

1 **Prolonged Storage at Commercially Recommended Temperatures Promotes**
2 **Chilling Injury in Fresh Georgia Peaches**

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6 Footnotes

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8 **Abstract**

9 Peach (*Prunus persica* L.) is a climacteric fruit highly susceptible to chilling injury (CI) during
10 cold storage, a physiological disorder that significantly reduces commercial quality and shelf life.
11 This study evaluated the postharvest quality of fresh-market peaches stored at different
12 temperatures, with a focus on CI development and the critical temperature interval known as the
13 storage ‘killing zone’. Three commercial cultivars, ‘Blazeprince’, ‘Rich Pride’, and ‘O’Henry’
14 were stored for up to 28 days (d) at 1.1°C, 5.5°C, or 10°C with 90% relative humidity. Fruit
15 quality was assessed based on visual appearance, respiration rate, weight loss, firmness, decay
16 incidence, CI incidence, flesh color, and total soluble solids (TSS) concentration. Flesh firmness
17 declined in all three cultivars over time, with the most significant losses occurring at 10°C.
18 Weight loss and decay incidence were also higher at 10°C, particularly after 21 d. CI symptoms
19 were most severe in peaches stored at 5.5°C, confirming the elevated risk associated with the
20 ‘killing zone’ temperature range. Importantly, our results showed that 1.1°C, which is usually
21 considered a safe storage temperature, did not prevent CI, with all three cultivars developing CI
22 symptoms after a prolonged storage period. TSS levels increased slightly as fruit ripening
23 progressed, while color changes varied by cultivar and were more pronounced under warmer
24 storage conditions. Overall, these results showed that CI can develop during extended storage
25 even under temperatures commonly regarded as safe for peach preservation.

26

27 **Keywords:** firmness, mealiness, leatheriness, bleeding, weight loss, decay

28 **Introduction**

29 Peach (*Prunus persica* L.) is a stone fruit with wide varietal diversity [1]. Originally cultivated in
30 China, it was later introduced into Europe through Persia and Egypt [1,2]. Currently, peaches and
31 nectarines are cultivated worldwide, in response to strong consumer demand, reaching a global
32 production of 25.3 million metric tons in the 2024/2025 season [3]. Peaches are known for their
33 distinct flavor, aroma, and texture. However, their high perishability presents major challenges
34 and limitations for postharvest handling and market supply [4]. As climacteric fruit, peaches will
35 ripen both on and off the tree, requiring cold storage immediately after harvest to slow down the
36 ripening process and prevent decay [5].

37 Peaches are cold-sensitive, and storage within the temperature range of 2.2°C to 7.7°C,
38 commonly referred to as the ‘killing zone’ is detrimental to their postharvest quality [6]. This
39 range, although above the freezing point, promotes the development of chilling injury (CI), a
40 physiological disorder that typically becomes visible once the fruit is transferred to ambient
41 temperatures [7]. CI is particularly challenging to detect because it does not always manifest
42 externally, making visual assessment unreliable. However, it causes significant internal quality
43 deterioration on the fruit flesh, including symptoms such as mealiness or wooliness (dry, grainy
44 texture, and reduced juiciness), flesh translucency, browning, internal breakdown, incomplete
45 ripening, and, most importantly, loss of flavor [8–11]. Previous studies have shown that to
46 minimize the CI risk, peaches should be stored within the recommended temperature range of -1
47 to 1.6°C, which slows down ripening, while avoiding freezing injury [12].

48 Chilling injury-related quality issues are typically noticed by consumers rather than growers or
49 shippers, often after purchase, which can negatively affect market sales [13]. Repeated instances
50 of poor quality due to CI may further discourage consumers and shift preferences toward
51 alternative fruits [14]. Considering the impact of CI symptoms on consumer perception, CI is
52 recognized as a major postharvest disorder and remains one of the primary challenges in the
53 peach industry. In addition to reducing consumer acceptance, CI results in considerable
54 economic losses due to fruit rejection during marketing and processing [15]. This study
55 evaluated the effects of three storage temperatures, including a recommended optimum, a
56 temperature within the ‘killing zone’, and a temperature above that range, on the postharvest

57 quality and shelf life of three commercial peach cultivars, aiming to identify novel approaches to
58 reduce CI incidence.

59 **Materials and Methods**

60 *Fruit Material*

61 Three commercial peach cultivars were utilized in this study: ‘Blazeprince’, an early-season
62 clingstone cultivar released by the University of Arkansas breeding program; ‘Rich Pride’, a
63 mid-season clingstone peach developed by the USDA-ARS breeding program in Byron, Georgia;
64 and ‘O’Henry’, a late-season freestone cultivar originating from the Stiles private breeding
65 program in California. Fruit was harvested at commercial optimum maturity from orchards
66 located in central Georgia (Fort Valley, GA) (Table 1). Immediately after harvest, peaches were
67 hydrocooled in 1 to 3°C water and sanitized using a chlorine solution containing approximately
68 60 ppm free chlorine, with pH maintained between 6.5 and 7.5. Peaches were transferred the
69 same day to the postharvest laboratory at the University of Georgia located in Tifton, GA, in an
70 air-conditioned vehicle held at 20°C. Upon arrival, the fruit was sorted for uniformity of size and
71 color, and any fruit showing defects, bruises, or decay were discarded.

