

A study on the relationships between some fruit characteristics in cherries

Hüsnü DEMIRSOY*, Leyla DEMIRSOY

OMU, Agricultural Faculty,
Horticulture Department,
55139-Kurupelit, Samsun,
Turkey
husnud@omu.edu.tr

A study on the relationships between some fruit characteristics in cherries.

Abstract — Introduction. Some fruit characteristics are very important for cherry marketing. This study aimed at determining relationships between some of them to help researchers on fruit quality. **Materials and methods.** The relationships between fruit cracking, fruit weight and diameter, soluble solid and acidity content, and fruit stalk thickness were determined on 35 sweet cherry cultivars in Amasya in Turkey. **Results and discussion.** There was a positive polynomial relationship between the fruit stalk thickness and fruit cracking; between fruit weight and fruit stalk thickness; and between fruit weight and fruit firmness. There was a positive relationship between the fruit weight and the acidity content, and between the fruit firmness, acidity and soluble solid. There was a negative relationship between fruit firmness and pH. **Conclusions.** Some relationships between cherry characteristics exist, which may help researchers to solve some problems such as fruit cracking. These studies may contribute to producing fruit with a good quality and help to evaluate new cultivars.

Turkey / *Prunus avium* / cherries / agronomic characters / variety trials

Étude des interrelations existant entre certaines caractéristiques de la cerise.

Résumé — Introduction. Certaines caractéristiques du fruit sont très importantes pour la commercialisation des cerises. Notre étude a cherché à déterminer les relations existant parmi certaines d'entre elles afin d'aider les recherches sur la qualité du fruit. **Matériel et méthodes.** Les relations liant l'éclatement du fruit, les poids et diamètre du fruit, les teneurs en solides solubles et en acidité, ainsi que l'épaisseur du pédoncule du fruit ont été déterminées sur 35 cultivars de cerisiers à Amasya en Turquie. **Résultats et discussion.** Une corrélation positive a été trouvée entre l'épaisseur du pédoncule fructifère et l'éclatement du fruit ; entre le poids de fruit et l'épaisseur du pédoncule ; et entre le poids de fruit et la fermeté de fruit. De même, le poids de fruit a varié dans le même sens que son acidité, et la fermeté de fruit s'est révélée liée positivement avec ses teneurs en acidité et en solides solubles. Il y a eu une relation négative entre la fermeté du fruit et son pH. **Conclusions.** Il existe des interrelations entre certaines caractéristiques de cerises ; ces études peuvent aider la recherche à résoudre des problèmes comme l'éclatement du fruit; elles peuvent contribuer à la production d'un fruit de bonne qualité et à l'évaluation de nouveaux cultivars.

* Correspondence and reprints

Fruits, 2004, vol. 59, p. 219–223
© 2004 Cirad/EDP Sciences
All rights reserved
DOI: 10.1051/fruits:2004021

RESUMEN ESPAÑOL, p. 223

Turquie / *Prunus avium* / cerise / caractère agronomique / essai de variété

Table I.
Cherry cultivars studied for their fruit characteristics (Turkey).

Türkoglu	Karakiraz	Köroglu	Tabaniyarik	Early Burlat
Izmit	Çavusayse	Hüsenba	Kargayüregi	Erkara
Erkiraz	Abdullah	Honey Heart	Hafizahmet	Cinikirazi
Sapikisakarakiraz	Van	Arap	Otabatmaz	Stella
Lambert	Sap-uzunkarakiraz	Haciali	Bing	Eraslama
Bella Di Pistoia	Pasa	Ankarakirazi	0900 Ziraat	Çavdarali
Karakirtik-1	Geçaslama	Barama	Karakirtik-2	Geçkiraz

1. Introduction

Fruit characteristics such as fruit weight, fruit size, fruit diameter, fruit stalk thickness and length, acidity, soluble solids, fruit cracking, etc. are very important for cherry marketing [1–4]. Therefore, defining these characteristics and determining relationships between them will help researchers in studies on improving fruit quality and developing new cultivars through breeding. Consequently, the knowledge of these relationships may contribute to producing the good quality fruit demanded by markets and consumers. Some studies have already shown that there are correlations between some fruit characteristics [5–8].

Our study aimed at helping to solve problems such as fruit cracking, determining relationships between some fruit characteristics. Moreover, as there are not a lot of such studies, it could provide technical or practical information for researchers to explain some experimental results.

