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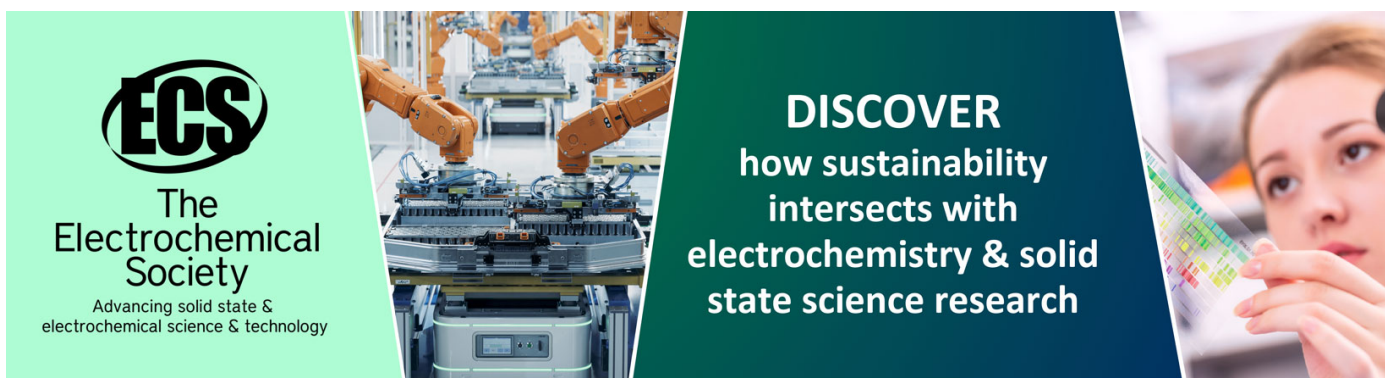
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Study on the Adaptability of ‘Huangguogan’ in Jiangyou, Sichuan Province

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Abstract. In this experiment, ‘Huangguogan’ introduced from Shimian to Jiangyou was used as the material and Shimian ‘Huangguogan’ as the reference. The adaptability of ‘Huangguogan’ was studied from three aspects: site climate conditions, basic indicators of tree body and fruit quality. The results showed that the overall situation of Shimian ‘Huangguogan’ was better than Jiangyou ‘Huangguogan’, especially the internal quality of the fruit, which indicated that Jiangyou was not suitable to introduce ‘Huangguogan’.

1. Introduction

‘Huangguogan’ was a hybrid variety of Citrus in Rutaceae family[1]. It originated from Shimian County, Ya'an City, Sichuan Province, and was a local late ripening characteristic fruit[2]. It has three characteristics of the flowers and fruit exist at the same time, high yield and late ripening. As of 2016, the planting area of Huangguogan in Shimian County has reached 2700hm² and the output was 140000 tons and the annual output value was 504 million yuan. It has become the key industry of agricultural economic development in Shimian County, creating better economic benefits for farmers, and becoming the “national geographic indication registration and protection of agricultural products”. Previous studies have found that under different habitat conditions and the phenotype of a species will change, known as phenotypic plasticity or environmental decoration, which was a response ability of the same species due to environmental changes[3-6]. Introduction was a way to provide environmental changes, which will affect the change of its phenotype and internal quality. According to some data, since the company of ‘Huangguogan’ commercial base in Hanyuan County, it has been introduced and cultivated by millions of plants in and out of the province, but there were few reports on its introduction adaptability. Therefore, it was very important to study the introduction experiment of ‘Huangguogan’. In this experiment, ‘Huangguogan’ was used as the material to analyze the feasibility of the introduction and cultivation of ‘Huangguogan’ in different places by comparing the differences of the site climate conditions, the basic index of tree body and fruit quality between Shimian and Jiangyou, so as to provide guidance for the subsequent production of the variety in Jiangyou and scientific reference for the introduction of ‘Huangguogan’ in other places.



2. Materials and Methods

2.1 Experimental materials

The test materials were 7-year ‘Huangguogan’ trees with the same tree age, tree potential and tree shape in Shimian County of Ya'an City and Xiping town of Jiangyou City.

2.2 Experimental design

This experiment was based on Jiangyou ‘Huangguogan’ as the material and Shimian ‘Huangguogan’ as the reference. In order to ensure the representativeness of the materials, all the materials were selected by the “S” type sample selection method. Five plants were treated as one treatment, three times of repetition, and a total of 30 plants were used as the test materials. All the plants were marked and recorded with numbers.