72

73 *Storage Conditions*

74 Peaches were randomly divided into groups for storage at three different temperatures. The first
75 group was stored at 1.1°C, the second at 5.5°C, and the third at 10°C. Relative humidity (RH)
76 was maintained at 90% to minimize excessive weight loss and shriveling. Each group consisted
77 of three biological replicates per evaluation day, with a minimum of 20 fruits per replicate used
78 as individual observations. Evaluations were conducted after 7, 14, 21, and 28 d of storage. After
79 each storage period, fruit was held for three additional days at 20°C and 70% RH to simulate
80 market or home conditions, which also induce the appearance of CI symptoms and other quality
81 defects.

82 *Weight loss*

83 Three boxes (replications) of 25 peaches (experimental units) each were labeled and weighed on
84 arrival (day 0), and weight loss was calculated with the difference between the initial and final

85 weights, then divided by the initial weight and multiplied by 100 to express the weight loss as a
86 percentage according to the following equation (1):

$$87 \quad \text{Weight Loss (\%)} = \frac{(W_i - W_f)}{W_i * 100} \quad (1)$$

88 Where W_i is the initial weight in grams (Day 0), and W_f is the final weight in grams.

89 ***Respiration Rate***

90 Ten peaches per replication were randomly selected from each storage temperature and enclosed
91 in two-gallon plastic buckets (United Solutions, Leominster, MA, USA) for one hour. Three
92 biological replicates were set for each group. Respiration rate (RR) was measured using a
93 CO₂/O₂ modified atmosphere package gas analyzer (Bridge 900141; Bedford Heights, OH,
94 USA). The values were determined using the formula (2) proposed by Fonseca et al. (2002) [16]
95 and expressed as the amount of CO₂ released per hour (mL·kg⁻¹·h⁻¹).

$$96 \quad R_{CO_2} = \frac{(y_{CO_2}^{t_f} - y_{CO_2}^{t_i}) \cdot V}{100 \cdot M \cdot (t_f - t_i)} \quad (2)$$

97

98 Where:

99 R= respiration (consumption/production) rate, mL·kg⁻¹·h⁻¹

100 V= free volume, mL

101 y= volumetric concentration, % v/v

102 M= mass, kg

103 t= time, h

104 ***Firmness***

105 Fruit firmness was assessed using an AFG 250N Mecmesin Advanced Force Gauge (Richmond
106 Works, Lake View, Halifax, UK) attached to a Multitest 2.5-d Mecmesin texture analyzer tower.
107 Nine peaches were randomly selected from each group. A 1-mm slice of peel was removed from
108 the surface of each fruit with a knife, and puncture tests were performed at that site with an 8-

109 mm cylindrical probe. The loading speed was set at 2 mm/s, and the maximum puncture depth
110 was 10 mm [17]. Firmness was expressed as the maximum force in Newtons (N).

111 ***Visual Flesh Appearance***

112 Flesh visual appearance was evaluated by randomly selecting five peaches from each storage
113 temperature at each evaluation point. Images were collected to document the development of CI
114 symptoms during storage. High-quality photographs were captured on days 0, 7, 14, 21, and 28
115 using a smartphone camera (iPhone 15 Pro Max, Apple, Cupertino, CA, USA) placed within an
116 enclosed photobooth to ensure uniform lighting and consistent imaging conditions.

117

118 ***Flesh Color Evaluation***

119 On each sampling day, three peaches were randomly selected from each replication (nine fruits
120 per storage temperature). Flesh color was assessed on the cut flesh surface by taking three
121 readings at different positions, and their mean was used as the color value for each fruit.
122 Measurements were obtained using a digital colorimeter (Konica Minolta CR-400, Tokyo, Japan)
123 and expressed in the CIE L* a* b* color space, where L* represents lightness (0 = black, 100 =
124 white), a* the red-green index (+a = red, -a = green), and b* the yellow-blue index (+b = yellow,
125 -b = blue).

126 ***Decay and CI Incidence***

127 Decay incidence was determined visually by inspecting a minimum of 20 peaches per replicate at
128 each storage temperature. Fruits displaying mold growth or water-soaked lesions on the surface
129 were considered rotten. The decay incidence was calculated as the percentage of affected fruits
130 relative to the total number of peaches evaluated. CI incidence was similarly determined by
131 recording the presence or absence of characteristic CI symptoms on each fruit and expressing the
132 results as a percentage.

133 ***Total Soluble Solids***

134 Samples were prepared by homogenizing 10 g of fruit with a homogenizer (PowerGen 500,
135 Fisher Scientific, Waltham, MA, USA). The homogenate was centrifuged in an Allegra 25R unit
136 (Beckman Coulter, Brea, CA, USA) at 4,800 rpm and 4°C for 35 min. Subsequently, the
137 supernatant was filtered through cheesecloth, and the juice was stored at -20°C until analysis.

138 TSS concentration was measured using a pocket refractometer (PAL-1; Minato-ku City, Tokyo,
139 Japan) by placing a drop of juice on the prism, and the results were expressed as a percentage of
140 TSS.

