EFFECT OF PESTICIDE ON VEGETATIVE GROWTH AND FRUIT YIELD OF MANDARIN CITRUS SEEDLESS IN BASIC DESIGN PERIOD AT THAI NGUYEN PROVINCE

ABSTRACT

Aims: This study was carry out to evaluate the effects of pesticide on vegetative growth, fruit yield, fruit quality of sweet seedless Mandarin citrus seedless in basic design period at thai nguyen province

Study design: The study was carried out in Dai Tu district, Thai Nguyen province in 2017-2018. The experiment included three treatments was designed in Randomized Complete Block Design with three replications.

Results and discussion: The vegetative growth of tree and shoot, fruit yield and fruit quality were collected. Results indicated that T_2 treatment (Trebon 10 EC) had the best results in vegetative growth, fruit quality and fruit yield.

Conclusion: It was concluded that T_2 treatment application has greatly enhanced vegetative growth, fruit yield, and fruit quality of sweet seedless Mandarin under field conditions.

Keywords: *Pesticide, Trebon 10 EC, Newsgard 75 WP, sweet seedless Mandarin*

1. INTRODUCTION

Citrus is an important fruit crop around the globe [1]. It is a major fruit crop grown worldwide and is mainly cultivated in parts of tropical and sub-tropical regions of the world [2]. However, its production is hampered by numerous species of insect pests including psyllids, leafminers, fruit flies and scales, and diseases including canker, greening and downy mildews [3]. Batool et al. [4] reported that citrus diseases have emerged as potential threat to citrus productivity globally. Akhtar and Ahmed [5] noted severe loss of citrus due to these diseases like 22% in Kinnow, 25–40% in sweet orange, 15% in grapefruit, 10% in sweet lime, and 2% lemon. In order to control these pests and to protect their crop and yield, farmers indiscriminately and recurrently use a wide range of synthetic pesticides including insecticides and fungicides [6]. In addition, large amounts of chemicals are employed in the management of insect pests and diseases in Viet Nam, however lack of information about control of diseases and plant protection measures on the part of citrus growers are other factors that affect the production and quality of sweet seedless Mandarin cultivar. Therefore, the aim of this study was to evaluate the effect of pesticide on vegetative growth, fruit development and yield in sweet seedless mandarin cultivar under field conditions.

2. MATERIALS AND METHODS

2.1. Experiment treatment

The experiment was carried out in sweet seedless mandarin cultivar (*Citrus unshiu* Marc) 1 to 2 years old from 2017 to 2018 at Dai Tu district, Thai Nguyen province. The experiment consists of three treatments including the control was designed in Randomized Complete Block Design with three replications and three uniform trees were taken as an experiment unit. The experiment included three treatments as follows: T_1: Spray water (control); T_2: Spray Trebon 10 EC; T_3:

Spray Newsgard 75 WP. The pesticide was applied at the same time shoot innitial and development stage on windless mornings with a truck- mounted motorized sprayed until drip off

2.2. Data Collection

The number of shoot per tree were determined by choosing randomly 3 trees and the number of shoot were counted. Later shoot maturite (length and diameter) were measured with vernier calipers. Leaf number per shoot was evaluating by choosing randomly 4 shoots on each tagged tree and the number of leaf were counted. At harvesting, final fruit length, fruit diameter, flesh thickness was determined with the help of Vernier caliper. Average fruit weight, flesh fruit weight, peels fruit weight and yield was determined by weighing. Total soluble solid (TSS) was measured by using a hand refractometer (ATAGO Co. LTD., Tokyo, Japan) juice was squeezed from the fresh-cut wax apple and the result was expressed as ^{o}Brix.

