Cause Analysis of Fruit Cracking of Sweet Cherry and Its Integrated Control Measures

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Abstract: The cracking of sweet cherry fruit after rain is one of the main causes of economic losses of the producers. The cracking not only affects the appearance, but also reduces the quality and hardness of the fruit and directly reduces the economic income of the fruit farmers, greatly shorten the sales period, and even have no time to sell on the canker down, it is a pity, to the fruit farmers caused heavy economic losses. This paper analyzes the reasons for the cracking of Sweet Cherry, and outlines the various measures taken by countries around the world to solve the cracking after rain, including site selection, selection of Sweet Cherry varieties that are not easy to crack, strengthening orchard management, foliar calcium supplementation, spraying with hydrophobic or lipophilic properties materials and construction of rain shelters, in order to guide the production of fruit farmers.

1 INTRODUCTION

Fruit cracking caused by rainfall before harvest is a serious problem in the production of sweet cherry. In some years, the rate of fruit cracking of sensitive varieties can reach 90%, which is the main reason of yield reduction in many cherry producing areas in the world (Simon, 2006). The sweet cherry industry in china is developing rapidly. In addition to the traditional production area around bohai bay, the cultivation area of new production areas such as shanxi, sichuan and yunnan-guizhou plateau is expanding rapidly, the appearance quality is affected, and the leaching of water-soluble materials (including water-soluble sugar) will reduce the taste quality and hardness, while the fruit cracking is more vulnerable to diseases and insects, resulting in post-harvest decay, greatly reducing shelf life, it is an important problem that affects fruit quality and economic benefit. In order to solve the problem of fruit cracking of sweet cherry before ripening, the main factors affecting fruit cracking of sweet cherry were put forward, and the methods of preventing and reducing fruit cracking of sweet cherry were put forward.

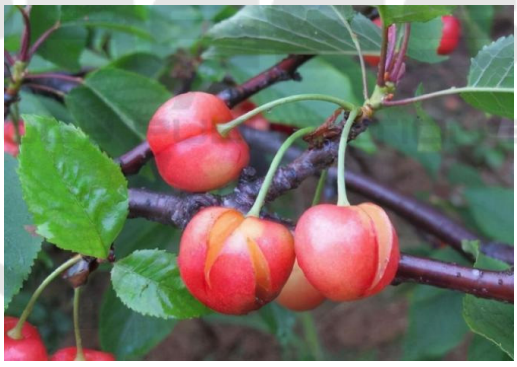

Figure 1: Sweet Cherry Cracking.

Figure 2: Sweet Cherry Cracking.

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2 CAUSE ANALYSIS OF FRUIT CRACKING OF SWEET CHERRY

2.1 Poor Site Condition of Orchard

The fruit cracking of sweet cherry is related to site condition and soil moisture. In low-lying orchards and those with sticky soil, the irrigation is not balanced, the drainage is not smooth, the soil moisture content is high or the moisture distribution is not uniform, the humidity change range in the orchard is big, the orchard is easy to crack fruit.

2.2 Breed Characteristics

Cherry cracking is a natural phenomenon in the ripening period of sweet cherry, because there is a period of rapid expansion before the fruit ripens, and the volume of the fruit increases rapidly, and it is much larger than the first expansion, at this time the skin cell division is not as fast as the flesh cell division, the skin quickly thinning, can not withstand the pulp expansion caused by the tremendous pressure, the skin will naturally split. The number and degree of fruit dehiscence varied with the variety characteristics and rainfall. The varieties with strong water absorption, large stomata on the fruit surface, high stomata density, and good peel toughness (such as Black tartarian, cerasus pseudocerasus, Black Pearl, etc.) were not easy to crack fruit varieties with poor pericarp toughness are liable to dehiscence, such as Hongfeng, Juhong, etc. .

2.3 Cause of Age and Growth Period

Different tree age, the degree of fruit cracking is not the same, such as the sun, early fruit trees on the fruit cracking, fruit more light yield cracking. Different fruit development stage, the ability of anti-cracking fruit is also different, such as red light, cracking fruit easy to occur in the fruit turn white to coloring period, after completely coloring, cracking fruit light.

2.4 Weather Conditions

If the development of long-term non-rainfall, lack of water in the soil or fruit maturity, high temperature, occasional rain. During the early period of fruit growth, the soil was in a drought state for a long time. During the near-mature period, if the continuous rain or rainstorm happened, the water content in the soil increased rapidly, the pulp cells would absorb water and expand rapidly, and the swelling pressure of the fruit would increase, causing the epidermis to swell and crack.

2.5 Calcium Deficiency

Calcium is one of the most important elements to determine the fruit quality of sweet cherry. The main component of cell pectin is calcium. The results showed that fruit cracking was lighter in orchards which could supply calcium timely.