141

142 *Data Analysis*

143 The study was conducted during the summers of 2023 and 2024 and involved three commercial
144 melting flesh peach cultivars ('Blazeprince', 'Rich Pride', and 'O'Henry') stored at 1.1°C,
145 5.5°C, or 10°C. Quality attributes were evaluated on days 0, 7, 14, 21, and 28. A subset of three
146 biological replicates per storage temperature was held for three additional days at 20°C and 70%
147 RH to assess CI incidence under simulated market conditions. A completely randomized design
148 was used in this experiment. All statistical analyses were performed in R (R Foundation for
149 Statistical Computing, Vienna, Austria). Data were analyzed separately for each sampling day.
150 For each cultivar and each storage day, a linear model was fitted, followed by a one-way
151 ANOVA to test for differences among storage temperatures. When the significant effects were
152 detected ($p < 0.05$), means were compared using Tukey's HSD test (95% confidence level).
153 Compact letter displays were used to illustrate statistical differences among the groups. The
154 results were expressed as means \pm standard errors.

155

156 **Results**

157 *Weight Loss*

158 Weight loss in the ‘Blazeprince’ cultivar progressively increased during storage (Fig. 1, II, A).
159 After 7 d, peaches stored at 1.1°C exhibited significantly lower weight loss ($5.29 \pm 0.28\%$) when
160 compared to 5.5°C ($6.94 \pm 0.07\%$) and 10°C ($6.70 \pm 0.13\%$) (Fig. 1, II, A). On 14 d, differences
161 among storage temperatures were not statistically significant (Fig. 1, II, A). By 21 d, peaches
162 stored at 1.1°C demonstrated significantly lower weight loss ($11.04 \pm 1.13\%$) compared to 5.5°C
163 ($13.46 \pm 0.47\%$) (Fig. 1, II, A). This trend remained consistent throughout the 28 d storage
164 period, where peaches stored at 1.1°C maintained significantly the lowest values ($10.99 \pm$
165 0.09%) compared to the other storage temperatures (Fig. 1, II, A).

166 Weight loss in the ‘Rich Pride’ cultivar, increased over time during storage (Fig. 1, II, B),
167 following a similar trend to ‘Blazeprince.’ After 7 d, peaches stored at 1.1°C ($4.81 \pm 0.23\%$) and
168 5.5°C ($5.97 \pm 0.12\%$) showed significantly lower weight loss compared to 10°C ($7.33 \pm 0.45\%$)
169 (Fig. 1, II, B). On day 14, peaches stored at 1.1°C exhibited significantly lower weight loss (6.90
170 $\pm 0.63\%$), compared to those stored at 10°C ($10.11 \pm 0.39\%$) (Fig. 1, II, B). By day 21,
171 differences among the three different storage temperatures were not statistically significant (Fig.
172 1, II, B). However, after 28 d of storage, fruit stored at 1.1°C maintained significantly lower
173 weight loss ($12.56 \pm 0.22\%$) compared with fruit stored at 10°C ($17.30 \pm 0.30\%$) (Fig. 1, II, B).

174 In ‘O’Henry’ peaches, weight loss gradually increased during storage at all storage temperatures
175 evaluated (Fig. 1, II, C). On 7 d, peaches stored at 1.1°C demonstrated significantly lower weight
176 loss ($2.78 \pm 0.44\%$) when compared to 5.5°C ($4.84 \pm 0.23\%$) and 10°C ($5.10 \pm 0.48\%$) (Fig. 1, II,
177 C). On 14 d, no statistically significant differences were observed among the three storage
178 temperatures (Fig. 1, II, C). As storage progressed to 21 d, weight loss followed a trend similar to
179 that observed in ‘Blazeprince’ and ‘Rich Pride’, with peaches stored at 1.1°C showing the lowest
180 weight loss value ($8.65 \pm 0.63\%$) (Fig. 1, II, C). A comparable pattern was maintained at 28 d,
181 when peaches stored at 1.1°C demonstrated significantly lower weight loss ($19.8 \pm 0.48\%$),
182 compared to storage at 5.5°C ($22.5 \pm 0.80\%$) and 10°C ($27.3 \pm 3.03\%$) (Fig. 1, II, C).

183

184 **Respiration Rate**

185 In the ‘Blazeprince’ cultivar, RR increased gradually during the storage period (Fig. 2, II, A).
186 After 7 d of storage, peaches stored at 10°C exhibited significantly higher RR compared to
187 peaches stored at 1.1°C. After 14 d of storage, peaches stored at 5.5°C demonstrated a
188 significantly higher respiration rate ($28.84 \pm 1.60 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$), compared to those stored at
189 1.1°C (24.54 ± 0.59), while fruit stored at 10°C exhibited intermediate values (25.19 ± 0.65
190 $\text{mL}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$) (Fig. 2, II, A). On 21 and 28 d, no statistical differences were observed between
191 storage conditions.

