Optimum Procedures for Ripening Kiwifruit

by Carlos H. Crisosto

Most consumers prefer to purchase kiwifruit that are near ripe ("ready to eat"). To ensure good tasting, "ready to eat" fruit, kiwifruit should be ripened at any step during postharvest handling before consumer consumption. This is essential for early season, freshly harvested kiwifruit. To assure good flavor of kiwifruit when ripe, we recommend picking them when they reach at least a minimum of 6.5% SSC measured in the field or 13% SSC after the accelerated ripening test. Flesh firmness is the best indicator of kiwifruit ripening and predictor of shelf life. Fruit that measures 2-3 pounds-force flesh firmness is ripe and "ready-to-eat".

Ripening at the Shipping Point (Ethylene pre-conditioning treatment)

Ethylene applied at 100 ppm by using the "shot system" for 12 hours within a 0 to 20^{o}C temperature range will induce ripening as indicated by uniform kiwifruit softening and starch conversion into sugars. Ethylene exposure can be shortened to 6 hours by using a catalytic generator (C_2H_4) or flow through application system. Ethylene pre-conditioning treatment (100 ppm for 12 hours) is only effective on freshly harvested kiwifruit or those that have been in cold storage for less than 5 weeks. Fruits kept in cold storage for longer than 5 weeks will ripen upon transfer to ripening temperatures of 59o-70oC(15-21oF) by their own ethylene

The temperature setting during treatment and shipment should be adjusted according to the anticipated consumption schedule. To prevent softening due to delayed shipments, apply ethylene to cold kiwifruit. Cold kiwifruit treated at near 0^{o}C and maintained at that temperature may be held up to 5 weeks. These kiwifruit will reach a firmness of about 3 pounds in 2 to 3 days after being transferred to 20^{o}C.

<u>Application of ethylene pre-conditioning treatment:</u> Place kiwifruit in a ripening room with good temperature and relative humidity control.

The type of kiwifruit container such as tray pack, volume fill packages, or tri-wall containers with polyliners do not interfere with the preconditioning treatment. The ripening room should be located far away from any packing facilities to avoid ethylene contamination of long-term storage kiwifruit. High relative humidity (90-95%) is especially recommended when ripening is carried out at temperatures higher than 7.5oC(45oF). The temperature setting during treatment and shipment should be adjusted according to the anticipated consumption schedule (Table 1).

Table 1. Rate of kiwifruit softening after ethylene treatment at 20oC (68oF).

Temperature		Days to reach a firmness of 3 lbs-force
ºC	ºF	
0	32	6.5 to 7.0
7.5	45	6.0 to 7.0
20	68	3.0 to 4.5

If shipping is delayed after treatment, fruit will reach a firmness of about 3 pounds-force within six days when held at 0ºC(32ºF). In this case, the temperature setting during storage and transportation should be close to 0ºC (32ºF). Cold kiwifruit treated at near 0ºC (32ºF) and maintained at that temperature may be held up to 5 weeks. These kiwifruit will reach a firmness of about 3 pounds-force in 2 to 3 days after being transferred to 20ºC (68ºF). The temperature should be set near 0ºC (32ºF) during transportation.

Ripening at the retail end

As a general rule, non-conditioned ripened kiwifruit received in your warehouse that have been in storage less than 4 weeks or have a flesh firmness level of 8-10 pounds or greater should be ripened by using ethylene at warm temperature.

Pre-conditioned kiwifruit firmness must be tested upon arrival to the warehouse or retail store and handled according to its rate of softening and your rotation time. Fruit that has been in storage equal to or longer than 4 weeks or have a flesh firmness of less than 8

pounds can be ripened close to “ready to eat” by temperature management only.

In all the cases, temperature conditions for kiwifruit during storage treatment should be adjusted according to your anticipated marketing/selling schedule. The flesh softening rate of kiwifruit is about 2.0 pounds per day when exposed to 20°C. Softening can be slowed down when fruit is stored at temperatures.

In general, kiwifruit should always be kept at low temperatures below 7.5ºC (45ºF) and enclosed with liners, except if they are going to be consumed within 3 days.

References

- Crisosto, Carlos H. 1997. Final preconditioning guidelines for kiwifruit shippers. Central Valley Postharvest Newsletter 6(1-2):1-4.
- Crisosto, Carlos H., David Garner, and Gayle M. Crisosto. 1997. Kiwifruit preconditioning protocol. Acta Horticulturae 444(2):555-559.
- Ritenour, Mark A., Carlos H. Crisosto, David T. Garner, Guiwen W. Cheng, Juan Pablo Zoffoli. 1999. Temperature, length of cold storage and maturity influence the ripening rate of ethylene-preconditioned kiwifruit. Postharvest Biology and Technology 15:107-115.
- Crisosto, C.H., David Garner, and Billie Shaver. 1992. Studies on kiwifruit ripening, Progress Summary Report, 1992. Report to Kiwifruit Commission, 1 p.
- Crisosto, Carlos, H. 1994. Ripening guidelines for kiwifruit handlers. Report to California Kiwifruit Commission, 4 pp.
- Crisosto, C.H., M.A. Ritenour, D.T. Garner, and G.U. Crisosto. 1996. Affects of maturity and postharvest factors on the ethylene requirement for kiwifruit ripening. 1995-96 Kiwifruit Report. California Kiwifruit Commission, Sacramento, CA, 20 pp.
- Crisosto, Carlos H., Gayle M. Crisosto, and David Garner. 1997. Kiwifruit storage compatibility. Preliminary Report to the California Kiwifruit Commission, 1997. 5 pp.