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Researches on 0900 Ziraat Cherry Cultivar Prevent from Fruit Cracking

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Abstract
The study was carried out on 5 years old 0900 Ziraat sweet cherry cultivar which is grafted on MaxMa 60 rootstock, 5x5m planting distance. The trees were pruned as central leader system and cultivated in Niğde province at an altitude 1480m. The aim of this study is preventing from fruit cracking. The treatment's specified for this purpose were applied; 0.5% Calcium Nitrate, 20ppm GA3, 100lt/ 300cc Green Miracle, 100lt/ 400gr Green Stim, water (control). In this research all applications were made in the same period. Pomological analyzes were carried out in order to determine the fruit quality criteria in the study where standard fertilization and irrigation programs were applied. Cracking indices were calculated in order to determine the effect of these applications on the resistance to cracking. According to the results obtained fruit weight was found to be higher in all treatments compared to control and it was obtained with Green Stim at the highest of 9.87 g. Fruit flesh hardness was measured with the highest Green Stim (72.65 Shore), Green Miracle (72.16 shore) and Calcium Nitrate (69.77 shore). According to the cracking index results, the lowest value was determined as 37.6 in Green Stim application and the highest value was measured in GA3 application (44.0) and control (Water) (45.2). The best results were obtained from the Green Stim application in terms of prevent fruit cracking ratio, on the other hand all applications reduced the cracking of the fruit. We are thankful to financial support of the Scientific Research Projects Unit of Cukurova University (Project No: FBA-2017-7391)

Keywords: Cherry, Cracking, Treatments, Fruit quality.

INTRODUCTION

Turkey is the major producer of sweet cherry in the world with an annual production of 494.325 ton (FAO, 2014). Cherry (*Prunus avium* L.) is originated to South Caucasia, Caspian Sea and North Anatolia. Cherry is mainly grown in Marmara, Aegean, Black Sea and Mediterranean regions in Turkey. In these areas, the major production season of cherries is June and July which is similar to the world's production season. Cherry growing in Turkey begins from 500-600 m elevations up to 2000 m at Taurus Mountains. Moreover, August sweet cherry production is relatively low comparing to the major season. It is foreseen that exploitation of cherry production during the offseason particularly in high elevations (up to 1250m) region provides a great advantage for domestic consumption and exportation in Turkey. Turkey is the biggest exporter country and meets 14.57% of the world's sweet cherry exports the amount of 79.789 ton [1].Turkey is the main cherry exporter country in the world; therefore, especially on late season cultivars such as 0900 Ziraat Cherry cultivar, cracking can seriously compromise quality and crop profitability. Rain-induced cracking in cherries is a complex phenomenon and there are several factors associated with its occurrence. Cultivar, growing conditions, irrigation management, rootstock, fruit size, flesh osmotic potential, cuticular characteristics of the skin and stage of fruit development, are among the most commonly reported factors influencing the onset of the problem [2], [3], [4]. Some researchers on mechanism causing this disorder, though not fully understood, seems to be the rapid increase in water absorption by the fruit. This increment on the water content of the fruit may be the result of the direct water absorption through the fruit skin cuticle or its absorption through the vascular system [5]. Research from Australia suggests that the type of cracking (i.e., stem, apical, and side) may not be an expression of the severity of a single process, but may rather be the manifestation of the different water uptake pathways during the onset of the problem [1], [6].Torres et al., 2009a [7] reported significant reduction of induced cracking when fruit was sprayed with a lipophilic hydrophobic compound which formed a film over the fruit. Schrader and Sun, 2005 [8] have also reported significant reduction of cherry cracking when hydrophobic films were used under commercial conditions. Torres et al., 2009b [8] showed that the cracking index was reduced when fruit was immersed in Ca solutions (1% v/v) compared to distilled water. This was assessed in the laboratory by submerging fruit in different osmotic solutions for 8 h. After this time, the number of cracked fruit was counted and the cracking index calculated [9]. According to laboratory tests and field trials, when fruit ripened, cracking index increased progressively. hydrophobic films alone or mixed with calcium chloride ($CaCl_2$) solutions can also reduce cherry cracking [10], [11] and [12].). Rain-induced cracking in fruits of sweet cherry (*Prunus avium* L.) is a problem in most producing areas in the world and causes significant economic losses. Different treatments have been used to reduce the severity of this problem and many trials have been done by researchers Most common treatments to reducing fruit cracking are Nutrient sprays (calcium), Plant bio regulators (gibberellins), Anti transparent /adjuvants, Water removal (Air blasters, helicopter) and rain covers. But last two technic couldn't preferable because of application difficulties and cost. The aim of the present study was to investigate impact of preharvest sprays of different chemical forms on cracking and quality of 0900 Ziraat Cherry cultivar.

