Study on Application Effect of Humic Acid on Guanxi Pomelo

Zeng Chunhua[1], Lin Wenhui[1], Wu Bingqing[2]
(1. Agricultural Technical Extension Station, Agriculture Bureau of Pinghe County, Zhangzhou City, Fujian Province, 363700; 2. Agricultural Technical Extension Station, Shange Town, Pinghe County, Zhangzhou City, Fujian Province, 363700)

Abstract: The application effect of soluble humic acid on red-flesh and white-flesh Guanxi pomelo was studied, and the results showed that the application of soluble humic acid could significantly increase the average single fruit weight, yield and total soluble sugar content of the pomelo. The average single fruit weight and yield per 666.67m^2 of the treated pomelo increased by 9.62% and 10.1% for the red-flesh variety and by 9.16% and 9.75% for the white-flesh variety, respectively, while the total soluble sugar content increased by 13.5% and 15.3%, respectively. Furthermore, the application of soluble humic acid could also lead to reduced cracking rate, increased vitamin C (ascorbic acid) content, and improved quality of the pomelo.
Keywords: Humic acid; Pomelo; Application effect
Chinese Library Classification No.: S666.306$^+$.2 **Document Code:** A
Article No.: 1006-2327-(2015)02-0022-03

Pinghe County, located in the southwest of Zhangzhou City, part of the Hokkien Golden Triangle, Fujian Province, is renowned in the world for the cultivation of Guanxi pomelo. Currently, Guanxi pomelo has become a rural economic pillar industry in Pinghe. By 2013, the planting area and total yield of Guanxi pomelo in the whole county had reached 43,000hm^2 and more than 1.10 million tons[1-2], and the fruit was sold almost all over the world, with major export markets in Europe, the United States, and Southeast Asia. However, orchards with truly high quality and high yield are not abundant, and improper fertilizer use is a significant reason[3]. Reasonable fertilization is the only solution for achieving high quality and high yield.

Humic acid is the primary constituent of humus and typically forms complexes with ions in natural environments. Studies have shown[4-7] that humic acid can enhance the yield and quality of citrus, corn and various vegetables. However, the application of humic acid in pomelo cultivation remains unreported. In Pinghe County, now there are six varieties of Guanxi pomelo[8]], with white-flesh pomelo (traditional Guanxi pomelo) and red-flesh pomelo being the most extensively cultivated varieties. This paper is a preliminary endeavor to investigate the application effect of humic acid on Guanxi pomelo by testing soluble humic acid on these two pomelo varieties.

1. Material and Method

1.1 Test Crop

Guanxi pomelo is classified into the red flesh variety and the white flesh variety. The cultivation density of white-flesh pomelo is 55 plants/666.67m^2, with a tree age of 10; the cultivation density of red-flesh pomelo is 50 plants/666.67m^2, with a tree age of 8.

1.2 Test Fertilizer

"KEJIEJIA" Highly Active Humic Acid liquid.

1.3 Test Location and Soil

The test locations are Cuoqiu Village and Neilin Village in Xiaoxi Town, Pinghe County, Zhangzhou City. Cuoqiu Village, known as the birthplace of the nationally renowned red-flesh pomelo, is located in the western part of Pinghe County, boasting convenient transportation and fertile land. The village yields more than 5,000 tons of red-flesh and white-flesh pomelo annually. Neilin Village, located along the picturesque Huashan Creek and backed by Daping Mountain, is recognized as the origin of yellow-flesh pomelo. It is 3km away from Pinghe County. In this test, lateritic soil was chosen for cultivating pomelo in both villages.

1.4 Test Time and Method

The test was started on May 3, 2014, with foliage spray of fertilizer diluted 500 times. The fertilizer was administered every other month, and there were four sprays in total. The two varieties of red-flesh and white-flesh pomelo covered an area of 1hm^2 per treatment, and each treatment was replicated three times. A blank control (spray of clear water only) was set for each treatment, as shown in Table 1. The application time, method and dosage of other conventional fertilizers remained consistent throughout the test.

1.5 Field Management

Field management practices, including disease and pest control, fertilizer and water management, as well as weeding, remained consistent across all the treatment groups.

Table 1 Basic Information about Test Locations and Fertilizer Usage

Test Location	Variety of Pomelo	Total Area of Treatment Group (666.67m^2)	Control Area (666.67m^2)	Dilution Ratio of Fertilizer
Cuoqiu Village	Red flesh	45	5	500
Neilin Village	White flesh	45	5	500

There were 4 rounds of conventional fertilization, namely, fertilizer for promoting branch and flower growth, fruit retention fertilizer, fruit swelling fertilizer, and fruit harvesting fertilizer. The specific fertilization method is shown in Table 2. The diseases of Guanxi pomelo mainly included scab, anthracnose, maculopathy and canker, and the insect pests mainly included scale insects, aleyrodid, spider mites, phyllocoptruta oleivora, etc. The weed was prevented and controlled by 41% glyphosate. The specific method of pesticide usage is shown in Table 3.