192 In ‘Rich Pride’, RR progressively increased during the storage period across all evaluated storage
193 temperatures (Fig. 2, II, B). No significant differences were observed between storage
194 temperatures at any time point, except at 28 d, when peaches stored at 10°C exhibited the highest
195 RR ($37.31 \pm 1.15 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$) (Fig. 2, II, B).

196 In the ‘O’Henry’ cultivar, RR increased on a larger scale compared with ‘Blazeprince’ and ‘Rich
197 Pride’ throughout the 28 d of storage for all three storage temperatures (Fig. 2, II, C). After 14 d
198 of storage, RR ranged from $50.83 \pm 4.56 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$ (1.1°C) to $53.91 \pm 2.77 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$
199 (10°C), with no statistically significant differences observed among storage temperatures (Fig. 2,
200 II, C). However, after 21 d of storage, peaches stored at 10°C showed statistically significantly
201 higher RR ($62.83 \pm 1.45 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$) compared with those at 1.1°C ($50.04 \pm 0.60 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$)
202 and 5.5°C ($53.89 \pm 0.77 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$) (Fig. 2, II, C). This trend continued after 28 d of storage,
203 where fruit held at 10°C showed the highest RR ($88.12 \pm 5.06 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$) (Fig. 2, II, C).

204

205 **Firmness**

206 In the ‘Blazeprince’ cultivar (Fig. 2, I, A), fruit firmness declined from 0 to 7 d of storage. By 7
207 d, peaches stored at 1.1°C maintained significantly higher firmness ($4.29 \pm 0.28 \text{ N}$) compared to
208 those stored at 5.5°C ($3.54 \pm 0.14 \text{ N}$) or 10°C ($3.44 \pm 0.14 \text{ N}$), a trend that persisted at 14 d. After
209 21 d, peaches stored at 1.1°C showed a marked increase in firmness ($5.33 \pm 0.18 \text{ N}$), both
210 relative to the previous time point (14 d) and compared to fruit stored at 5.5°C ($1.94 \pm 0.22 \text{ N}$) or
211 10°C ($3.20 \pm 0.14 \text{ N}$) (Fig. 2, I, A). Firmness at 1.1°C continued to rise through 28 d and

212 remained the highest among storage temperatures. No differences were detected between 5.5°C
213 and 10°C at this final time point. (Fig. 2, I, A).

214 Similarly, for the ‘Rich Pride’ cultivar, firmness declined from 0 to 7 d of storage (Fig. 2, I, B).
215 After 7 d, fruit stored at 1.1°C exhibited the highest firmness (6.21 ± 0.30 N), while those stored
216 at 10°C exhibited the lowest readings (4.00 ± 0.15 N) (Fig. 2, I, B). After 14 d of storage,
217 peaches stored at 1.1 and 5.5°C were significantly firmer than those stored at 10°C (Fig. 2, I, B).
218 This trend continued through 21 and 28 d, with fruit stored at 1.1 and 5.5°C consistently
219 maintaining higher firmness compared with those stored at 10°C (Fig. 2, I, B).

220 In the ‘O’Henry’ cultivar, firmness decreased sharply during the first 7 d of the storage period
221 (Fig. 2, I, C). After 7 d, peaches stored at 1.1 and 5.5°C maintained higher firmness compared
222 with those stored at 10°C (Fig. 2, I, C). After 21 d, peaches stored at 5.5°C were firmer than
223 those at 10°C, while 1.1°C showed intermediate values (Fig. 2, I, C). After 28 d, peaches stored
224 at 10°C showed the lowest firmness readings (8.10 ± 0.75 N), when compared to both 1.1°C
225 (13.70 ± 0.96 N) and 5.5°C (12.57 ± 0.78 N) (Fig. 2, I, C).

226 ***Flesh Visual Appearance***

227 During the first 7 d of storage, all cultivars retained their visual quality, with no sign of CI across
228 storage temperatures (Figs. 3, 4, and 5). By 14 d of storage, CI symptoms appeared in fruit stored
229 at 5.5°C, whereas peaches at 1.1 and 10°C remained unaffected (Figs. 3, 4, and 5). On day 21, CI
230 was observed on peaches stored at 1.1°C and 5.5°C, while fruit stored at 10°C continued free of
231 symptoms, a pattern consistent across cultivars (Figs. 3, 4, and 5). This trend persisted through
232 28 d, when peaches stored at 1.1°C and 5.5°C showed CI (Figs. 3, 4, and 5), whereas peaches
233 stored at 10°C remained free of CI throughout the entire storage period (Figs. 3, 4, and 5).

234 ***Flesh Color Evaluation***

235 The L* value, representing lightness, showed no significant differences among storage
236 temperatures in the ‘Blazeprince’ cultivar through 14 d. However, on 21 d, peaches stored at
237 10°C exhibited significantly higher L* values (66.8 ± 0.41) compared to 5.5°C (62.9 ± 1.46)
238 (Table 2). In the ‘Rich Pride’ cultivar, no significant differences were observed until 28 d, when
239 fruit stored at 10°C presented lower values relative to the other conditions. For the ‘O’Henry’

240 cultivar, significant differences were observed at 21 d, with peaches at 5.5°C showing
241 significantly lower L* values (69.0 ± 1.62) compared to fruit stored at 1.1°C.

