of leaf were counted.

Statistical analysis

The data obtained from the study were analyzed using SAS 6.12 statistical software. The least significant difference was calculated following a significance F-test (at $p \leq 0.05$).

RESULTS AND DISCUSSION

Effect of fertilizer compound on vegetative growth of madarin sweet seedless tree

The results summarized in Table 1 showed that, there was significant different plant height among treatments ($p<0.05$). In contract, application of T_2 treatment produced the maximum plant height with value of 145.89 cm, whereas the lowest plant height (120.56 cm) was found in control treatment. In the same table data showed that the tree canopy diameters among treatments significantly increase as compared to untreated control. In which, the highest tree canopy (131.06 cm) was obtained at T_2 treatment application, whereas the control treatment produced the lowest values (92.44 cm). However, application of T_3 and T_4 treatments also slightly increase tree canopy, even thought the effect was not significantly difference. These results are in accordance with the findings of [4] who indicated that the combination among farmyard manure, inorganic fertilizer and biofertilizer led to improving vegetative growth parameters of lemon tree in terms of plant height, trunk diameter and tree spread. For the number of branch leve 1, the results of Table 1 showed that there was significantly different in number of branch level 1 for all treatment in this study. The lowest value (2.67 branch/tree) was found in the control treatment, while the highest value (4.0 branch/tree) was observed in T_2 treatment application. Moreover, results in Table 1 also showed that T_2 treatment application have the highest number of branch level 2 (10.44 branch/tree), follow by the other treatments, whereas the lowest branch level 2 number (8.22 branch/tree) recorded in untreated control, although the difference was not statistically significant ($p<0.05$).

Table 1. *Effect of fertilizer compound on vegetative growth of mandarin sweet seedless tree*

Treatment	Plant height (cm)	Tree canopy diameter (cm)	Number of brandches level 1 (branch/tree)	Number of branche level 2 (branch/tree)
T_1	120.56^{b*}	92.44^{b}	2.67^{b}	8.22^{a}
T_2	145.89^{a}	131.06^{a}	4.00^{a}	10.44^{a}
T_3	144.67^{a}	101.89^{b}	3.11^{b}	9.89^{a}
T_4	134.94^{ab}	97.28^{b}	2.89^{b}	9.78^{a}
P	<0.05	<0.05	<0.05	>0.05
LSD.05	14.6	21.6	0.7	-

**Means followed by different letter are significantly different within columns by Duncan's multiple range test, P ≤ 0.05*

Effect of fertilizer compound on number of shoot in madarin sweet seedless cultivar

Table 2. *Effect of fertilizer compound on shoot number of madarin sweet seedless cultivar*

Treatment	Spring shoot number/tree	Summer shoot number/tree	Autumn shoot number/tree
T_1	8.0[b*]	8.9[a]	10.1[a]
T_2	12.9[a]	11.2[a]	11.6[a]
T_3	12.2[a]	9.1[a]	10.6[a]
T_4	10.3[ab]	9.0[a]	10.6[a]
P	<0.05	>0.05	>0.05
LSD.05	2.5	-	-

[*]*Means followed by different letter are significantly different within columns by Duncan's multiple range test, P ≤ 0.05*

Table 3. *Effect of fertilizer on shoot character of mandarin sweet seedless cultivar*

Treatm-ent	Spring shoot			Summer shoot			Aurtum shoot		
	Shoot length (cm)	Shoot diameter (cm)	Leaf number/ shoot (leaf)	Shoot length (cm)	Shoot diameter (cm)	Leaf numbe r/shoot (leaf)	Shoot length (cm)	Shoot diameter (cm)	Leaf numbe r/shoot (leaf)
T_1	15.21[b*]	0.41±0,02	7.83[b]	18.46[a]	0.38±0,01	11.08[a]	13.79	0.36±0,02	8.50[a]
T_2	21.02[a]	0.48±0,03	10.25[a]	21.66[a]	0.40±0,01	12.92[a]	18.50	0.39±0,02	10.92[a]
T_3	19.63[a]	0.48±0,01	8.67[b]	20.32[a]	0.39±0,03	12.25[a]	18.33	0.39±0,05	10.42[a]
T_4	18.75[a]	0.48±0,02	8.17[b]	19.98[a]	0.38±0,05	11.08[a]	14.17	0.39±0,04	8.83[a]
P	<0.05		<0.05	>0.05		>0.05	>0.05		>0.05
LSD.05	3,0		1,3	-		-	-		-