Table 2 Fertilizer Application Method

Fertilization Time	Type and Quantity of Fertilizer (Per Plant)
Fertilizer for promoting branch and flower growth	1kg nitrogen fertilizer, 0.5kg phosphate fertilizer, 0.5kg potassium fertilizer, and 0.25kg magnesium sulphate fertilizer
Fruit retention fertilizer	1.5-2kg 15:15:15 compound fertilizer
Fruit swelling fertilizer	10kg cow dung, 0.5kg calcium magnesium phosphate fertilizer, and 0.5kg potassium sulphate
Fruit harvesting fertilizer	3kg compound microbial organic fertilizer, 0.5kg urea, 0.5kg calcium magnesium phosphate fertilizer, 0.5kg potassium chloride, 0.1kg magnesium sulfate, and 0.1kg zinc sulfate

Table 3 Method of Pesticide Usage

Prevention and Control Item	Prevention and Control Method
Insect pest	24% spirodiclofen (5,000 times), 99% EnSpray emulsifiable oil (250 times) + imidacloprid, acetamiprid, lambda-cyhalothrin, etc.
Disease	86.2% cuprous oxide (1,500 times), 47% kasugamycin (1,200 times), 0.3% equivalent bordeaux mixture, mancozeb (600-800 times)
Weed	41% glyphosate

1.6 **Result Testing and Statistical Analysis**

1.6.1 Harvesting

During the pomelo harvesting season, a total of 20 plants were chosen at random for each treatment in order to compare the taste of the fruit and calculate the quantity of cracked fruit and average single fruit weight. At the same time, the average yield per 666.67m^2 was calculated based on the total actual yield.

1.6.2 Test of Sugar and Vitamin C Contents

The total soluble sugar (measured in glucose) and vitamin C (ascorbic acid) in the two varieties of pomelo harvested at the same time were determined in accordance with the national standards GB/T5009.8-2008 *Determination of Saccharose in Foods* and GB/T5009.86-2003 *Method for Determination of Total Ascorbic Acid in Fruits, Vegetables and Derived Products - Fluorometric Method and Colorimetric Method*.

2. Results and Analysis

2.1 **Effect on Pomelo Yield and Quality**

As shown in Table 4, the application of soluble humic acid could significantly increase the average single fruit weight and yield per 666.67m^2 of the pomelo. The average single fruit weight and yield per 666.67 m^2 of the treated pomelo increased by 9.62% and 10.1% for the red-flesh variety and by 9.16% and 9.75% for the white-flesh variety, respectively. The consistent increases in single fruit weight and yield suggested that the increased pomelo yield could be attributed to the increased single fruit weight.

Table 4 Application Effect of Humic Acid on the Yield of Pomelo

Test Location	Variety of Pomelo	Average Single Fruit Weight (kg)			Average Yield Weight Per 666.67m^2 (kg)		
		Treatment	CK	Increase (%)	Treatment	CK	Increase (%)
Cuoqiu Village	Red flesh	1.605	1.464	9.62	2631	2389	10.1
Neilin Village	White flesh	1.698	1.556	9.16	3016	2748	9.75

It was found through comparison of the appearance and taste of the pomelo that the cracking rates of the treatment groups (3.63%-3.72%) were significantly lower than those of the control groups (6.94%-7.81%). The pomelo treated with soluble humic acid also tasted more delicate and sweeter, while the pomelo in the control groups had relatively poorer taste. These results are shown in Table 5.

2.2 **Effect on Sugar and Vitamin C Contents**

The measurements of the total soluble sugar (measured in glucose) and vitamin C (ascorbic acid) contents in the pomelo (as shown in Table 6) indicated that the total soluble sugar contents in the red-flesh and white-flesh pomelo reached 8.799% and 8.492%, respectively, increasing by 13.5% and 15.3% when compared to the control groups; the vitamin C contents of the treated red-flesh and white-flesh pomelo were 41.35mg/100g and 40.21mg/100g, respectively, increasing only slightly by 4.10% and 6.07% when compared to the control groups.

