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Changes in Some Quality Parameters of the Perfect Delight Nectarine Cultivar during Cold Storage and Shelf Life

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Abstract: The objective of this study was to determine storage and shelf life periods of Perfect Delight nectarines grown in Mersin (Yenice, Tarsus). The fruit was kept at 0 °C and 85%-90% relative humidity for 8 weeks. After removal from cold storage at weekly intervals, the fruit was kept at 20 °C and 65%-70% relative humidity for 2, 4 or 6 days to determine shelf life in 3 replicates. Changes in weight loss (%), fruit skin color and flesh color (L*, a*, b*), fruit flesh firmness (N), total soluble solids (%), titratable acidity (g malic acid / 100 ml fruit juice), incidence of chilling injury and fungal decay were monitored weekly during cold storage and during the subsequent shelf life at 2-day intervals. The fruit lost 4%-6% of its initial weight after 8 weeks of cold storage and showed no visible symptoms of shriveling. Fruit flesh firmness decreased, but remained at about 20 N at the end of 8 weeks of storage. Perfect Delight nectarines can be kept at 0 °C and 85-90% relative humidity for 4-6 weeks and can have a 2-day shelf life following cold storage.

Key Words: Nectarine, Perfect Delight, storage, shelf life

Perfect Delight Nektarin Çeşidinin Soğukta Muhafaza ve Raf Ömrü Sırasında Bazı Kalite Paremetrelerindeki Değişimler

Özet: Bu çalışmanın amacı, Mersin (Yenice/Tarsus) yöresinde yetiştirilen Perfect Delight nektarin çeşidinin soğukta muhafaza süresi ve raf ömrünün belirlenmesidir. Meyveler, 0 °C sıcaklık ve %85-90 oransal nem koşullarında 8 hafta süreyle depolanmıştır. Raf ömrünü belirlemek için depolama sırasında her hafta soğuk hava deposundan 3 yinelemeli olarak çıkartılan meyveler 20 °C sıcaklık ve %65-70 oransal nem koşullarında 2, 4 ve 6 gün bekletilmişlerdir. Soğukta muhafaza sırasında haftalık olarak ve raf ömrü koşullarında bekletme sırasında 2 gün aralıklarla alınan meyve örneklerinde ağırlık kaybı (%), meyve kabuk ve et rengi (L* a* b*), meyve eti sertliği (N), SÇKM (%), titre edilebilir asit (g malik asit/100 ml) içeriklerinde meydana gelen değişimler, üşüme zararı ve çürümeler saptanmıştır. 8 haftalık soğukta muhafaza süresince meyvelerde %4-6 oranında ağırlık kaybı meydana gelmiş, ancak buruşmalar gözlenmemiştir. Meyve eti sertliği azalmış ancak, 8 haftalık muhafaza sonunda 20 N civarında olmuştur. Perfect Delight nektarin çeşidinin 0 °C sıcaklık ve %85-90 oransal neme sahip depo koşullarında 4-6 hafta depolanabileceği ve depolamadan sonra 2 gün içinde tüketilmesi gerektiği saptanmıştır.

Anahtar Sözcükler: Nektarin, Perfect Delight, muhafaza, raf ömrü

Introduction

Cold storage of peaches and nectarines after harvest is necessary to minimize excessive softening, quality loss and decay and to prolong time for marketing (Buescher and Griffith, 1976). Storage of peaches at low, non-freezing temperatures is limited due to the development of internal breakdown or chilling injury (CI) symptoms such as internal and external browning, flesh breakdown, woolliness, reddish discoloration, loss of ability to ripen and increased incidence of decay (Crisosto et al., 1995; Artes et al., 1996; Fernandez-Trujillo and Artes, 1997a, 1997b; Lurie and Crisosto, 2005). The storage life of nectarines under ideal conditions of 0 °C and high relative humidity (90%-95%) is limited to 1 to 7 weeks (Crisosto et al., 2000). Onset of CI symptoms determines storage/shipping potential because their development reduces consumer acceptance (Crisosto et al., 1997). The storage life of most nectarine cultivars with low

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susceptibility to CI varies from 4 to 6 weeks at 0 °C. With CI-susceptible cultivars, the marketing life is reduced to 2-3 weeks at 0 °C (Mitchell and Kader, 1989; Crisosto et al., 1999).

