

OLIVE FRUIT ABSCISSION: ANATOMICAL OBSERVATIONS FOLLOWING APPLICATION OF ETHYLENE-RELEASING COMPOUND

Bartolini S., Cantini C., Vitagliano C.
Scuola Superiore di Studi Universitari e di
Perfezionamento "S. Anna", Pisa - Italy.

Abstract

Various ethylene-releasing compounds (ERC's) were used in order to increase fruit removal and improve mechanical harvesting. The study was undertaken on two cultivars ("Frantoio" and "Leccino") to determine whether there are variations in site of the abscission zone during fruit-ripening stages. Ethrel treatment was applied at 2000 ppm and various abscission zones were identified that are differently activated during fruit development.

1. Introduction

Ethylene-releasing compounds were utilized in various fruit trees in order to promote fruit removal efficiency and improve harvest yields (Lang and Martin, 1989; Martin et al. 1981; Goren, 1988). These products induce differentiated effects depending on concentration, environmental conditions, species, and stage of fruit development. Anatomical site of the abscission zone varies according to species, cultivar, and stage of fruit maturity (Wittembach and Bukovac, 1972). Since olive is a species characterized by stagewise maturation, fruits of different stages of darkening are present on the tree when fruit-loosening products are used. Fruits may present differentiated response to treatment. The object of this study was to locate fruit abscission zones and to examine how fruits abscise following ethylene-releasing compound treatment of two cultivars presenting different maturation models.

2. Material and Method

Adult trees of the cultivars "Frantoio" and "Leccino", cultivated in the coastal area of Tuscany, were used. In November, several branches were sprayed with 2000 ppm Ethrel. "Leccino", which presents early darkened fruits, was treated 20 days earlier than "Frantoio". At 48 hr intervals for the first ten post-treatment days, samples of the inflorescence were taken, consisting of peduncle-shoot, peduncle-pedicel and pedicel-fruit segments. Fruits were distinguished by epidermis colour (green, darkening, black). The material was fixed in FAA, dehydrated through alcohol series and embedded in paraffin 10 um sections were stained with safranin and fast-green and observed under the optical microscope. At the same time similar fruits were detached by a

dynamometer, in order to determine variation in fruit removal force (FRF).

3. Results and Discussion

The anatomical studies showed that in both cultivars, along all lateral axes of the inflorescence, rows of cells with distinctive structure and size compared to surrounding cells can be observed. These zones are thought to represent potential abscission sites, identifiable even before the flowering stage (Cantini 1991).

Throughout the inflorescence and fruit development cycle, abscission occurs at all predetermined zones except between shoot-peduncle. In the cv. "Frantoio", which presents stagewise maturation, differences dependent on fruit colour were observed. With fully black-ripe fruit, abscission processes are always located close to the fruit and more frequently between pedicel and fruit. No differences were observed for "Leccino", which is characterized by early and simultaneous fruit dark-ripening.

Ethrel affected several of the early zones on the inflorescence. In both cultivars, seven days after treatment two main zones were identified where cell separation processes occurred simultaneously: at the juncture of pedicel-peduncle and pedicel-fruit. Two main zones were observed also by Reed and Hartman (1976) in the "Manzanillo" olive cultivar. Other abscission zones were however identified along the whole of the inflorescence, including the peduncle-shoot, which was shown to be the last activated zone. With particularly small pedicels it was difficult to distinguish the two abscission zones because the pedicel was contained within the peduncular cavity.

Anatomically, abscission zones are characterized by about 8-10 rows of isodiametric and thin-walled cells smaller than adjacent cells. Development of abscission was characterized by progressive plasmolysis followed by cell collapse. No cell divisions were observed prior to separation in any zones.

Treatment effect on the open field was shown by gradual decrease in F.R.F. In "Frantoio", minimum F.R.F. was reached after 10 days, independently of fruit colour. In "Leccino", whose fruits had completely darkened, minimum F.R.F. value was recorded as early as the fifth post-treatment day (figure 1). Treatment induced decrease in FRF is thought to start at the moment of tissue separation, at the identified abscission sites.

4. Conclusions

Ethrel activates fruit abscission processes independently of degree of darkening. Its action affects all predetermined zones but with differentiated results. Detachment was recorded more frequently at peduncle-pedicel

and pedicel-fruit junctions, both in "Leccino" and "Frantoio". In "Frantoio", characterized by stagewise maturation, abscission of fully black-ripe fruits occurred more often close to the fruit, affecting only pedicel tissue.

Ethrel affected both predetermined but not yet activated zones and also where natural abscission processes were already taking place. The periodically observed decrease in FRF following ethylene-releasing compound treatment occurred at the same time as separation processes identified through anatomical observations.

Acknowledgements

Work supported by M.U.R.S.T., scientific research 40 %.

References

- Cantini, C., 1991. Variazione di alcuni parametri durante lo sviluppo e la maturazione delle drupe in cinque cultivar di olivo. Tesi di Laurea. Università di Pisa.
- Lavee Lang, G.A., and Martin, G.C., 1989. Olive organ abscission: fruit and leaf response to applied ethylene. *J. Amer. Soc. Hort. Sci.* 114(1):134-138.
- Goren, R., 1988. Hormonal control of abscission in Citrus: physiological and biochemical aspects. *Proc. Symp. "Physiology of fruit drop ripening, storage and post-harvest processing of fruits"*. Turin. 3-4 Oct.:5-10.
- Martin, G.C., Lavee, S. and Sibbett, G.S., 1981. Chemical loosening agents to assist mechanical harvest of olive. *J. Amer. Soc. Hort. Sci.* 106:325-330.
- Reed, N.R., Hartmann T.H., 1976. Histochemical and ultrastructural studies of fruit abscission in the olive after treatment with 2-chloroethyl-tris-(2-methoxyethoxy)-silane. *J. Amer. Soc. Hort. Sci.* 101(6):633-637.
- Wittembach, V.A., and Bukovac, M.J., 1972. An anatomical and histochemical study of abscission in maturing sweet cherry fruit. *J. Amer. Soc. Hort. Sci.* 97(2):214-219.

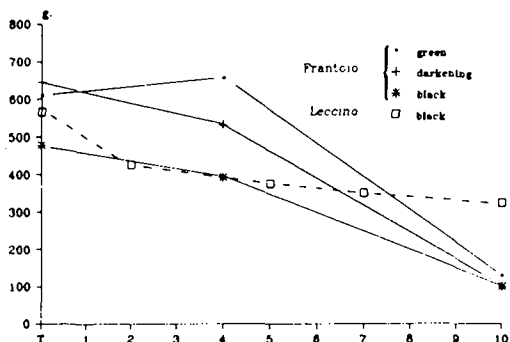


Figure 1 - Fruit removal force after treatment