[*]*Means followed by different letter are significantly different within columns by Duncan's multiple range test, P ≤ 0.05*

The shoots number per tree for all treatment in this study is presented in Table 2. For spring shoots number, T_2 treatment application exhibited the maximum (12.9) number of shoots/tree, whereas the lowest value was found in untreated control with 8.0 number of shoots/tree. The same was also observed concerning the number of summer shoots. In term, the highest values (11.2 number of shoots/tree) was obtained at T_2 treatment application, follow by T_3 and T_4 treatment with value (9.1 and 9.0 number of shoots/tree, respectively), while the control gave the lowest values of 8.9 number of shoots/tree. For autumn shoot number, the highest shoots number/tree (11.6) was observed at T_2 treatment application, followed by T_3 and T_4 treatment application, whereas the control treatment had the lowest value of 10.1 shoots number/tree.

Effect of fertilizer compound on shoot character of mandarin sweet seedless cultivar

Shoot length

As shown in Table 3, the highest shoot length with value (21.02 cm) was obtained with T_2 treatment application, followed by T_3 and T_4 treatment application with value (19.63 cm and 18.75 cm, respectively), compared to lowest value of 15.21 cm was found in untreated control in the case of spring shoot. For summer shoot the results in Table 3 indicated that maximum shoot length (21.66 cm) was recorded in T_2 treatment application, whereas the control treatment produced the minimum shoot length (18.46 cm), although there was no statistically significant ($p<0.05$). Moreover, T_2 treatment application also gave the highest shoot length with value of 18.50 cm, whereas the control treatment produced the lowest shoot length (13.79 cm), which was achieved in the case of autumn shoot. This result are in agreement with [1] who started that sweet orange trees fertilized with 70 kg farmyard manure + 850 g urea/tree produce more leaves, shoot length.

Shoot diameter

As can be seen from Table 3 indicated that application of T_2 treatment produced the maximum shoot diameter with value of 0.48 cm, whereas the lowest shoot diameter (0.41 cm) was found in control treatment, which was achieved in the case of spring shoot. In the same table data showed that in the case of summer shoot, the T_2 treatment application also produced the maximum value (0.40 cm), while minimum of shoot diameter (0.38 cm) was obtained in control. However, for autumn shoot case, T_2 treatment application exhibited the maximum shoot diameter (0.39 cm), but control treatment showed the lowest value of 0.36 cm (Table 3). Similar results were reported by [1].

Leaf number per shoot

Results in Table 3 showed that there was significant different among treatment in leaf number per shoot in spring shoot case. In whichs, application of T_2 treatment gave the highest value (10.25 number of leaf/shoot), whereas the lowest (7.83 number of leaf/shoot) was recorded in control treatment. However, T_2 treatment application produced the highest value (12.92 number of leaf/shoot and 10.92 number of leaf/shoot) in case of summer shoot and autumn shoot, respectively, while the control treatment showed the lowest value of 11.08 and 8.50 number of leaf/shoot, although the difference was not statistically significant ($p<0.05$), which is in accordance with the finding of [3].

CONCLUSIONS AND SUGGESTIONS

Conclusions

From the experiment results, it can be concluded that treatment with (8 kg Songgianh micro organic fertilizer/tree + foliar Dau trau 501) was the most effective treatment in enhancing vegetative growth parameters as well as shoot length, diameter, number of leaves per shoot. Besides, increasing soil content of most nutrients without side harmful effects on the tree and environment.