MATERIALS AND METHODS

The study was carried out six years old "0900 Ziraat" cherry trees (*Prunus Avium* L.) grafted on MaxMa 60 rootstock, 5x5m planting distance. The trees were pruned as central leader system and cultivated in Niğde province at Kılan village 1480m.elevations in 2016.

Traitments

Green Stim were used as 300cc/100lt water concentration and it contains; glycine, betaine, osmotic pressure compensator; Green Miracle: (300cc/100lt water) anti transparant, (C8-C18) amino acid, peptid and oligopeptit (STANES Company), Calcium Chloride; $CaCl_2$ (0.5%) [12], [13], Giberellik Acid (GA_3), 20 ppm [14], Calcium Chloride + Giberellik Acid (GA_3), 0.5% + 20ppm and tap water were used as control. All application were done as spray and when the fruit color turns from green to yellow (22.06.2016)

Phenological Observations

Budbreak date at 50% of budbreak and fruit set date 50% of fruit set for all treatments dates were recorded [15].

Pomological Analysis

Fruit pomological analysis such as fruit weight (g) was measured by using a digital scale (Shinko DJ-600E, Japan precision (0.1 g).) Total soluble solids (TSS) content was determined by digital hand refractometer (ATC-1. Atago, Tokyo, Japan), fruit elasticity (shore) was determined by a penetrometer (N.O.W. FHR-5. Tokyo Japan) equipped with an 8 mm cylindrical plunger. The measurement was performed on two opposite faces of the equatorial zone, after skin removal of the equatorial zone. Titratable acidity (TA) was determined by using an automatic titration apparatus (877 Titrino plus, Metrohm, Herisau, Switzerland) with 0.1 mol/L NaOH up to pH 8.1; results were shown as g citric acid/100ml (Ozkaya et al., 2006). Fruit skin color was determined using a Minolta 300 Chroma Meter (Minolta Camera, Co., Ltd., Osaka, Japan), the observations were calculated.

Cracking Index

Cracking indexes of cherries were calculated according to Bilgener et al., 1999 [17]. Fifty cherry were randomly selected from each replicate and immersed in 2 L glass jar filled water (20 ± 1 ºC) for 6 h. Cherries were then removed from the water; cracked fruit were counted and separated and uncracked fruit were quickly immersed again in the water. This process was repeated 3 times for each treatment. Cracking indexes were calculated according to the following formula: Cracking index = (5a+ 3b+ c) × 100/250. Where a, b and c, represent the number of cracked fruit, after 2, 4 and 6 h, respectively. Total number of fruits immersed= 50; maximum cracking, 50 × 5 = 250.

Figure 1. Cracking Index Trials in Glass Jam.

Experimental design and statistical analysis

Experiments were carried out as a complete randomized design. Each treatment consisted of three replicates and each replicate included four trees. DATA were subjected by LSD test. Statistical analyses were carried out using JMP 5.0.1 version. ANOVA using SAS 9.0 software.

RESULTS AND DISCUSSION

The various treatments had no marked effects on Phenological stages (Budbreak, full bloom and fruit set dates in 0900 Ziraat Cherry cultivar. Therefore, data not given.

The similar results were obtained from Fruit pomological analysis. There is no significant differences were detected in 0900Ziraat Cherry cultivar quality criteria on average cherry weight, which varied from 8.60 to 9.87 g. Preharvest foliar $CaCl_2$ and GA_3 treatments did not affect fruit weight in kiwi [12], [14], [18] or apple [19]. (Table. 2). Fruit firmness is the most important quality criteria in cherries especially in terms of fruit cracking resistance [20]. The effects of foliar treatments on fruit firmness were detected significant. The highest fruit skin firmness value were found in Green stim (67.77). While the other aplication were detected GA_3 (68.10 shore), $CaCl_2$ +GA_3 (68,45) and the lowest value was obtained from Control (tap water treatment) as 63.78 shore (Table.1). According to some researchers fruit firmness couldn't affected by applications like Calcium and GA_3 [21], [22]. While according to recent research showed that this type of applications effected on Fruit cracking ratio by way of fruit firmness and fruit skin color.

Fruit color results especially L* value is important for fruit skin coloration. This value ranging (33.32%) GA_3 from 28.76% ($CaCl_2$) this results accordance with Yıldırım and Koyuncu., 2010 [14] research. (Table. 1). A statistically significant difference was found between applications in color values The highest a* and b* values were found in GA_3 application (22.33 and 6.17, respectively) (Table 2). The similar results about a*, b* values were detected by Yıldırım and Koyuncu., 2010 [14] as 24.42 and 7.76, respectively. Fruit skin color is important for both fruit quality and fruit maturity [23], [24].