2.3 Test methods

2.3.1 Investigation methods of tree related indexes. Investigate the basic situation of the tree body, including tree height, trunk height, trunk girth, crown diameter and yield, etc..The investigation referred to the methods of Luo Jianxia and Sun Jianshe[7].

2.3.2 Fruit quality measurement method. The two experimental plants were sampled on March 12, 2018. One fruit was collected from the East, South, West, North and middle of the plant respectively, 5 for each tree, and a total of 150 fruits were taken back to the laboratory for determination in time[8]. The determination methods of sugar, acid and vitamin C (V_C) were respectively determined by Fehling reagent method[9], NaOH neutralization titration method and 2,6-d titration method. The comprehensive evaluation of fruit quality was based on Li Wei' method[10]. All the results were recorded in the table with the average of the experimental data of the two places.

3. Results and analysis

3.1 Investigation and analysis of conventional weather in the experimental site

It can be seen from table 1 that the average temperature difference between the two places was very obvious. The average temperature difference between Shimian and Jiangyou was 0.9°C, and the annual rainfall difference was 322.6mm, and the annual sunshine hours difference was 121.4h and the frost free period difference was 46d. Under the special geographical conditions, the annual evaporation of Shimian was 1.6 times of that of Jiangyou, and the annual effective accumulated temperature of more than or equal to 10°C in both places was about 5400. The soil types were all laterite. In the production of fruit trees, temperature and light were the main influencing factors, while the average temperature and annual sunshine hours in the data were very different, which shows that the site conditions of the two places were very different, which may directly affect the adaptability of ‘Huangguogan’.

Table 1. Questionnaire of conventional meteorology and soil in the test site

Treatment	Average temperature /°C	Precipitation /mm	Annual sunshine hours/h	Frost free period /d	Annual evaporation /mm	≥10°C Temperature	Soil type
Shimian	17.1	777.4	1245.6	326	1573	5468	laterite
Jiangyou	16.2	1100	1367	280	980	5352	laterite

3.2 Investigation and analysis of the basic situation of trees

It can be seen from table 2 that the tested plants selected in the two places had a mean tree middle and were naturally open tree form. The height, trunk height and trunk girth of the trees were basically the same. However, the crown diameter of Shimian ‘Huangguogan’ was smaller than Jiangyou

‘Huangguogan’, but the yield of a single plant was 12kg higher than Jiangyou ‘Huangguogan’, indicating that Jiangyou ‘Huangguogan’ was prosperous in health preservation, but the yield was relatively low.

Table 2. Basic information of tree

Treatment	Tree vigor	Tree form	Tree height/m	Trunk height/cm	Trunk girth/cm	Crown diameter / (m × m)	Yield per plant/kg
Shimian	Middle	open tree form	4.40	23.00	62.00	4.36 × 4.86	103.39
Jiangyou	middle	open tree form	4.49	23.59	64.50	4.52 × 5.32	96.25

3.3 Analysis of fruit appearance quality

The test results (Table 3) show that the average single fruit weight, vertical and horizontal diameter of Jiangyou ‘Huangguogan’ were greater than that of Shimian ‘Huangguogan’, and the fruit shape index has changed a lot.

Table 3. Determination of fruit appearance index

Treatment	Single fruit weight /g	Longitudinal diameter /cm	Transverse diameter /cm	Fruit shape index
Shimian	125.55	6.51	6.14	1.06
Jiangyou	147.51	6.39	6.82	0.94

Note: generally, the fruit shape index was 0.8-0.9 for round or nearly round, 0.8-0.6 for flat round, 0.9-1.0 for oval or cone, and above 1.0 for oblong.

3.4 Analysis on the internal quality of fruit

It can be seen from table 4 that the contents of reducing sugar, transforming sugar, total sugar, soluble solids, V_C and sugar acid ratio in the internal quality of Shimian ‘Huangguogan’ were higher than those of Jiangyou ‘Huangguogan’, but the titratable acid was lower than Jiangyou ‘Huangguogan’, which indicated that the internal quality of Shimian ‘Huangguogan’ was better than Jiangyou ‘Huangguogan’, and the sugar content of Jiangyou ‘Huangguogan’ was low and the acid content was high, which led to over sour taste and was not conducive to the market extension.