Turkey is the sixth largest producer of peaches and nectarines, and supplied 485,000 tons of fruit in 2005 (FAOSTAT, 2005). Peaches and nectarines, along with cherries, have become the major fresh stone fruit exports for Turkey (USDA, 2005). The European Union is the primary market for peaches and nectarines, and accounts for 15% of total exports (AKIB, 2003). The quality and productivity of peaches and nectarines have increased in recent years due to the establishment of larger orchards with imported cultivars. Perfect Delight, which is a new and popular nectarine cultivar in European markets, is currently grown in the Çukurova region, southern Turkey. There is no study regarding the postharvest physiology and storage performance of this cultivar. This study aimed to investigate the storage and shelf life of the Perfect Delight nectarine cultivar.

Materials and Methods

Perfect Delight nectarines were obtained from a commercial orchard in Mersin, Turkey, during the 2002 and 2003 seasons. Perfect Delight is yellow flesh, semi-clingstone and midseason nectarine cultivar (FRUTAS, 2006). Fruit was harvested from 5-6-year-old trees grafted on GF-677 rootstocks at the firm-ripe stage and immediately transported via ventilated truck to cold storage facilities at the Department of Horticulture, Faculty of Agriculture, Mustafa Kemal University in Antakya. The fruit was then kept at 0 °C and 85%-90% relative humidity for 8 weeks. It was removed from cold storage after 2, 3, 4, 5, 6 or 8 weeks and subsequently held at 20 °C and 65%-70% relative humidity for 2, 4 or 6 days for ripening. On the day of removal and at days 2, 4 or 6, 3 replicates of 5 nectarines were sampled to determine quality changes and physiological disorders and fungal decay.

Weight loss was calculated as percentage loss of initial weight. Flesh firmness was measured on opposite sides of each fruit at the equatorial region, after the removal of a 1-mm-thick disk of skin from each side of the fruit, and the force in kilograms required to insert an Effegi penetrometer (model FT 327) fitted with an 8-mm diameter probe was recorded and expressed in Newtons (N). Total soluble solids (%TSS) content and titratable acidity (%TA) were assessed in juice obtained from 3 replicate samples of 5 nectarines. TSS content was determined with a refractometer, and TA by titration of 5 ml of fruit juice with 0.01 N NaOH to pH 8.1 and expressed as grams of malic acid per 100 ml of juice. Skin color and flesh color were determined with a colorimeter (Minolta CR-300, Osaka, Japan). Color measurements were recorded using the CIE L*a*b* color space. Color values for each fruit were computed as means of 2 measurements taken from opposite sides at the equatorial region of the fruit (Abbott, 1999).

Ten nectarines per replicate were halved and examined visually for assessment of disorders of CI or internal breakdown (IB) such as lack of juiciness (mealiness or woolliness), flesh browning, flesh bleeding, and flesh translucency (gel breakdown) immediately after removal from cold storage and after 2, 4 and 6 days at 20 °C. The severity of CI was assessed as described by Fernandez-Trujillo and Artes (1997b) on a scale of 1 to 5 where 1 = none, 2 = very slight, 3 = slight, 4 = moderately severe and 5 = severe.

Fungal decay incidence was determined weekly during storage and at 2-day intervals during shelf life by counting the number of decayed nectarines in each replicate.

The data were analyzed as a factorial experiment in a completely randomized block design by ANOVA using SAS software of SAS Institute, Cary, N.C., U.S.A., considering storage and shelf life as the main factors (SAS, 1990). Mean separation was performed by Tukey's test at $P < 0.05$ level using SAS's Proc GLM procedure.

Results and Discussion

Weight Loss

The percent weight loss of Perfect Delight nectarines increased significantly during prolonged storage. At the end of storage, weight loss reached 4.06% and 6.04% in 2002 and 2003, respectively (Tables 1 and 2). As the storage period was extended, weight loss of fruit kept at 20 °C after cold storage increased at a higher rate (Tables 3 and 4). After 2 to 8 weeks of cold storage, weight loss of fruits kept at 20 °C for 2 days remained below 5% in both years. The weight loss of fruit kept at 0 °C more than 3 to 4 weeks plus 4 days at 20 °C exceeded 5%. The

Table 1. Changes in some quality parameters evaluated in Perfect Delight nectarines during cold storage in 2002.