2.3. 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 $p \leq 0.05$)

3. RESULTS AND DISCUSSION

3.1. Effect of pesticide on vegetative growth of sweet seedless M adarin cultivar

The results in Table 1 showed that in the case of 2017, there was no significant different plant height, tree canopy diameter, number of branch level 1 as number of branch level 2 among treatment ($p < 0.05$). However, in 2018 the same table data showed that there was significant different plant height between treatments ($p<0.05$). In contract, application of T_2 treatment produced the highest value of 183.56 cm, whereas the control treatment gave the lowest value (162.11 cm). For the tree canopy diameter, the results also indicated that T_3 treatment application gave the highest value of 125.22 cm, whereas the lowest tree canopy diameter was found in untreated control with value of 122.44 cm, although the difference was not statistically significant ($p<0.05$). Furthermore, the data in Table 1 showed that there was significant different in number of branch level 2 among treatments ($p<0.05$). T_3 treatment application gave the highest value (92.89 number of branches level 2/tree), whereas the lowest number of branches level 2/tree was recorded in control treatment with value of 48.44 branches /tree.

Table 1. Effect of pesticide on vegetative growth of sweet seedless madarin cultivar

Year	Treatment	Plant height (cm)	Tree canopy diameter (cm)	No.branch level 1 (branch/tree)	No. branch level 2 (branch/tree)
2017	**T_1**	144.67^a	88.56^a	3.78^a	10.33^a
	T_2	148.22^a	88.89^a	3.89^a	11.78^a
	T_3	145.33^a	99.78^a	4.00^a	12.11^a
	p	>0.05	>0.05	>0.05	>0.05

	LSD.05	-	-	-	-
2018	**T_1**	162.11^{c}	122.44^{a}	*	48.00^{b}
	T_2	183.56^{a}	123.50^{a}	*	75.44^{a}
	T_3	171.44^{b}	125.22^{a}	*	92.89^{a}
	p	<0.05	>0.05		<0.05
	LSD.05	8.1	-		23.3

Number of branches level 1 only measure in first year, then do not change to desing the canopy of tree.

3.2. Effect of pesticide on number of shoot in sweet seedless madarin cultivar

T_3 treatment application gave the highest value of 11.9 spring shoot/tree, followed by T_2 treatment application, whereas the lowest value of 9.3 Spring hoot/tree recorded in untreated control, although the difference was not statistically significant ($p<0.05$). The same data in Table 2 indicated that there was significantly summer shoots number and Autumn shoot number in all treatment as compared to untreated control. In term, T_3 treatment had the maximum value of 16.6 shoots/tree and 12.6 shoots/tree in summer and autumn shoot, respectively. The minimum summer shoots and autumn shoot number with value of 9.6 shoots/tree was recorded in control treatment, which was achieved in the case of 2017 study. However, in the case of 2018 study, the results in Table showed that there was no significant difference in srping shoot, summer shoot ans autumn shoot in all treatment as compared to untreated control.

Table 2. Effect of pesticide on number of shoot in sweet seedless madarin cultivar

Year	**Treatment**	**Spring shoot number/tree**	**Summer shoot number/tree**	**Autumn shoot number/tree**
2017	**T_1**	9.3^{a}	9.6^{c}	9.6^{b}
	T_2	9.7^{a}	12.8^{b}	11.9^{a}
	T_3	11.9^{a}	16.6^{a}	12.6^{a}
	P	>0.05	<0.05	<0.05
	LSD.05	-	2.5	1.8
2018	**T_1**	68.6^{a}	71.8^{a}	94.2^{a}
	T_2	75.2^{a}	79.8^{a}	101.4^{a}
	T_3	87.0^{a}	85.9^{a}	100.3^{a}

P	>0.05	>0.05	>0.05
LSD.05	-	-	-

**Means followed by different letter are significantly different within columns by Duncan's multiple range test, P ≤ 0.0.5*