2. Materials and methods

Our experiment was carried out on 35 sweet cherry cvs. in Amasya, Turkey, in 2001 (table I). Three 18- to 20-year-old trees, planted at a 7 m × 7 m distance, were selected for each cultivar. The fruit characteristics such as the fruit weight, fruit diameter, fruit stalk length and thickness, fruit firmness, cracking index, soluble solid content, fruit acidity, pH and [fruit flesh / fruit

stone] rate were determined for 50 fruit samples. These samples were extracted at random from fruit picked on selected trees, at the optimal ripening time determined by the fruit color and soluble solid content.

The fruit firmness was measured by removing the fruit skin on both cheek sides of the fruit at the maximum width of the fruit, opposite the suture line. A penetrometer (FHR-5, fruit hardness tester) with a 4.5-mm-diameter spherical tip was used. Soluble solid content was determined with a refractometer, acidity was measured as the equivalent of malic acid, pH was measured with a pH meter and the cracking index (%) was assessed with Christensen's methods [9]. The relationships between the fruit characteristics were determined by multiple regression analysis by using the Excel 7.0 and SlideWrite 2.0 package programs.

3. Results and discussion

There was a positive polynomial relationship between the fruit stalk thickness and fruit cracking ($R^2 = 0.2684^{**}$) (figure 1). The cultivars with the thickest fruit stalks had a higher cracking index than that of the cultivars with the thinnest fruit stalks. For cherries, many studies have been carried out on the factors affecting fruit cracking [10–16]. A recent study [13] reported that the passing of water into or out of fruit through the fruit stalk might cause fruit cracking. According to our results, the fruit stalk thickness may be an important criterion affecting fruit cracking.

There was a positive polynomial relationship between the fruit weight and the fruit stalk thickness ($R^2 = 0.4476^{**}$) and fruit firmness ($R^2 = 0.2754^{**}$) (figure 1). The fruit stalk thickness and fruit firmness of the cultivars with the heaviest fruits were higher than those of the cultivars with the lightest fruits. Also, Christensen [17, 18] showed that the fruit firmness of the cultivars with the heaviest fruits such as Spalding, Larian, Lambert and Badeborner cvs. was higher than that of the cultivars with the lightest fruits such as Sekunda, Asdonhse, Jaboulay and Early River cvs.

The acidity content of the cultivars with the heaviest fruits was the highest; thus, their pH was lower than that of the others (figure 2). In the same way, Kappel and Lane [4] reported that the acidity of the cultivars with the heaviest fruits such as Sonata, Skeena and Sandra cvs. was higher than that of the cultivars with the lightest fruits such as Santana and Van cvs. In our study, the acidity and soluble solid content of the cultivars with the firmest fruits were the highest (figure 2).

Moreover, in the cultivars we studied, there was a positive polynomial relationship between the fruit weight and fruit diameter ($R^2 = 0.9455^{**}$): the fruit diameters of the cultivars with the heaviest fruits were larger than those of the cultivars with the lightest fruits. Theiler-Hedtrich [7], studying some cultivars, also found a linear regression between the fruit weight and fruit diameter. In cherries, fruit diameter is an important criterion to help the fruit classification. Thus, the relationship can be used in cherry marketing and industry. There was also a positive polynomial relationship between the acidity and fruit diameter ($R^2 = 0.3411^{**}$) and soluble solid content ($R^2 = 0.1263^*$): fruit diameters of the cultivars with the highest acidity content were larger, while their soluble solid content was lower than that of the cultivars with the lowest acidity content. In addition, there was a positive linear regression between the fruit stalk thickness and fruit diameter ($R^2 = 0.3363^{**}$). Fruit diameters of the cultivars with the thickest fruit stalk were larger than those of the cultivars with the thinnest fruits.

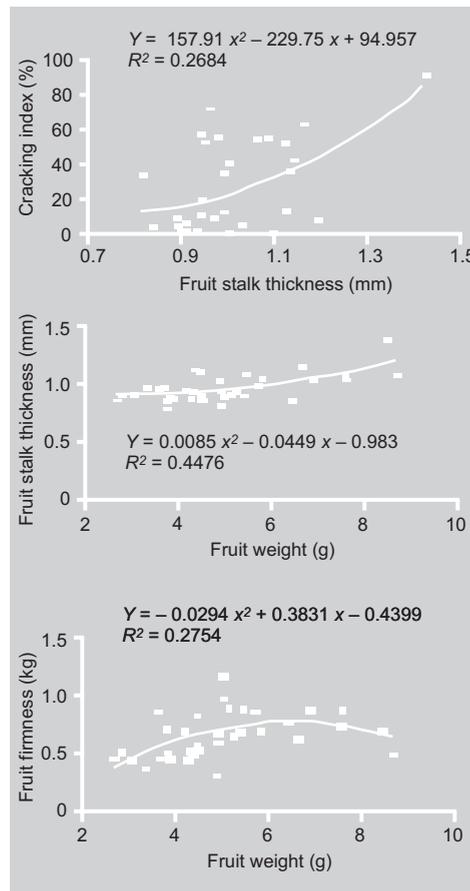


Figure 1. Relationships between fruit stalk thickness and cracking index; fruit weight and fruit stalk thickness; and fruit weight and fruit firmness for 35 sweet cherry cultivars studied in Amasya in Turkey.