Storage Period (week)	Weight Loss (%)	Fruit Flesh Firmness (N)	TSS (%)	Titratable Acidity (%)	Fungal Decay (%)	Chilling Injury (%)
Beginning	0.00	41,68	11.27	1.07	0.00	0.00 (1.0) *
2	0.99	35,99	11.33	0.93	0.00	0.00 (1.0)
3	1.37	26,09	11.67	1.08	0.00	0.00 (1.0)
4	1.82	25,11	11.33	0.84	0.00	0.00 (1.0)
5	2.06	20,59	11.80	0.75	0.00	6.67 (5.0)
6	2.74	24,32	11.73	0.80	21.67	11.67 (5.0)
7	3.34	20,01	12.00	0.78	26.67	13.33 (5.0)
8	4.06	19,02	11.80	0.71	28.33	18.33 (5.0)
$HSD^{**}_{(0.05)}$ (Storage life)	1.40	6,28	ns	0.07	7.45	8.05

*Values in parentheses represent degree of chilling injury rated 1 (none) to 5 (severe)
** Mean separation was performed by Tukey's Studentized Range (HSD) test at $P < 0.05$ level (n = 3)
ns: Non-significant

Table 2. Changes in some quality parameters evaluated in Perfect Delight nectarines during cold storage in 2003.

Storage Period (week)	Weight Loss (%)	Fruit Flesh Firmness (N)	TSS (%)	Titratable Acidity (%)	Fungal Decay (%)	Chilling Injury (%)
Beginning	0.00	42.66	11.60	0.83	0.00	0.00 (1.0) *
2	1.29	34.52	11.80	0.94	0.00	0.00 (1.0)
3	1.81	34.03	12.00	0.88	0.00	0.00 (1.0)
4	2.56	35.40	11.33	0.95	0.00	0.00 (1.0)
5	3.15	30.20	11.20	0.85	0.00	0.00 (1.0)
6	4.09	30.01	11.33	0.82	0.00	0.00 (1.0)
7	5.05	29.32	12.07	0.71	0.00	3.33 (4.3)
8	6.04	23.44	11.87	0.66	0.00	8.33 (5.0)
$HSD^{**}_{(0.05)}$ (Storage life)	1.93	8.34	ns	0.11	ns	4.30

*Values in parentheses represent degree of chilling injury rated 1(none) to 5 (severe)
** Mean separation was performed by Tukey's Studentized Range (HSD) test at $P < 0.05$ level (n = 3)
ns: Non-significant

weight loss of fruit kept at 20 °C for 6 days after 3-6 weeks of cold storage exceeded 10%. In agreement with our results, previous studies showed that the weight losses of some peach and nectarine cultivars could exceed 10% during storage and 20% during shelf life (Ağar et al., 1993; Kurnaz and Kaşka, 1993a; Kurnaz et al., 1993). Previously, it was reported that visually observed shriveling usually appeared when water loss reached 4% to 5% in stone fruits (Mitchell, 1986, 1992). Similarly, Ertan et al. (1991) reported that shriveling can be seen if the weight loss is more than 5%, and weight loss of 7%-8% impaired the visual quality of Red Globe peaches. Crisosto et al. (1994) found that peach shriveling symptoms became apparent when weight loss exceeded 10% of the initial fresh weight. In recent years, 10% of weight loss has been commonly accepted as the commercially acceptable limit (Fernandez-Trujilo and Artes, 1998). In our study, weight losses reached about

5% at the end of 8 weeks of storage and exceeded 10% during 6 days of shelf life after storage, but no noticeable shriveling was observed in Perfect Delight nectarines. Similar to our results, Obeland et al. (2005) studied 6 peach and 5 nectarine cultivars, and did not observe any visual shriveling symptoms although weight loss ranged from as low as 4% to as high as 10% during 3 weeks of storage at 1 °C. However, Fernandez-Trujilo and Artes (1998) observed about 10% of weight loss, resulting from shriveling due to the high surface/weight ratio of this cultivar, during 4 weeks of storage at 2 °C in Paraguayo peaches.