3.3. Effect of pesticide on shoot character of sweet seedless mandarin cultivar

The results in Table 3 showed that there was no significant difference shoot length for all treatment in the case of spring shoot in 2017. However, in 2018 the highest spring shoot length with value of 17.5 cm was observed in T_3 treatment, whereas the lowest spring shoot length with value of 12.0 cm was found in the control treatment. For the summer shoot, , the results showed that the highest shoot length 29.17 cm in 2017 and 19.9 cm in 2018 was obtained with T_3 treatment application, while the lowest value of of 26.25 cm and 16.3 cm in 2017 and 2018, respectively was found in untreated control, although the difference was not statistically significant ($p<0.05$). Furthermore, the results in Table 3 showed that there was significantly shoot length for all treatment in the case of autumn shoot in 2017 and 2018. The highest shoot length with value of 17.17 cm in 2017 and 15.4 cm in 2018 was observed in T_3 treatment, while the lowest shoot length with value of 13.25 cm in 2017 and 13.5 cm in 2018 was found in the control treatment, respectively.

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

		Spring shoot			**Summer shoot**			**Aurtum shoot**		
Year	**Treatment**	**Shoot length (cm)**	**Shoot diameter (cm)**	**Leaf number/ shoot (in leaf)**	**Shoot length (cm)**	**Shoot diameter (cm)**	**Leaf number/ shoot**	**Shoot length (cm)**	**Shoot diameter (cm)**	**Leaf number/ shoot**
2017	T_1	16.08^{a}	0.45±0,01	8.92^{a}	26.25^{a}	0.37±0,01	14.00^{a}	13.25^{b}	0.33±0,02	9.17^{a}
	T_2	18.22^{a}	0.44±0,03	9.33^{a}	28.83^{a}	0.42±0,02	16.33^{a}	16.33^{a}	0.36±0,02	9.92^{a}
	T_3	18.66^{a}	0.46±0,04	9.50^{a}	29.17^{a}	0.42±0,05	17.58^{a}	17.17^{a}	0.38±0,03	10.50^{a}
	P	>0.05		>0.05	>0.05		>0.05	<0.05		>.05
	LSD.05	-		-	-		-	2,1		-
2018	T_1	12.0^{b}	0.32±0.04	8.25^{a}	16.3^{b}	0.36±0.03	7.58^{b}	13.5^{c}	0.39±0.01	10.42^{b}
	T_2	13.5^{b}	0.34±0.03	8.42^{a}	18.3^{a}	0.40±0.04	8.17^{ab}	14.5^{b}	0,34±0.02	11.08^{b}
	T_3	17.5^{a}	0.37±0.07	9.33^{a}	19.9^{a}	0.44±0.01	9.42^{a}	15.4^{a}	0,41±0.02	12.25^{a}
	P	<0.05		>0.05	<0.05		<0.05	<0.05		<0.05
	LSD.05	2.0		-	1.9		0.9	0.7		1.0

**Means followed by different letter are significantly different within columns by Duncan's multiple range test, P ≤ 0.0.5*

For the shoot diameter the results in Table 3 showed that T_3 treatment application gave the highest value of 0.46 cm; 0.42 cm; 0.38 cm in spring shoot, summer shoot and autumn shoot, respectively, whereas the lowest shoot diameter with value of 0.32 cm; 0.36 cm and 0.33 cm was found in control treatment, which was achieved in the case of 2017 study. Data showed that in the case of 2018 study, the T_3 treatment application also produced the maximum shoot diameter with value of 0.37 cm; 0.44 cm; 0.41 cm in in spring shoot, summer shoot and autumn shoot, respectively, while minimum of shoot diameter with value of 0.32 cm; 0.36 cm; 0.39 cm was recorded in control treatment, respectively.

For the leaves number, the results in Table 3 indicated that 3 there was no significant number of leaf per shoot for all treatment as compared untreated control in the case of spring shoot in 2017 and 2018. However, in the case of summer shoot in 2017 showed that the highest value of 17.58 number of leaves per shoot was achieved in T_3 treatment application, whereas the control treatment has the lowest value of 14.0 number of leaves per shoot, although the difference was not statistically significant ($p<0,05$). Furthermore, the results in Table 3 also showed that there was significantly number leaves per shoot for all treatment as compared untreated control in the case of summer shoot in 2018 study. In which, T_3 treatment application gave the highest value of 9.42 number of leaves/shoot, whereas the lowest value of 7.58 number of leaves/shoot was recorded in control treatment. For the autumn shoot, Table showed that there was no significant difference leaves number/shoot for all treatment in 2017. However, in 2018 study, the results indicated that application of T_3 treatment gave the highest value (12.25 number of leaves/shoot), whereas the lowest number of leaves/shoot with value of 10.42 was found in untreated control.

