Preliminary Study on The Control Method of *Prunus Americanc* Fruit Cracking

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Abstract. From 2018 to 2019, the control methods of *Prunus american* fruit were tested with *Prunus american* as experimental material. The fruit cracking rate of fruit trees was reduced by using comprehensive technical measures such as orchard grass, plastic film mulching, spraying gibberellin and spraying calcium fertilizer. The results showed that all treatments could reduce the fruit cracking rate of American plum fruit, and the effect of spraying gibberellin was the best.

1 Introduction

Prunus american is one of the traditional fruit trees of the Rosaceae, which has great fruit, sweet taste and good quality [1]. The *Prunus american* has strong adaptability, pressure resistance, cold resistance and high temperature, and can be grown in a damp and dry place. The fruit has the characteristics of beautiful fruit, thin skin, rich residue, moderate acidity and sweetness, pure flavor, rich nutrition, and the like. As a local characteristic fruit in Dazhou, Sichuan, *Prunus american* is the second-largest fruit of Dazhou.

In 2016, the development scale of the whole city reached 10667.2 hm², the output reached 6000 hm², the output reached about 120,000 tons, and the output value was 1 billion RMB. The *Prunus american* industry has become a pillar industry in Dazhou. Industrial development has led to the development of local labor services, transportation and wholesale and other related industries. The results showed that there were many reasons for fruit cracking, including genetic factors, water, plant hormones, mineral nutrition, pericarp mechanical properties and pericarp strength, climatic factors, agronomic measures, and the most important physiological and biochemical factors, such as water, gibberellin, calcium and so on.

From May to late August, the degree of summer drought in Dazhou is different, and after the drought, it rains or even rainstorm for a period of time. During this period, during the expansion and maturity of fruit trees, the fruit trees suddenly encountered heavy rain and a large amount of water absorption under the condition of lack of water, resulting in fruit cracking and fruit drop. According to statistics, the annual fruit drop rate is 25%-40%, or even higher, which has brought huge economic losses to fruit farmers.

In this experiment, a series of studies on the prevention and control of fruit cracking of *Prunus american* were carried out in order to find the most economical and effective method to prevent and control the fruit cracking of *Prunus american*. Therefore, it has a strong pertinence, practicability and necessity.

2 Test materials and methods

2.1 Test materials

Xuanhan County is a subtropical humid monsoon climate area, frost-free period is long. The average annual temperature is 16.8 °C, the sunshine is 1488 hours, the precipitation is 1230 mm, and the frost-free period is 296 days. In March 2018, *Prunus american* orchard was leased in Miao'an Township, Xuanhan County, Dazhou City. *Prunus american* is an early-maturing variety with an age of 8 years. The management level is general. 55 666.7m² plants and 2500 kg 666.7m² were planted in March 2018.

2.2 Methods

In this experiment, five treatments were set up (control, spraying calcium fertilizer, spraying gibberellin, orchard grass, plastic film mulching). In the same *Prunus american* orchard, the plum plants with the same tree shape, crown height and layer spacing were selected as the test materials, with a single plant as a repetition, each treatment with three repeats, respectively numbered, listed markers, and when the *Prunus american* fruit matured, the fruit cracking rate of the *Prunus american* was investigated, and the work was recorded truthfully. Material input. Repeated 2018 test in 2019.

2.2.1 Control

Donundefinedt do anything about it.

2.2.2 Spraying calcium fertilize

Before the second rapid expansion period of *Prunus american*, pure calcium was sprayed with pure calcium for 3 times in a row, and the interval between the two times was 7 days.

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2.2.3 Spraying gibberellin

Spraying 20 mg/L gibberellin at young fruit stage, fruit expansion stage and fruit maturity stage, 40 mg/L, 60mg/L gibberellin (up to crown drip)

2.2.4 Orchard grass

In March, clover, ryegrass and other grass species were sown (one replanting was carried out during the period), and the ground was deeply turned over before sowing (in order to ensure the same experimental conditions and other treatments were carried out). When the grass reached 40-50 cm, it could be mowed and covered around the tree disk.

2.2.5 Plastic film mulching

Before the second rapid expansion period of *Prunus americanc*, the plastic film was covered with plastic film under the condition of ensuring the suitability of soil moisture (bounded by the crown drop waterline).

2.3 Data analysis

The statistical data are analyzed by DPS data processing system for complete random single factor variance analysis, and multiple comparisons are carried out by LSD method [6].

3 Test results

The harvest began in late June and finished in early July. The test results are shown in tables 1 and 2.