Fruit Flesh Firmness

Fruit flesh firmness of Perfect Delight nectarines at harvest was 41.68 and 42.66 N in 2002 and 2003, respectively. During 8 weeks of cold storage, flesh firmness decreased to 19.02 and 23.44 N in 2002 and 2003, respectively (Tables 1 and 2). The rate of fruit softening during storage was higher in 2002 than it was in 2003. Flesh firmness is the best predictor of the potential shelf life of peaches and nectarines. Fruit that reaches 26.5-35.3 N flesh firmness is considered 'ready to buy' (Crisosto, 2002) because fruit below 27 N is susceptible to damage during postharvest handling (Crisosto et al., 2001). Therefore, Crisosto (2002) suggested transferring peaches/nectarines to retail stores before the fruit reached the 'ready to buy' stage to reduce potential physical damage occurring during transportation from the warehouse to retail stores and during handling at retail stores. In our study, Perfect Delight nectarines remained at the 'ready to buy' stage for 4 weeks in 2002 and 7 weeks in 2003. Thus, this cultivar could be kept at 0 °C until 4 to 7 weeks before transferring to the retail store. Peach and nectarine ripening upon removal from cold storage involves extensive fruit softening. Decreases in fruit flesh firmness occur at a higher rate during shelf life as the cold storage is extended (Kurnaz and Kaşka, 1993a). Very rapid fruit softening was observed with Perfect Delight nectarines during shelf life after their removal from cold storage. Flesh firmness decreased to about 10 N or below within 2 days at 20 °C following cold storage (Tables 3 and 4). Fruit with 8.8-13.2 N flesh firmness is considered ripe or 'ready to eat' (Crisosto, 2002). As far as fruit firmness is concerned, it is concluded that Perfect Delight nectarines have only 2 days of shelf life because they became 'ready to eat' within 2 days at 20 °C following cold storage.

Total Soluble Solids

Changes in total soluble solids (TSS) content of Perfect Delight nectarines were not significant during cold storage and no regular trend was observed (Tables 1 and 2). TSS content of fruit increased during shelf life upon removal from cold storage (Tables 3 and 4). Similarly, previous studies showed increased TSS content during shelf life (Kurnaz and Kaşka, 1993a; Kurnaz et al., 1993; Ağar et al., 1994; Ertürk and Özcan, 1995; Koyuncu and Çavuşoğlu, 2001; Bahar and Dündar, 2003; Koyuncu et al., 2003).

Titratable Acidity

Titratable acid (TA) content at harvest was 1.07% and 0.83% in 2001 and 2002, respectively, which gradually decreased throughout the storage period. TA content was 0.71% and 0.66% at the end of storage in 2001 and 2002, respectively (Tables 1 and 2). TA content continued to decrease during shelf life after removal from cold storage in both years (Tables 3 and 4). Acid loss in peaches and nectarines during cold storage (Robertson et al., 1990; Ağar et al., 1993; Eriş et al., 1994; Ertürk and Özcan, 1995; Koyuncu and Çavuşoğlu, 2001; Bahar and Dündar, 2003; Koyuncu et al., 2003) and shelf life (Robertson et al., 1990; Ağar et al., 1993; Kurnaz and Kaska, 1993a, 1993b) was reported previously.

Skin and Flesh Color

Perfect Delight nectarines exhibited little or no change in skin color and flesh color during cold storage and shelf life (data not shown). In the first year of the experiment, the L* value of skin color remained unchanged while the a* value slightly decreased and the b* value slightly increased during 8 weeks of storage. Changes in L*, a* and b* values were irregular and showed a generally decreasing trend during shelf life. Similar findings were reported by Ağar et al. (1993). In the second year of the experiment, L*, a* and b* values of skin color were not influenced by storage or shelf life. Similarly, Ağar et al. (1994) and Koyuncu et al. (2003) found little or no change in the L* value during storage. Dündar (1997)

Table 3. Changes in some quality parameters evaluated in Perfect Delight nectarines kept at 20 °C following cold storage in 2002.