242 The a* values, representing red-green color tones, remained stable throughout storage in the
243 'Blazeprince' cultivar, with no statistically significant differences among storage temperatures
244 (Table 2). In the 'Rich Pride' cultivar, differences emerged after 21 d of storage, when peaches
245 stored at 1.1°C showed lower a* values (6.2 ± 1.56) compared with 10°C (11.3 ± 1.15) (Table 2).
246 By 28 d, peaches stored at 10°C retained higher redness (9.3 ± 0.73) (Table 2). For the 'O'Henry'
247 cultivar, significant differences appeared earlier, at 14 d, with peaches stored at 10°C showing
248 significantly lower a* value (1.29 ± 0.29) compared to 1.1°C (3.12 ± 0.64), and 5.5°C ($5.45 \pm$
249 0.45) (Table 2). On 28 d, peaches stored at 10°C expressed significantly higher a* values ($10.9 \pm$
250 1.58) compared to 1.1°C (6.2 ± 0.88) (Table 2).

251 The b* values indicate yellow-blue tones. For the 'Blazeprince' cultivar, fruit stored at 10°C
252 expressed significantly higher b* values at 14 d (49.1 ± 0.99) compared to fruit stored at 5.5°C
253 (43.5 ± 1.71). A similar trend was observed at 21 d, when peaches stored at 10°C expressed
254 significantly higher b* values (53.8 ± 0.99) compared to both 5.5 and 1.1°C storage temperatures
255 (Table 2). For the 'Rich Pride' cultivar, b* values remained stable throughout storage, with no
256 significant differences among storage temperatures. In the 'O'Henry' cultivar, significant
257 differences were detected at later stages, with fruit stored at 10°C presenting higher b* values
258 after 21 and 28 d of storage compared to 5.5°C.

259 ***Decay Incidence***

260 In the 'Blazeprince' cultivar, decay incidence was not significantly different among storage
261 temperatures until 21 d, when peaches stored at 5.5°C showed a significant increase in decay
262 incidence ($32.0 \pm 1.63\%$) compared with the other conditions (Fig. 1, I, A). At 28 d, decay
263 incidence increased sharply in peaches stored at 5.5°C ($80.0 \pm 2.94\%$). Fruit stored at 10°C also
264 showed a marked increase during this interval, reaching approximately $25.3\% \pm 2.62\%$. In
265 contrast, fruit stored at 1.1°C remained free of decay throughout the entire storage period (Fig. 1,
266 I, A).

267 In 'Rich Pride', decay incidence was not significantly different among storage temperatures until
268 21 d, when fruit stored at 5.5°C showed significantly higher decay incidence ($46.7 \pm 2.87\%$)

269 compared with other conditions (Fig. 1, I, B). By 28 d, decay incidence remained highest in
270 peaches stored at 5.5°C ($49.3 \pm 2.36\%$), followed by 10°C ($14.7 \pm 1.25\%$) and 1.1°C ($6.7 \pm$
271 1.70%) (Fig. 1, I, B).

272 In ‘O’Henry’, no decay was observed until day 7. By 14 d, peaches stored at 10°C exhibited
273 significantly higher decay incidence ($11.7 \pm 0.47\%$) compared with 5.5°C ($6.7 \pm 0.47\%$) and
274 1.1°C ($3.7 \pm 0.47\%$) (Fig. 1, I, C). At 21 d, decay incidence was higher in fruit stored at 10°C
275 ($12.3 \pm 1.25\%$) and 1.1°C ($9.3 \pm 1.89\%$) than at 5.5°C ($3.5 \pm 0.47\%$) (Fig. 1, I, C). By 28 d, fruit
276 stored at 10°C exhibited the highest decay incidence ($23.3 \pm 0.47\%$) compared to 5.5°C ($4.3 \pm$
277 0.47%) and 1.1°C ($6.7 \pm 0.47\%$) (Fig. 1, I, C).

278 *Chilling Injury*

279 CI in ‘Blazeprince’ peaches was absent across all three storage temperatures up to 7 d (Fig. 1, III,
280 A). On day 14, peaches stored at 5.5°C exhibited significantly higher CI incidence ($84.0 \pm$
281 1.41%), while no symptoms were detected at 1.1 or 10°C (Fig. 1, III, A). However, by day 21,
282 fruit stored at 1.1 and 5.5°C showed significantly higher CI than those at 10°C, which remained
283 free of symptoms (Fig. 1, III, A). This pattern persisted through 28 d of storage, when peaches
284 stored at 1.1°C reached 100% CI incidence, statistically similar to 5.5°C ($92.0 \pm 1.41\%$),
285 whereas peaches stored at 10°C remained unaffected (Fig. 1, III, A).