Table 4. Determination of internal quality of fruit

Treatment	Reducing sugar / (g·100 mL ⁻¹)	Transforming sugar / (g·100 mL ⁻¹)	Total sugar / (g·100 mL ⁻¹)	Soluble solid state/%	Titratable acid / (g·100 mL ⁻¹)	V_C / (mg·100 mL ⁻¹)	Sugar acid ratio
Shimian	4.38	11.07	10.74	13.30	0.82	37.72	16.22
Jiangyou	3.66	9.14	8.87	10.85	0.96	35.32	11.30

4. Discussion and conclusion

The analysis of the meteorological data shows that the basic site conditions of Shimian and Jiangyou were very different, especially the average temperature, annual sunshine hours and annual evaporation, which were the most critical factors in the adaptability of introduction, so this may be the key factor for Jiangyou not to be suitable for the introduction of ‘Huangguogan’. It can be seen from the basic situation of tree body that Jiangyou ‘Huangguogan’ was superior to Shimian ‘Huangguogan’ in tree height, trunk height, trunk girth, crown diameter and other tree body indexes, but the yield per plant was 12 kg lower than Shimian ‘Huangguogan’, which shows that Jiangyou ‘Huangguogan’ was more nutritious than Shimian ‘Huangguogan’, while reproductive growth was opposite.

From the analysis of fruit quality parameters, we can see that the internal quality and appearance quality of Shimian ‘Huangguogan’ were better than Jiangyou ‘Huangguogan’, especially the internal quality. In appearance quality, Jiangyou ‘Huangguogan’ has the characteristics of different fruit regularity; in internal quality, the ratio of reducing sugar, transforming sugar, total sugar, soluble solids, V_C and sugar acid of Jiangyou ‘Huangguogan’ was smaller than that of Shimian ‘Huangguogan’,

and titratable acid was larger than that of Shimian ‘Huangguogan’, indicating that the internal quality of Shimian ‘Huangguogan’ was better than that of Jiangyou ‘Huangguogan’.

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References

- [1] Xiong B., Ye S., Qiu X., et al.. (2016) Effect of boron on physiological and antioxidant enzymes activity of Huangguogan. *Acta Agriculturae Zhejiangensis*, 28:1171-1176.
- [2] Yan Q.Q., Wang Z.H., Wu S.L., et al.. (2012) Research on the Prevention and Control Technology in the Field of Leaves Moss of Citrus cultivar cv. Huangguogan. *Northern Horticulture*, 23: 148-150.
- [3] Wen X. (2003) Genetic diversity in wild accessions of *rosa roxburghii* trutt from four provinces as revealed by RAPD analysis. *Scientia Agricultura Sinica*, 36(7): 823-828.
- [4] Li X., Zhu D., Du Y., et al.. (2004) Studies on genetic diversity and phylogenetic relationship of cucumber (*Cucumis sativus* L.) germplasm by AFLP technique. *Acta Horticulturae Sinica*, 31(3): 309-314.
- [5] Zhu H., Zhang H., Mao K., et al.. (2004) The genetic diversity of yunnan local varieties and wild species of tomato. *Journal of Yunnan Agricultural University*, 19(4): 373-377.
- [6] Macdonald S.E., Chinnappa C.C., Reid D.M. (1988) Evolution of phenotypic plasticity in the *stellaria longipes* complex: Comparisons Among Cytotypes and Habitats. *Evolution*, 42(5): 1036.
- [7] Luo J.X., Sun J.S. (2002) Introduction to the study of horticultural plant science. China Agriculture Press, Beijing.
- [8] Gu X.J., Cao S.Y., Li Q.N., et al.. (2016) Cloning and Sequence Analysis of XET Gene from Huangguogan Fruit. *Molecular Plant Breeding*, 14(6):1382-1388.
- [9] China National Standard. (1987) Method of inspection for export citrus fruit. http://ss.zhizhen.com/detail_38502727e7500f262a83bbf0e81e2110a5004fac4d280dee1921b0a3ea255101ec06fb7872c54b46711b13f6d5d50b889014c38c23f4dfba0e1da79dd1065d6082580b3a07b769852957e052909ae844?&apistrclassfy=0_17_9.
- [10] Li W., Gao H.Y., Chen H.J., et al.. (2017) Evaluation of Comprehensive Quality of Different Varieties of Bayberry Based on Principal Components Analysis. *Journal of Chinese Institute of Food Science and Technology*, 17:161-171.