Storage Period (week)	Shelf Life (day)	Weight Loss (%)	Flesh Firmness (N)	TSS (%)	Titratable Acidity (%)	Fungal Decay (%)	Chilling Injury (%)
	0	0.00	35.99	11.33	0.93	0.00	0.00 (1.0) *
2	2	0.69	4.81	11.80	0.59	0.00	11.00 (5.0)
	4	2.54	0.00	11.47	0.64	3.33	3.33 (2.7)
	6	4.90	0.00	12.07	0.57	13.33	0.00 (0.0)
	0	0.00	26.09	11.67	1.08	0.00	0.00 (1.0)
3	2	2.45	4.41	11.80	0.63	2.33	9.00 (4.7)
	4	6.07	0.00	11.93	0.83	16.67	6.67 (4.3)
	6	10.09	0.00	12.27	0.66	66.67	0.00 (1.0)
	0	0.00	25.11	11.33	0.84	0.00	0.00 (1.0)
4	2	3.07	10.10	12.07	0.74	0.00	13.00 (5.0)
	4	7.70	0.00	12.33	0.73	26.67	6.67 (4.3)
	6	10.81	0.00	12.60	0.61	80.00	0.00 (0.0)
	0	0.00	20.59	11.80	0.75	0.00	0.00 (1.0)
5	2	4.34	6.47	11.33	0.58	4.67	6.67 (4.3)
	4	9.19	0.00	12.80	0.52	26.67	3.33 (2.7)
	6	13.41	0.00	13.27	0.48	66.67	0.00 (1.0)
	0	0.00	24.32	11.73	0.80	0.00	0.00 (0.0)
6	2	4.48	4.41	12.20	0.62	4.33	15.67 (5.0)
	4	10.28	0.00	12.93	0.57	30.00	13.33 (5.0)
	6	13.78	0.00	13.53	0.51	73.33	6.67 (1.7)
	0	0.00	20.01	12.00	0.78	0.00	0.00 (1.0)
7	2	4.41	2.45	12.27	0.58	4.67	17.67 (5.0)
	4	10.91	0.00	12.80	0.51	26.67	13.33 (5.0)
	6	14.70	0.00	13.60	0.47	100.00	0.00 (1.0)
	0	0.00	19.02	11.80	0.71	0.00	0.00 (1.0)
8	2	4.68	0.00	12.13	0.51	8.67	15.33 (5.0)
	4	11.62	0.00	12.60	0.52	40.00	6.67 (4.3)
	6	16.51	0.00	13.60	0.46	100.00	0.00 (1.0)
$HSD^{**}_{(0.05)}$ (Storage life x Shelf life)		1.53	4.22	1.21	0.10	25.93	15.49

*Values in parentheses represent degree of chilling injury rated 1 (none) to 5 (severe)
** Mean separation was performed by Tukey's Studentized Range (HSD) test at $P < 0.05$ level (n = 3)

also reported no significant differences in L*, a* and b* values during the storage of peaches.

Changes in L* and b* values of flesh color was insignificant during storage while the a* value increased until the fifth week of storage and then decreased in both years. Fruit kept at 20 °C following cold storage showed a decrease in the L* value, which indicated a reduction in the lightness of fruit flesh. The a* value of flesh color increased during shelf life and the b* value remained unchanged.

Physiological Disorders

Perfect Delight nectarines began to develop CI symptoms such as flesh browning and woolliness after 4 weeks of storage in 2002 and 7 weeks of storage in 2003 at 0 °C. At the end of 8 weeks of storage, incidence of CI was 18.33% and 8.33% in 2002 and 2003, respectively. Differences in the incidence of CI between 2002 and 2003 might be due to the prevalent weather conditions before harvest. Preharvest factors that influence postharvest CI are mostly those to do with

Table 4. Changes in some quality parameters evaluated in Perfect Delight nectarines kept at 20 °C following cold storage in 2003.

Storage Period (week)	Shelf Life (day)	Weight Loss (%)	Flesh Firmness (N)	TSS (%)	Titratable Acidity (%)	Fungal Decay (%)	Chilling Injury (%)
	0	0.00	34.52	11.80	0.94	0.00	0.00 (0.0) *
2	2	1.95	13.53	12.33	0.65	0.00	0.00 (0.0)
	4	4.42	3.63	12.60	0.58	0.00	0.00 (0.0)
	6	6.63	0.00	13.33	0.73	0.00	0.00 (0.0)
	0	0.00	34.03	12.00	0.88	0.00	0.00 (0.0)
3	2	2.14	12.26	12.67	0.59	0.00	0.00 (0.0)
	4	4.74	0.00	12.80	0.58	0.00	0.00 (0.0)
	6	6.57	0.00	12.93	0.60	0.00	0.00 (0.0)
	0	0.00	35.40	11.33	0.95	0.00	0.00 (0.0)
4	2	2.53	12.36	12.60	0.57	0.00	0.00 (0.0)
	4	5.32	0.00	13.27	0.59	3.33	0.00 (0.0)
	6	8.37	0.00	13.87	0.64	13.33	0.00 (0.0)
	0	0.00	30.20	11.20	0.85	0.00	0.00 (0.0)
5	2	3.23	14.51	12.73	0.63	0.00	2.33 (1.7)
	4	6.18	3.73	13.93	0.62	3.33	3.33 (1.7)
	6	8.93	0.00	13.87	0.65	20.00	0.00 (0.0)
	0	0.00	30.01	11.33	0.82	0.00	0.00 (0.0)
6	2	3.54	10.69	13.07	070	0.00	4.67 (3.3)
	4	6.99	0.00	13.60	0.71	13.33	13.33 (5.0)
	6	10.63	0.00	13.80	0.63	33.33	0.00 (0.0)
	0	0.00	29.32	12.07	0.71	0.00	0.00 (0.0)
7	2	3.61	5.98	12.20	0.79	0.00	0.00 (0.0)
	4	7.76	0.00	13.07	0.69	40.00	7.00 (5.0)
	6	13.27	0.00	13.60	0.65	86.67	13.33 (3.3)
	0	0.00	23.44	11.87	0.66	0.00	0.00 (0.0)
8	2	4.21	5.69	12.47	0.64	9.00	13.33 (5.0)
	4	9.16	0.00	13.47	0.65	26.67	16.67 (5.0)
	6	14.28	0.00	13.67	0.61	93.33	0.00 (0.0)
$HSD^{**}_{(0.05)}$ (Storage life x Shelf life)		1.62	5.39	1.79	0.10	22.40	11.91