2.6 Soil Nutrient Imbalance

The content of K, Ca, B in soil is not enough or the content of n is too high, the cracking of sweet cherry fruit is intensified, and the n content in the flesh is increased too quickly during the fruit expansion period after the stone development stops, which will aggravate the occurrence of fruit cracking, at the later stage, obvious transverse cracks were formed.

2.7 Poor Soil Fertility

The soil fertility is good, the tree body absorbs the nutrient adequately, the tree vigor is strong, the resistance and the resistance are strong. If the soil fertility is poor, the tree lacks nutrition, tree vigor is weak, resistance, resistance, immunity is poor, crack resistance is poor. Too little fertilizer or partial application of chemical fertilizer, no organic fertilizer, will also cause the tree Huwang, poor resistance.

2.8 Poor Condition of Ventilation and Light Transmission in Orchard

The canopy is closed, the ventilation and light are not good, the water on the shady side of the fruit can not be distributed quickly, and finally leads to the cork of the wound at the crack, slight blackening of the fruit spots, serious cracking of the fruit surface into strips or transverse wounds, and the fruit wilts in the later stage, and loses its commodity value.

3 COMPREHENSIVE CONTROL MEASURES TO PREVENT FRUIT CRACKING OF SWEET CHERRY

3.1 Suitable Site

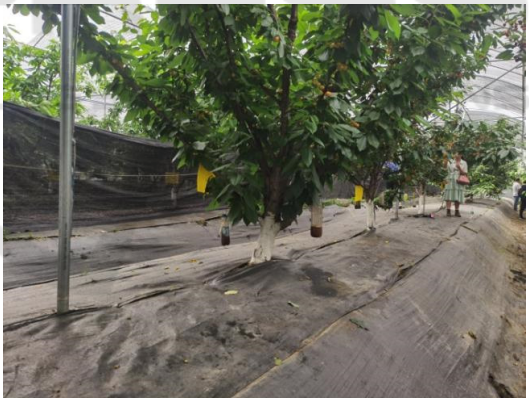
Choosing a suitable site for gardening is the most economical and effective way to reduce fruit cracking after rain. When building a garden, choose sunny slopes with good ventilation to avoid low-lying areas. When building a garden on sloping land, build a simple fish-scale pit with energy storage row. In addition, areas with little or no rain at or near maturity are the best places to grow sweet cherries. It is now available in countries such as Norway, Canada, the US (Washington, Michigan and New York) and Switzerland. With the development of the sweet cherry industry and the expansion of its cultivation area, the best area for sweet cherry cultivation will be selected sound of the underground.

3.2 Select Non-Crackable Fruit Varieties

First of all, we should choose the varieties with high self-flowering and fruit-setting rate in the greenhouse. Like pioneer, rabbins. The dehiscent fruit is generally manifested in two aspects: one is determined by the genetic characteristics of the variety itself, and the other is that the ripening time can avoid the rainy season. Brooksville crack rate is very high, see rain crack, red light, the sun crack rate is higher, and rabbins, pioneer and other strong ability to resist cracking. At present, no one variety can completely resist fruit cracking, therefore, breeding high-quality variety and isolation resistance-related genes is the focus of breeding work. However, it is difficult to obtain objective anti-cracking fruit data because many years field test and in vitro test are needed to breed anti-cracking fruit varieties, and the results of field test and laboratory test are not consistent. In the production can choose the variety that does not crack fruit to carry on planting (Balbontín, 2013).

3.3 Strengthening Orchard Management

Strengthening soil, fertilizer and water management is an important link to prevent fruit cracking. First, increase the application of organic fertilizer, increase the content of soil organic matter. Base fertilizer should be applied in autumn, early rather than late, mainly decomposed organic fertilizer, combined with appropriate amount of phosphate, potassium fertilizer and micronutrient fertilizer. Second, the orchard row grass. Planting grass in orchard can provide green manure for fruit trees, improve soil fertility, improve soil structure, adjust the orchard microclimate and save labor. Third, the orchard is covered with grass. The orchard covered with grass can keep the soil moisture well, keep the soil moisture in a relatively stable state, and reduce the occurrence of fruit cracking. At the same time, the orchard covered with grass can obviously increase the content of organic matter in the soil and activate the calcium in the soil, to improve the state of soil compaction, wheat straw, wheat bran, crushed corn straw, sawdust, mushroom residue and so on can be used as mulching materials, it can reduce the rate of fruit cracking; fifth, it is reasonable pruning, improve the ventilation and light permeability of the orchard, strengthen the tree power and keep the soil moisture stable after anthesis, so that the soil moisture content can be kept at 60% ~ 80% of the maximum water holding capacity in the field, and prevent the soil from being dry and wet, drought when need watering, should be small water diligent watering, forbidden big water flood irrigation, if the orchard can carry out drip irrigation or micro-drip irrigation is better.