3.4. Effect of pesticide on fruit character and yield of mandarin sweet seedless cultivar

The results in Table 4 showed that T3 treatment application gave the highest value of 13.0 fruit initial number/tree, whereas the lowest value of 6.2 fruit initial number/tree was recorded in untreated control. For the number of fruit maturity, the same data also indicated that T_2 treatment application exhibited the maximum (0.7) number of fruit maturity/tree, whereas the lowest value was found in untreated control with 0.3 number of fruit maturity/tree.0020However, table 4 indicated that fruit weight among treatment increase as compared to untreated control. In term the highest fruit weight (133.4 g/fruit) was achieved at T_2 treatment application, followed by T_3 treatment application, whereas the control treatment gave the lowest value of 124.3 g/fruit. For the fruit size, the highest value of 5.47 cm fruit length was recorded in T3 treatment application, followed by T2 treatment, while the control treatment gave the lowest value of 5.3 cm fruit length. However, the same data in Table 4 also indicated that T2 treatment application gave the highest value of 6.5 cm fruit diameter. For the fruit yield, the maximum fruit yield with value of 0.26 kg/tree was achieved in T2 treatment application, followed by T3 treatment, whereas the control treatment gave the lowest fruit yield with value of 0.13 kg/tree.

Table 4. Effect of pesticide on fruit character and yield of mandarin sweet seedless cultivar

Treatment	**No. fruit innitial (fruit/tree)**	**No. fruit maturity (fruit/tree)**	**Fruit weight (g/fruit)**	**Fruit length (cm)**	**Fruit diameter (cm)**	**Yield (kg/tree)**

T_1	6.2±5.64	0.3±0.13	121.8±11.86	5.30±0.26	6.37±0.15	0.13±0.12
T_2	11.3±9.76	0.7±0.13	129.83±2.46	5.37±0.25	6.50±0.30	0.26±0.13
T_3	13.0±10.91	0.4±0.19	127.56±17.23	5.47±0.32	6.27±0.32	0.17±0.09

Effect of pesticide on fruit quality of mandarin sweet seedless cultivar

The result in Table 5 showed that the highest flesh fruit weight was achieved in T3 treatment application with value of 98.01 g/fruit, followed by T2 treatment application (97.81 g/fruit), whereas the lowest value of 89.22 g/fruit was found in untreated control. For the peel fruit weight, the control treatment gave the maximum value of 28.32 g/fruit, while the T3 treatment application had the lowest value of 25.97 g/fruit. However, the results in table showed that there was no seed number in all treatment. For the TSS, the results in Table 5 showed that T2 treatment application gave the highest value of 8.5 ^{o}Brix, followed by T3 treatment, whereas the control treatment gave the lowest value of 7.53 ^{o}Brix.

Table 5. Effect of pesticide on fruit quality of mandarin sweet seedless cultivar

Treatment	**Flesh fruit weight (g/fruit)**	**Peel fruit weight (g/fruit)**	**Seed number**	**TSS content (^{0}Brix)**
T_1	89.22±13.6	28.32±5.15	0	7.53±0.25
T_2	97.81±7.57	27.973±6.27	0	8.50±0.17
T_3	98.01±12.7	25.967±2.54	0	7.80±0.17

4. Conclusion

From the experiment results, it can be concluded that application of Trebon 10 EC greatly enhancing vegetative growth, fruit size, fruit weight and yield of sweet seedless mandarin cultivar. Therefore, we concluded that Trebon 10EC application may be recommended as practical tool for increasing vegetative growth, fruit development of sweet seedless mandarin cultivar under Thai Nguyen province conditions.

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