Table 5 Application Effect of Humic Acid on the Quality of Pomelo

Test Location	Variety of Pomelo	Cracking Rate (%)		Taste	
		Treatment	CK	Treatment	CK
Cuoqiu Village	Red flesh	3.63	7.81	Delicate and sweet	Less sweet
Neilin Village	White flesh	3.72	6.94	Delicate and sweet	Less sweet

Table 6 Application Effect of Humic Acid on Sugar and Vitamin C Contents of Pomelo

Test Location	Variety of Pomelo	Total Soluble Sugar (Measured in Glucose) (%)			Vitamin C Content (mg/100g)		
		Treatment	CK	Increase (%)	Treatment	CK	Increase (%)
Cuoqiu Village	Red flesh	8.799	7.753	13.5	41.35	39.72	4.10
Neilin Village	White flesh	8.492	7.365	15.3	40.21	37.91	6.07

3. **Conclusion and Prospect**

The analysis on the test showed that repeated application of soluble humic acid throughout the pomelo fruiting season could result in significantly increased yield, reduced cracked fruit, improved sugar content, and enhanced quality of pomelo, thereby assisting pomelo growers in maximizing their yield and income. (Continued on Page 34)

Pesticide Varieties: Methamidophos, parathion-methyl, parathion, monocrotophos, phosphamidon, phorate, isofenphos-methyl, terbufos, phosfolan-methyl, sulfotep, demeton, carbofuran, aldicarb, ethoprophos, phosfolan, coumaphos, fonofos, isazofos, fenamiphos, benzene hexachloride, DDT, toxaphene, dibromochloropropane, chlordimeform, dibromethane, nitrofen, aldrin, dieldrin, mercurial, arsenic, plumbum, Bis-A-TDA, fluoroacetamide, gliftor, silatrane, etc.

7.2.2 Pesticide Use Requirement

Pesticides with varying modes of action or cross resistance should be mixed and alternated reasonably to prevent and delay the onset and progression of resistance in diseases and insect pests.

7.3 **Prevention and Control of Underground Pests**

Underground pests should be prevented by mixing 80g 40% high-permeability phoxim emulsifiable concentrate with water spray per 666.67m^2 before sowing.

7.4 **Prevention and Control of Weed**

The weed should be prevented by mixing 100g 50% butachlor emulsifiable concentrate with water spray per 666.67m^2 before sowing.

7.5 **Prevention and Control of Aphids**

Aphids should be prevented by mixing 10g 10% imidacloprid wettable powders with water spray per 666.67m^2.

7.6 **Prevention and Control of Powdery Mildew**

The powdery mildew should be prevented by mixing 100g 70% thiophanate-methyl wettable powders with water spray per 666.67m^2; or mixing 60g 15% triadimefon wettable powders with water spray per 666.67m^2.

8. Timely Harvesting

Harvesting takes place when the fleshy roots of the carrots have fully developed and some of the leaves start to turn yellow. Premature harvesting can result in low yield and poor quality when the fleshy roots do not fully develop. Delayed harvesting is prone to suberification, which leads to deteriorating quality. Therefore, it is crucial to harvest at the right time based on market demands and customer requirements. Typically, harvesting takes place between late January and early May. It is important to minimize damage during both harvesting and transportation. The garden should be cleaned promptly after harvesting. Timely post-harvesting plowing and weeding are required, in order to reduce the risk of diseases and habitats of pests.

(Continued from Page 23)

References

[1] Huang Risheng. “Road to Standardized Production of Guanxi Pomelo in Pinghe.” [J]. *China Fruit News*, 2015, 32(1): 19-21

[2] Zhang Jintao. “Standardized Cultivation Technology of High-quality and High-yield Guanxi Pomelo in Pinghe.” [J]. *China Tropical Agriculture*, 2014, 5: 67-70

[3] Zeng Chunhua, and Wu Bingqing. “A Preliminary Study on the Fertilization Technology of Gunxi Pomelo in Pinghe County.” [J]. *Fujian Agricultural*, 2014, 6: 74-75

[4] Yuan Lifeng, Huang Tengyue, Wang Xiaoling, et al. “Effects of Humic Acid and Humic Acid Organic Fertilizer on the Yield and Crude Protein Content of Maize.” [J]. *Tianjin Agricultural Sciences*, 2014, 20(8): 87-90

[5] Zhang Man, Bu Yushan, Wang Jing, et al. “Effect of Coal-based Humic Acids and Exogenous Cu on Pak-choi.” [J]. *Tianjin Agricultural Sciences*, 2014, 20(6): 9-13

[6] Zhang Zhao. “Experiment on the Application Effect of Humic Acid-containing Water Soluble Fertilizers on the Intensive Cultivation of Tomatoes.” [J]. *Anhui Agricultural Science Bulletin*, 2014,20(9): 69-70

[7] Lin Ze’an, and Zhou Fuzhong. “Study on the Application Effect of Humic Acid-containing Water Soluble Fertilizers (Jinong) on Citrus in Lichuan City.” [J]. *Bulletin of Agricultural Science and Technology*, 2013, 7: 136-140

[8] He Zhifa. “Status and Development Idea of ‘Guanximiyou’ Pomelo Industry in Pinghe County.” [J]. *Southeast Horticulture*, 2014, 2(5): 58-62