286 For the ‘Rich Pride’ cultivar, no CI symptoms were observed until 14 d, when peaches stored at
287 5.5°C showed a slight increase in CI incidence ($13.3 \pm 2.49\%$) (Fig. 1, III, B). By 21 d, fruit
288 stored at 1.1°C and 5.5°C exhibited significantly higher CI incidence ($86.6 \pm 1.25\%$ and $82.6 \pm$
289 0.94% , respectively), compared to fruit stored at 10°C, which remained free of CI symptoms
290 (Fig. 1, III, B). By 28 d, a similar pattern was observed, with peaches stored at 5.5°C exhibiting
291 the highest CI incidence ($94.6 \pm 1.25\%$), followed by 1.1°C ($70.6 \pm 3.40\%$), both significantly
292 greater than 10°C, where no CI symptoms were detected throughout the storage period (Fig. 1,
293 III, B).

294 In ‘O’Henry’ cultivar, CI was absent during the first 7 d of storage across all three storage
295 temperatures evaluated (Fig. 1, III, C). On 14 d, peaches stored at 5.5°C exhibited significantly
296 higher CI incidence ($70.0 \pm 4.32\%$) compared with the other storage conditions, which showed
297 no CI (Fig. 1, III, C). On day 21, fruit stored at 5.5°C presented the highest CI ($89.47 \pm 0.82\%$),

298 significantly greater than 1.1°C ($48.1 \pm 3.30\%$), while no CI was detected at 10°C (Fig. 1, III, C).
299 This trend persisted through 28 d, when storage at 5.5°C resulted in the highest CI incidence
300 ($85.0 \pm 1.41\%$), followed by 1.1°C ($51.6 \pm 0.47\%$), while fruit stored at 10°C remained free of CI
301 symptoms throughout the storage period (Fig. 1, III, C).

302 ***Total Soluble Solids***

303 For the ‘Blazeprince’ cultivar, TSS increased gradually over 28 d of storage, with no consistent
304 pattern among storage temperatures (Fig. 2, III, A). Differences were not significant until after 28
305 d of storage, when peaches stored at 5.5°C had significantly lower TSS ($10.37 \pm 0.17\%$),
306 compared to the ones stored at 1.1 and 10°C (Fig. 2, III, A).

307 In the ‘Rich Pride’ cultivar, TSS increased gradually during storage, following a pattern similar
308 to of ‘Blazeprince’, with only minor variations among the temperatures (Fig. 2, III, B).
309 Specifically, after 21 d, peaches stored at 1.1 showed statistically significantly higher TSS values
310 ($9.40 \pm 0.10\%$) when compared to 10°C ($6.67 \pm 0.72\%$) (Fig. 2, III, B). By 28 d, TSS values no
311 differed significantly among storage temperatures.

312 In the ‘O’Henry’ cultivar, TSS values increased slightly throughout storage period (Fig. 2, III, C),
313 and no significant differences were detected among storage temperatures at any evaluated
314 timepoint (Fig. 2, III, C).

315

316

317 **Discussion**

318 Postharvest temperature management plays a key role in maintaining peach quality during
319 storage and distribution. Peaches, as climacteric fruit, continue to show increased metabolic
320 activity after harvest, which can lead to rapid softening, increased susceptibility to decay,
321 shortened shelf life, and declined marketability value [10]. Refrigeration is crucial to slow down
322 respiration and ethylene production, both of which contribute to the fruit ripening and senescence
323 [18]. Consequently, for producers, packing house owners, distributors, and even consumers, the
324 storage temperature must be carefully optimized. Peach storage is particularly challenging due to
325 the ‘killing zone’, defined in the literature as the temperature range between 2.2 and 7.7°C,
326 where the risk of CI symptoms such as mealiness, browning, and internal breakdown is elevated
327 [10,19]. In this study, ‘Blazeprince’, ‘Rich Pride’, and ‘O’Henry’ peaches were stored at 1.1°C
328 [20], 5.5°C (within the ‘killing zone’), and 10°C (above the ‘killing zone’) for a storage period of
329 up to 28 d. Our results showed that CI developed even at 1.1°C (putative safe storage
330 temperature) during extended storage durations. The incidence was higher at 5.5°C, but the
331 presence of CI at 1.1°C in all cultivars indicates that this storage temperature is not completely
332 safe under specific circumstances. This shows the cultivar differences and the need for more
333 precise temperature management in order to protect fruit quality after harvest. On the other hand,
334 storage of peaches at 10°C did not trigger any CI symptoms in any of the three cultivars.
335 Nevertheless, fruit stored at the elevated temperature softened faster and showed higher decay
336 incidence and weight loss. The complete absence of CI under 10°C storage suggests that this
337 storage temperature could be an acceptable solution for short storage periods or rapid distribution
338 when the main concern is the avoidance of chilling injury. However, this storage temperature is
339 unsuitable for long-term storage.

340 Weight loss steadily increased over storage for all three cultivars, and the highest values were
341 constantly observed at 10°C. Peaches stored at 1.1°C with 90% RH consistently showed the
342 lowest weight loss during the 28 days storage period, which agrees with the expected reduction
343 in weight loss at lower storage temperatures [21–23]. Storage at 5.5°C resulted in intermediate
344 values and showed a faster increase in weight loss after 21 d, especially in ‘Blazeprince’ and
345 ‘Rich Pride’. These results showed that even though weight loss is affected by the present
346 relative humidity in the air, storage temperature is also linked with losses and thus, 1.1°C

347 remains the most effective temperature for reducing weight loss. The higher weight loss at 10°C
348 also supports the observation that fruit at this temperature softened faster and had higher decay
349 incidence (after 21 d) due to the increased activity of cell wall modifying enzymes [24].