4. Conclusions

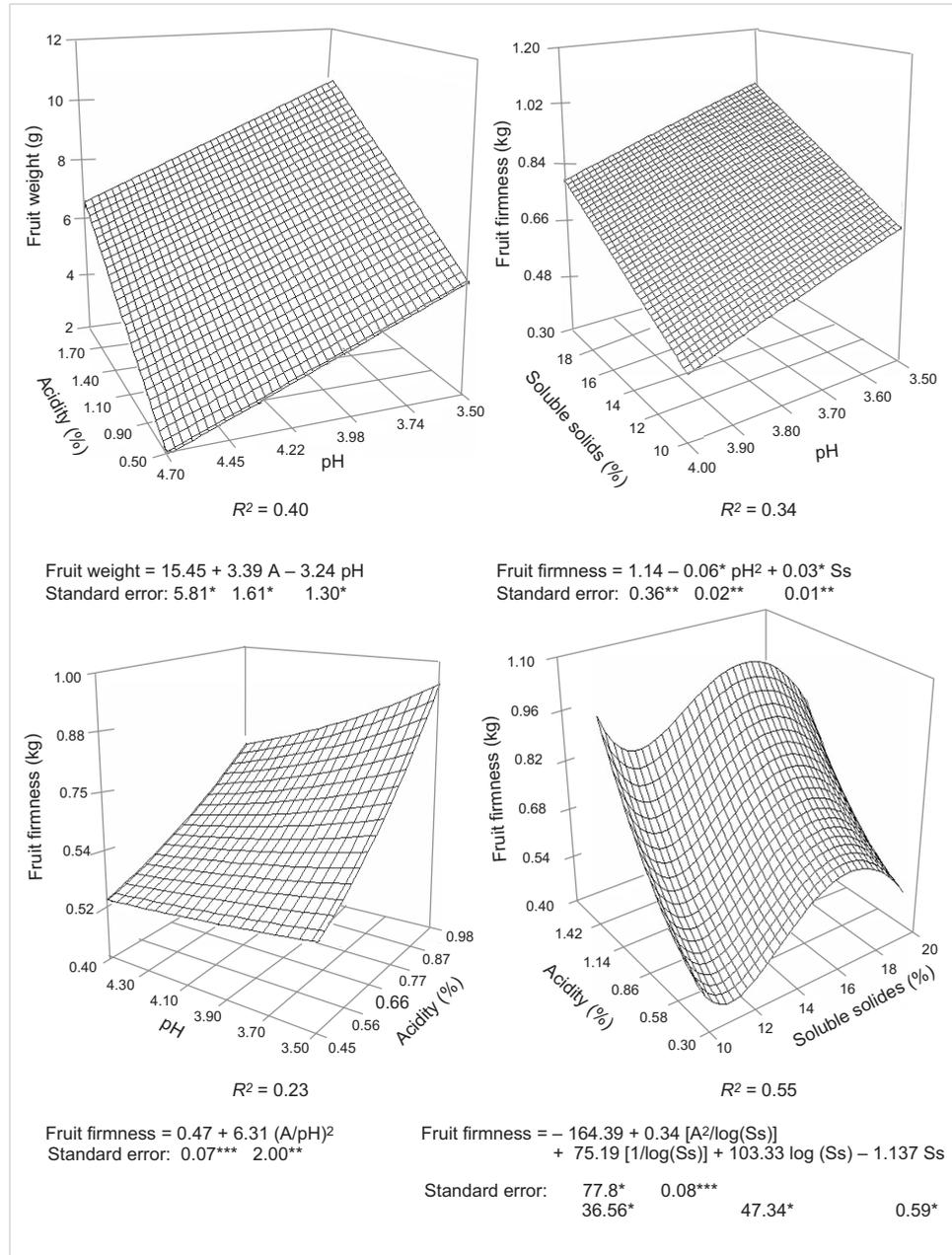
Our study on 35 cherry cultivars determined significant relationships between some of the fruit characteristics investigated. The R^2 values showing the relationships were low; however, these values are statistically important. Consequently, determining the relationships may help researchers to solve some problems such as fruit cracking; it may contribute to producing fruit with good quality and help to evaluate new cultivars.