The results showed that compared with the control, each treatment could reduce the fruit cracking rate of *Prunus americanc*, among which gibberellin spraying had the best effect, the fruit cracking rate was 8.3%, which was 69.6% lower than that of the control, and the fruit cracking rate of other treatments (spraying calcium fertilizer, orchard grass, plastic film mulching) was 44.32%, 52.74% and 50.55% lower than that of the control, respectively, and the fruit cracking rate of other treatments (spraying calcium fertilizer, orchard grass and plastic film mulching) was 44.32%, 52.74% and 50.55%, respectively. As far as yield was concerned, the implementation of each treatment could increase the yield of *Prunus americanc*, and the order was as follows: spraying gibberellin > spraying calcium fertilizer > orchard grass > plastic film mulching > control (without any treatment). The yield of each treatment (spraying gibberellin, spraying calcium fertilizer, orchard grass, plastic film mulching) increased by 28.28%, 20.33%, 19.82% and 9.46%, respectively.

According to Table 1, each treatment could reduce the amount of *Prunus americanc* fruit, and the order was as follows: spraying gibberellin < plastic film mulching < orchard grass < spraying calcium fertilizer < control (no treatment). The effect of spraying gibberellin was the best, and the fruit cracking per plant of each treatment (spraying gibberellin, spraying calcium fertilizer, orchard

grass, plastic film mulching) decreased by 61.02%, 33.20%, 43.33% and 45.99%, respectively. Compared with the control, the fruit cracking rate of each treatment (gibberellin, calcium fertilizer, orchard grass, plastic film mulching) decreased by 61.02%, 33.20%, 43.33% and 45.99%, respectively.

Table 2 is the statistical table of input cost estimation of materials and labor force of each treatment. It can be seen from the table that the order of cost of each treatment is as follows: control (CK) < spraying calcium fertilizer < spraying gibberellin < plastic film mulching < orchard grass, 39.4%, 41.3%, 75.1%, 62.4%, respectively. Therefore, compared with the control, the cost of spraying calcium fertilizer or gibberellin was the lowest.

Table 1 Statistics of crisp plum fruit cracking

Treatment	Output (kg/plant)	Number of cracked fruit (kg/ plant)	Fruit cracking rate (%)
control (CK)	46.93 bC	12.83 aA	27.34 aA
Spraying calcium fertilize	56.47 aAB	8.57 bB	15.18 bB
Spraying gibberellin	60.20 aA	5.00 cB	8.31 cC
orchard grass	56.23 aAB	7.27 bcB	12.93 bBC
plastic film mulching	51.37 bBC	6.93 bcB	13.49 bBC

Table 2 Statistics of input costs per plant for each treatment

Treatment	Cost (RMB/plant)	Higher than the control (%)
control (CK)	21.3	—
Spraying calcium fertilize	29.7	39.4%
Spraying gibberellin	30.1	41.3%
orchard grass	37.3	75.1%
plastic film mulching	34.6	62.4%

Note: In order to ensure that the test is carried out under the same conditions, the routine management is consistent except the test treatment method.

4 Summary and discussion

Previous studies have shown that excessive water content will increase the osmotic pressure of the fruit, thus reducing the osmotic pressure of the fruit itself by absorbing water. When water enters the pulp cells, the pericarp will produce a greater expansion pressure. When the expansion pressure exceeds the maximum pressure that the pericarp can bear, the fruit will crack [3].

The results of gibberellin showed that spraying gibberellin could reduce the swelling pressure and fruit cracking rate of pericarp [7-8]. The results showed that the surface water content of soil under plastic film mulching did not change much. When the soil moisture is too large, the mineral content absorbed by transpiration

decreases, and the absorption of essential nutrients by plants decreases, especially when calcium absorption decreases, the pericarp is stunted, the toughness decreases, and it is easy to crack [9]. Calcium is an important structural component of cell wall. It combines with pectin to form calcium salt, increases the elasticity of protoplasts, weakens the permeability of plasma membrane, enhances the pressure resistance and extension of cells, and enhances the crack resistance of pericarp [10]. Orchard grass can prolong photosynthetic time, increase photosynthetic rate, reduce soil moisture during forage growth in summer, promote soil water content, promote root growth and absorption, increase seed setting rate, overcome flower drop phenomenon, increase fruit yield and improve fruit quality [11-12].

The results showed that compared with the control, each treatment could reduce the fruit cracking of *Prunus american*, which was consistent with the results of previous studies, and could increase the yield of *Prunus american*. The results showed that spraying gibberellin < orchard grass < plastic film mulching < spraying calcium fertilizer < control (without any treatment), the cost of spraying calcium fertilizer or gibberellin was the lowest, which indicated that spraying gibberellin was an effective way to reduce the fruit cracking of early maturing and crisp plum in Dazhou area, and it was worth popularizing and applying. The prevention and control of American plum after superposition of each treatment remains to be studied in the next step.

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