350 Peach respiration rates increased overall during storage for all cultivars evaluated, and the
351 highest values were usually linked with the highest storage temperature (10°C). This is an
352 expected outcome because the warmer temperatures increase metabolic activities and lead to
353 faster CO₂ production. Several studies have shown that peaches stored at higher temperatures
354 respire more rapidly, which accelerates softening and reduces shelf life [14,19]. However,
355 'Blazeprince' showed higher respiration rates at 5.5°C compared to 10°C after 14 days of
356 storage, which suggests a possible stress response in the 'killing zone' temperature range for this
357 specific cultivar. The different patterns show that cultivars can react differently when exposed to
358 cold stress or warmer storage conditions. In our study the increase in respiration at 10°C was
359 accompanied by accelerated softening and higher decay incidence, while the lower respiration
360 rates at 1.1°C reflected the reduced metabolic activity under cold storage conditions.

361 Total soluble solids (TSS) values increased slightly during storage for all cultivars as expected
362 during ripening progression, with starches and complex carbohydrates breaking down into
363 simpler sugars [25,26]. The differences among temperatures were not consistent, and the changes
364 were small compared to the other quality traits. This agrees with previous work showing that
365 storage temperature has a limited direct influence on TSS in peaches, since sugar accumulation
366 mainly depends on ripening stage and cultivar characteristics rather than temperature alone [18].
367 In our study the minor increase in TSS reflected normal ripening during cold storage and did not
368 show a clear temperature effect or any correlation with the chilling injury (CI) disorder.

369 Firmness is key quality attribute for peaches and is directly reflecting textural integrity,
370 postharvest shelf life, and has a serious influence on the marketability value of the product [25].
371 Our results showed that firmness for all three cultivars declined over time. This softening is
372 primarily attributed to the enzymatic degradation of pectin, cellulose, and hemicellulose, crucial
373 cell wall components for fruit integrity. Enzymes, including polygalacturonase (PG), pectin
374 methylesterase (PME), and β-galactosidase, directly influence the pectic substances and loosen
375 the cell wall structure, ultimately leading to fruit softening [8,26]. An uncommon behavior was
376 observed in peaches stored at 1.1°C where firmness slightly increased during later storage stages

377 (after 14 days of cold storage). This response has been previously associated with the evidence of
378 CI, where peach mesocarp cells fail to fully disassemble, resulting in a dry and rubbery texture,
379 commonly referred to as mealiness or wooliness [8,10,27]. On the other hand, peaches stored at
380 10°C exhibited greater fruit softening, confirming previous findings that elevated storage
381 temperatures can accelerate the activity of softening-related enzymes [24,28].

382 Decay incidence development is a serious postharvest concern that can negatively affect peach
383 marketability, especially under conditions that compromise fruit integrity. In our study, decay
384 incidence increased notably after prolonged storage (21 d), with the highest rates observed in
385 fruit stored at the higher storage temperatures of 5.5 and 10 °C. A similar study by Sun et al.
386 (2018) [29] found that peaches stored at 5 and 8°C developed decay earlier and at higher
387 percentages than fruit stored at 0 and 2°C with decay increasing steadily as storage duration
388 progressed. In our study we also observed that decay appeared sooner at the higher storage
389 temperature of 10°C, while 5.5°C showed noticeable decay after 21 d and 1.1°C maintained the
390 lowest decay incidence throughout the storage period.

391 It is worth noting that our findings showed CI symptoms at 1.1°C in all three cultivars during
392 extended storage, which poses a challenge for the common view that this temperature is
393 completely safe for long-term peach storage. Franzoni et al. (2023) [12] reviewed the
394 biochemical and molecular responses of peaches to low temperature stress and described how
395 cold storage led to damage of membrane integrity, reactive oxygen species (ROS) accumulation,
396 as well as cell wall disruption associated with CI development. Our results are aligned with the
397 findings of this study, highlighting that extended storage durations at putative safe storage
398 temperatures (1.1°C) contribute to the development of visible CI symptoms, after a period of
399 three weeks or longer. This suggests that the presence and severity of CI are not solely dependent
400 on storage temperature but are also significantly influenced by storage duration and cultivar
401 variability.

402 **Conclusion**

403 This study demonstrated that storage temperature and duration play a crucial role in the
404 postharvest quality attributes and the chilling injury (CI) development of three commonly grown
405 Georgia peach cultivars. Among the three temperatures evaluated, fruit stored at 1.1°C exhibited