Table 1. The Effects of Traitments on Fruit Frimness and Color Characteristics in '0900 Ziraat' Sweet Cherry Cultivar

Traitments	Fruit Frimness (Shore)	L*	a*	b*
Green Stim	72.65a	30.33bc	15.97ab	3.09ab
Green Miracle	72.16a	31.80ab	17.01ab	3.47ab
CaCl +GA	68.45ab	28.76bc	13.89ab	2.47ab
$CaCl^{2}$ ^{3}	69.77a	29.73bc	9.01b	1.34b
GA^{2}	68.10ab	33.32a	22.33a	6.17a
Control	63.78b	30.45bc	14.13ab	2.57b

In parallel with the results of our study, other researchers found that some preharvest aplications did not change fruit quality parameters such as fruit weight, total soluble solids and total titratable acidity in cherry and peach [22], [25], [26]. . TSS and TA content depend on the variety; TSS ranges between 18.80–25%, while TA ranges between 0.4–1.5% [20], [27]. In our study there is no significant differences were found, in terms of fruit quality parameters such as; TSS ranges between 18.80–19.90%, while TA ranges between 0.62–0.69% (Table 2). This results were found harmony with Demirsoy and Bilgener, 1998 [28], [25], [26], [12], [14].

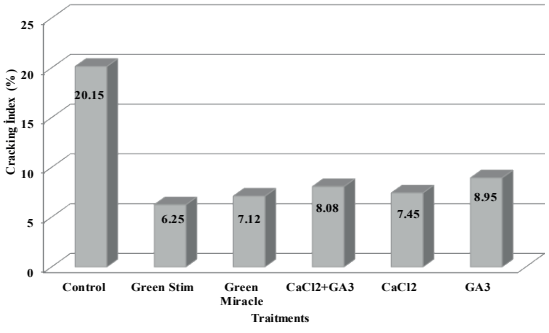
Table 2. Effects of DifferentTtraitments on 0900 Ziraat Cherry Fruit Pomological Qauality.

Treatments	Average fruit weight (g)	Total soluble solid content TSS (%)	Titrable acidity (TA) (g citric acid/100 ml)
Green Stim	9.87	18.80	0.62
Green Miracle	9.05	19.20	0.67
$CaCl_2$+GA_3	8.69	19.05	0.65
$CaCl_2$	8.57	19.15	0.66
GA_3	9.73	18.85	0,63
Control	8.60	19.90	0.69
	NS	NS	NS

EXPERIMENTAL RESULTS

In this study, the cracking index ratio in 0900 Ziraat cherry cultivar trees treated with Green Stim was 6.25%, compared to 20.15% in the control. While only GA_3 application was found as 8.95%. Other results were given in Table.3

Table 3. Effects of DifferentTtraitments on 0900 Ziraat Cherry Fruit Cracking Index



The all treatments significantly ($p \leq 0.01$) decreased the cracking ratio of 0900 Ziraat cherry cultivar according to the control (Tap water) (Table. 1). GA_3 was the least effective application for reducing cracking; cracking index was reduced by 8.95% in 0900 Ziraat Cherry cultivar. Our results revealed that the most efficient treatment for decreasing Cracking was Green Stim 68.98% (Table. 4). Other results were shown in Table. 4.

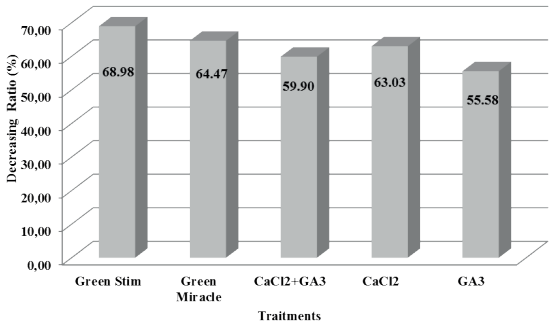


Table 4. Effects of Traitments on Reducing Cracked Fruit Ratio (%) in '0900 Ziraat' Sweet Cherry Cultivar

CONCLUSION

The results of this study have shown that al ttreatments significantly decreased the cracked fruit ratio compared to the control. But Green Stim applications especially reduced the amount of 68.98 percent. The research on 0900 Ziraat cherry, Green Stim found to be the most effective treatments. It was followed by Green Miracle and $CaCl_2$ applications There was no detected any differences Phenological and pomological observations. Thus, Green Stim, Green Miracle and $CaCl_2$ gave recommendable results compared to the other applications in 0900 Ziraat cherry cultivar in excessive rainfall years.

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