Figures 3: Mulch under tree tray.

Figures 4: Mulch under tree tray.

3.4 Foliar Calcium

Calcium supplementation is the main way to prevent fruit cracking of sweet cherry. At fruit development stage, calcium fertilizer such as 300 times solution of golden angle, 1500 times solution of sea green element, 800 times solution of rare earth calcium, zinc, boron and magnesium, 1000 times solution of complex titanium and foliar fertilizer of amino acid were applied at fruit expansion stage Spraying 10 ~ 15 mg/kg gibberellin 25 ~ 35 days before harvest or on rainy day can increase fruit swelling, reduce fruit water pressure and prevent fruit cracking. At present, domestic and foreign take this method to prevent fruit cracking. Experiments in poland and turkey showed that spraying calcium chloride before harvest reduced the rate of fruit cracking of the sweet cherry variety "Brandt" (Wójcik, 2013). The rate of fruit dehiscence of sato kam decreased from 14.59% to 3.74% when NAA was sprayed with 2mg/L alone 24 days before harvest. Spraying 1 mg/L NAA for 24 days before harvest and spraying 0.5% calcium nitrate for one week before harvest reduced the rate of fruit cracking of sato kam to 1.7%, and the rate of fruit cracking was only 1/3 (Takanori, 1992).

3.5 Sprayed with Hydrophobic or Lipophilic Materials

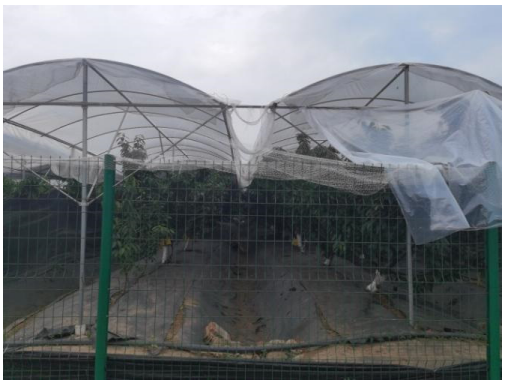
The principle of spraying hydrophobic or lipophilic material on the surface of fruit is to form a film on the surface of fruit to keep away the contact between fruit and rain water. In recent years, silicon-based materials have been used to form films on fruit surfaces (Sorrenti, 2008). Spraying 0.7% sodium silicate once a week, up to one week before harvest, 3 times can significantly reduce the cracking of sweet cherry fruit. The reason may be that in addition to strengthening the cell wall and maintaining structural stability, silicon also forms a film to prevent water and fungal invasion. Using a hydrophobic agent called Raingard^{TM}, Torres was able to reduce the rate of fruit cracking by 40.5%, 40% and 52% for benko, sugar and pioneer, respectively (Torres, 2014).

3.6 Building Storm Shelters

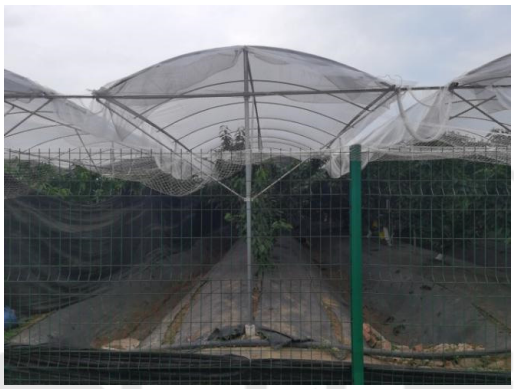
Build sweet cherry simple awning, simple, and can be used for many years. The cost per 667m^2 is only more than 2000 yuan. The fruit cracking rate of sweet cherry was controlled within 0.3% with low cost, and the occurrence of bird damage of sweet cherry was reduced. In the beginning of the fruit coloring, the arrival of the rainy season, the use of rain shelter for rain-proof cultivation, resulting in a small rain-free environment, but also can effectively prevent fruit cracking. In areas prone to frost damage in early spring, if the early construction of awning, but also play a role in anti-frost. It is recommended to use polyethylene tarpaulin, shrink-type tarpaulin and multi-span plastic fixed type rain-proof and frost-proof facilities in large areas, which can reduce the cost on the basis of guaranteed effect, four-wire curtain type and three-wire curtain type rain-proof and frost-proof facilities are recommended. The cost of the shed is low and the operation is simple.

4 IN CONCLUSION

This paper outlines the various measures taken by countries around the world to solve fruit cracking after rain, including site selection of parks, selection of Sweet Cherry varieties that are not easy to crack, strengthening orchard management, foliar calcium supplementation, spraying with hydrophobic or lipophilic materials, and building rain shelters. Can guide fruit grower production.



Figures 5: Rain shelter cultivation.



Figures 6: Rain shelter cultivation.

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