Suggestions

From the results, we recommended treatment with 8 kg Song Gianh micro organic fertilizer/tree + foliar Dau Trau 501 as practical tools for improving vegetative growth in mandarin sweet seedless cultivar at Dai Tu district, Thai Nguyen province.

REFERENCES

1. Dahiya S. S., Singh S., and Dalal R. P. (2013), "Studies on the effect of organic manure versus organic plus inorganic fertilizers in sweet orange (Citrus sinensis Osbeck) cv. Jaffa. Haryana", *J. Hort. Sci.*, 42(1/2), pp.9 – 12.

2. El-Khawaga A. S. and Maklad M. F. (2013), "Effect of combination between Bio and chemical fertilization on vegetative growth, yield and quality of Valencia orange fruits", *Hortscience Journal of Suez Canal University*, 1, pp. 269 – 279.

3. Ennab H. A. (2016), "Effect of Organic Manures, Biofertilizers and NPK on Vegetative Growth,Yield, Fruit Quality and Soil Fertility of Eureka Lemon Trees (*Citrus limon* (L.) Burm)", *J. Soil Sci. and Agric. Eng., Mansoura Univ.*, 7(10), pp. 767- 774.

4. Khehra S., and Bal J. S. (2014), "Influence of organic and inorganic nutrient sources on growth of lemon (Citrus limon (L.) Burm.) cv. Baramasi", *J. Exp. Bio. and Agri. Sci*, 2(1S), pp. 126 – 129.

5. Krauss A. (2000), "Quality production at balanced fertilization: The key for competitive marketing of crops", *Proceedings of the 12th CIEC International Symposium on Role of Fertilizers in Sustainable Agriculture, August 21-22, 2000, Suceaua, Romania*, pp. 1-16.

6. Quaggio J. A., Mattos D., Cantarella H., Almeida E. L. E. and Cardoso S. A. B. (2002), "Lemon yield and fruit quality affected by NPK fertilization", *Scientia Horticulturae*, 96, pp.151 – 162.

7. Srivastava A. K., Singh S., and Marathe R. A. (2002), "Organic citrus: Soil fertility and plant nutrition", *J. Sustainable Agric.*, 19(3), pp. 5 - 29

TÓM TẮT

NGHIÊN CỨU ẢNH HƯỞNG CỦA TỔ HỢP PHÂN BÓN ĐẾN SINH TRƯỞNG GIỐNG QUÝT NGỌT KHÔNG HẠT (*Citrus unshiu* Marc) GIAI ĐOẠN KIẾN THIẾT CƠ BẢN

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Thí nghiệm được tiến hành trên giống quýt ngọt không hạt (*Citrus unshiu* Marc) 1 năm tuổi tại huyện Đại Từ, tỉnh Thái Nguyên năm 2017. Thí nghiệm gồm 4 công thức được bố trí theo khối ngẫu nhiên hoàn toàn (RCBD) với 3 lần nhắc lại. Các chỉ tiêu về đặc điểm hình thái cây, số lượng lộc, đặc điểm lộc được đo đếm theo dõi. Kết quả nghiên cứu cho thấy sử dụng phân bón ở công thức 2 với lượng 8 kg phân hữu cơ vi sinh Sông Gianh + phân bón lá Đầu Trâu 501 cho đặc điểm hình thái cây cao nhất về chiều cao cây, đường kính tán, số cành cấp I, cấp II và cho giá trị về đặc điểm lộc gồm chiều dài, đường kính và số lá trên lộc cao nhất và cao hơn công thức đối chứng. Qua đó cho thấy, sử dụng công thức 2 có tác dụng thúc đẩy quá trình sinh trưởng phát triển của cây quýt ngọt không hạt.

Từ khóa: *Phân bón hữu cơ vi sinh, phân bón lá, giống quýt ngọt không hạt*

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