References

- [1] Christensen J.V., An evaluation of the sweet cherry cultivars, Dep. Fruit Veg. Food Sci., Arsløv, Denmark, 1999, 55 p.

Figure 2.

Relationships between the cherry characteristics fruit weight, acidity content (A) and pH, and between fruit firmness, soluble solid content (Ss), pH and acidity content (significance: *** at the 0.1% level, ** at the 1% level, * at the 5% level).



- [2] Wustenberghs H., Screening of sweet cherry cultivars in Flanders 1988–1996, *Acta Hort.* 468 (1998) 131–134.
- [3] Lang G., Ophardt D., Olmstead J., Sweet cherry breeding at Washington State University, *Acta Hort.* 468 (1998) 97–104.
- [4] Kappel F., Lane W.D., Recent sweet cherry introductions from the breeding program at Summerland, British Columbia, Canada, *Acta Hort.* 468 (1998) 105–109.
- [5] Pommier P., Fruit cracking in cherry. Research on new control methods, *Arboric. Fruit.* 34 (1987) 20–23.
- [6] Proebsting E.L., The interaction between fruit size and yield in sweet cherry, *Fruit Varieties J.* 44 (3) (1990) 169–172.

- [7] Theiler-Hedrich R., Relationships between fruit weight and diameter in cherries, Schweiz. Z. Obst Weinbau 126 (228) (1990) 590–598.
- [8] Milutinović M., Surlan-Mirović G., Rakonjac V., Variability and correlation analysis of morphological fruit characters in sweet cherry seedling (*Prunus avium* L.), Rev. Res. Work Fac. Agric., Belgrade, Serbie Montenegro, 39 (2) (1994) 129–134.
- [9] Christensen J.V., Cracking in cherries. IV. Physiological studies of the mechanism of cracking, Acta Agric. Scand. 22 (1972) 153–162.
- [10] Christensen J.V., Cracking in cherries. VII. Cracking susceptibility in relation to fruit size and firmness, Acta Agric. Scand. 25 (1) (1975) 11–13.
- [11] Sekse L., Fruit cracking in Norwegian sweet cherries, Acta Agric. Scand. 37 (1987) 325–328.
- [12] Sekse L., Cuticular fracturing in fruits sweet cherry (*Prunus avium* L.) resulting from changing soil water contents, J. Hortic. Sci. 70 (4) (1995) 631–635.
- [13] Sekse L., Fruit cracking mechanism in sweet cherries (*Prunus avium* L.) – A review, Acta Hortic. 468 (1998) 637–648.
- [14] Webster A.D., Cline J.A., Cherries, cracking, the problem, Fruit Grow. 121 (22) (1994) 14–16.
- [15] Demirsoy L., Bilgener S., The effect of chemical applications on cuticular and epidermal properties of some sweet cherry cultivars with respect to fruit cracking susceptibility, Turk. J. Agric. For. (24) (2000) 541–550.
- [16] Christensen J.V., Numerical studies of qualitative and morphological characteristics of 41 sweet cherry cultivars, State Res. Plant Cult. Report, No. 1156, 1974.
- [17] Christensen J.V., Evaluation of qualitative characteristics of 48 sweet cherry cultivars. IV, Tidsskrift for Planteavl. 88 (3) (1984) 277–285.

Estudio de las interrelaciones existentes entre algunas características de la cereza.

Resumen — Introducción. Ciertas características de la fruta son muy importantes para la comercialización de las cerezas. Nuestro estudio intentó determinar las relaciones existentes entre algunas de ellas para contribuir a las investigaciones sobre la calidad del fruto. **Material y métodos.** En 35 cultivares de cerezo, en Amasya (Turquía), se establecieron las relaciones entre rajado, peso y diámetro del fruto, contenido en sólidos solubles y acidez, así como el grosor del pedúnculo fructífero. **Resultados y discusión.** Se encontró una correlación positiva entre el grosor del pedúnculo y el rajado de la fruta; entre el peso del fruto y el grosor del pedúnculo fructífero, y entre el peso de fruta y la firmeza del fruto. Igualmente, el peso del fruto varió en el mismo sentido que su acidez, y la firmeza de la fruta evidenció una relación positiva con el contenido de acidez y de sólidos solubles. Hubo una relación negativa entre la firmeza de la fruta y su pH. **Conclusiones.** Existen interrelaciones entre algunas características de las cerezas; estos estudios pueden ayudar en las investigaciones encaminadas a solucionar problemas como el rajado de la fruta y, también, pueden contribuir a producir fruta de buena calidad y a ayudar a la evaluación de nuevos cultivares.

Turquía / *Prunus avium* / cereza / características agronómicas / ensayos de variedades