*Values in parentheses represent degree of chilling injury rated 1 (none) to 5 (severe)

** Mean separation was performed by Tukey's Studentized Range (HSD) test at $P < 0.05$ level (n = 3)

temperatures experienced during fruit development. (Ferguson et al., 1999). Similarly, Uthairatanakij (2003) reported that the occurrence and severity of CI varied more with year than with maturity. Intensity of CI was rated as severe in 2002 and moderate in 2003 (Tables 1 and 2). After removal from cold storage, the incidence of CI increased dramatically within 2 days at 20 °C and then declined during shelf life. This is due to the fact that fungal growth was observed on chill injured fruit on days 4 and 6 at 20 °C, and these nectarines were counted as decayed (Tables 3 and 4). A cultivar was determined to have reached the end of market life when ≥25% of fruit had become mealy or leathery, had flesh browning or severe flesh bleeding (Nanos and Mitchell, 1991). As in commercial practice, only moderate and severe levels were considered as losses, as rated for the intensity of CI

(Fernandez-Trujillo and Artes, 1997b). Fruit with uniform non-marked margin browning areas spreading from the pit cavity into ≥25% of the flesh area, representing moderate or severe CI is considered commercially affected by flesh browning (Crisosto et al., 1999). In our study, the percentage of commercially chilling injured fruits was below 25% throughout the 8 weeks of storage and an additional 6 days of shelf life.

Fungal Disorders

Gray mold decay, blue mold decay and *Rhizopus* decay were observed in Perfect Delight nectarines during storage and shelf life. Incidence of decay appeared after 6 weeks of storage (21.67%) in 2002 (Table 1). In 2003, no decay was recorded during the 8 weeks of storage (Table 2). Decay incidence increased during shelf life at 20 °C following cold storage. The longer the storage duration the more decay incidence during shelf life. CI increased the susceptibility of fruit to fungal pathogens and fungal growth developed on chilling injured fruits kept for 4-6 days at 20 °C (Tables 3 and 4). These fungal attacks could be due to secondary contamination associated with CI. Differences in the incidence of decay during storage between years might be due to variation in the occurrence of CI between years.

Conclusion

Weight loss of Perfect Delight nectarines reached 4%-6% at the end of 8 weeks of cold storage and exceeded 10% after 2 days of shelf life, but no visible shriveling appeared. Although moderate to severe CI occurred on fruit after 4 or 7 weeks of storage and after 2 days of shelf life, the percentage of fruit affected by CI was below the commercial threshold. Fungal decay mostly associated with CI exceeded 25% after 4 to 7 weeks of storage plus 2 days of shelf life. Perfect Delight nectarines maintained their flesh firmness at the 'ready to buy' stage at 0 °C for 4 to 7 weeks, and became 'ready to eat' within 2 days at 20 °C following cold storage. Since excessive softening occurred during storage and following shelf life, appropriate temperature management (near 0 °C) is recommended for Perfect Delight nectarines during storage, shipping, distribution and retail marketing. Based on these data, the predicted storage life of Perfect Delight nectarines was about 4 to 6 weeks at 0 °C and 85%-90% with a 2-day shelf life.

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