406 the lowest weight loss and decay incidence during the 28-day storage period. However, our
407 results showed that prolonged storage (≥ 21 d) at this temperature (1.1°C), previously considered
408 as safe and outside the ‘killing zone’, led to a gradual increase in firmness due to CI incidence,
409 indicating that 1.1°C is suitable only for short-term storage and should not be recommended for
410 periods exceeding three weeks. The low temperature might slow the fruit metabolism, but it does
411 not fully prevent the internal stress that leads to CI. On the other hand, peaches stored at 10°C
412 did not develop any CI symptoms, suggesting potential use for short-term storage or quick local
413 distribution. Responses to cold storage were cultivar-dependent, highlighting the need for
414 targeted postharvest handling protocols. Although this study focused on postharvest quality
415 attributes and the appearance of visual CI symptoms other factors such as aroma volatiles,
416 consumer flavor perception, or different harvest maturity stages, may further influence CI
417 susceptibility and warrant future investigation. Due to the nature of CI symptoms which manifest
418 only when the fruit is exposed to room temperatures (20°C), the quality decline is usually
419 noticed by end of market consumers rather than producers, packers or shippers. Overall, these
420 findings provide practical postharvest information for optimizing cold chain management by
421 balancing storage temperature and duration, directly relevant to commercial peach postharvest
422 handling protocols.

423

424 **Data availability statement**

425 The data that supports the findings of this study are available in the supplementary
426 material of this article.

427 **Conflicts of interest**

428 The author(s) declare(s) that there is no conflict of interest regarding the publication of this
429 article.

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435 **References**

- 436 [1] Bassi D, Monet R. Botany and taxonomy. The peach: botany, production and uses, Cabi
437 Wallingford UK; 2008, p. 1–36.
- 438 [2] Weisskopf A, Fuller DQ. Peach: Origins and development. Encyclopedia of global
439 archaeology, Springer; 2020, p. 8459–61.
- 440 [3] USDA FAS. Peaches & Nectarines: Production – Peaches & Nectarines. United States
441 Department of Agriculture, Foreign Agricultural Service.; 2025. Available at:
442 <https://www.fas.usda.gov/data/production/commodity/0579309>
- 443 [4] Zhang G, Zhang Y, Yang T, Luo D, Zhao Z, Ba L, et al. Physiological and transcriptomic
444 analysis of salicylic acid on membrane lipid metabolism and cell wall metabolism in
445 postharvest peach fruit. *Postharvest Biology and Technology* 2025;229:113683.
446 <https://doi.org/10.1016/j.postharvbio.2025.113683>.
- 447 [5] Crisosto C, Valero D. Harvesting and postharvest handling of peaches for the fresh market.
448 The peach: botany, production and uses, CABI Wallingford UK; 2008, p. 575–96.
- 449 [6] Rodrigues C, Gaspar PD, Simões MP, Silva PD, Andrade LP. Review on techniques and
450 treatments toward the mitigation of the chilling injury of peaches. *Journal of Food*
451 *Processing and Preservation* 2022;46:e14358. <https://doi.org/10.1111/jfpp.14358>.
- 452 [7] Zhou H, Zhang X, Su M, Du J, Li X, Zhang M, et al. Controlled atmosphere storage
453 alleviates internal browning in flat peach fruit by regulating energy and sugar metabolisms.
454 *Plant Physiology and Biochemistry* 2022;186:107–20.
455 <https://doi.org/10.1016/j.plaphy.2022.07.003>.
- 456 [8] Brummell DA, Dal Cin V, Lurie S, Crisosto CH, Labavitch JM. Cell wall metabolism
457 during the development of chilling injury in cold-stored peach fruit: association of
458 mealiness with arrested disassembly of cell wall pectins. *Journal of Experimental Botany*
459 2004;55:2041–52. <https://doi.org/10.1093/jxb/erh228>.
- 460 [9] Crisosto CH, Garner D, Crisosto GM, Bowerman E. Increasing ‘Blackamber’ plum (*Prunus*
461 *salicina* Lindell) consumer acceptance. *Postharvest Biology and Technology* 2004;34:237–
462 44.
- 463 [10] Lurie S, Crisosto CH. Chilling injury in peach and nectarine. *Postharvest Biology and*
464 *Technology* 2005;37:195–208. <https://doi.org/10.1016/j.postharvbio.2005.04.012>.
- 465 [11] Martínez-García PJ, Peace CP, Parfitt DE, Ogundiwin EA, Fresnedo-Ramírez J, Dandekar
466 AM, et al. Influence of year and genetic factors on chilling injury susceptibility in peach
467 (*Prunus persica* (L.) Batsch). *Euphytica* 2012;185:267–80. [https://doi.org/10.1007/s10681-](https://doi.org/10.1007/s10681-011-0572-1)
468 [011-0572-1](https://doi.org/10.1007/s10681-011-0572-1).
- 469 [12] Franzoni G, Spadafora ND, Sirangelo TM, Ferrante A, Rogers HJ. Biochemical and
470 molecular changes in peach fruit exposed to cold stress conditions. *Molecular Horticulture*
471 2023;3:24. <https://doi.org/10.1186/s43897-023-00073-0>.
- 472 [13] Manganaris GA, Minas I, Cirilli M, Torres R, Bassi D, Costa G. Peach for the future: A
473 specialty crop revisited. *Scientia Horticulturae* 2022;305:111390.
474 <https://doi.org/10.1016/j.scienta.2022.111390>.
- 475 [14] Farcuh M, Hopfer H. Aroma volatiles as predictors of chilling injury development during
476 peach (*Prunus persica* (L.) Batsch) cold storage and subsequent shelf-life. *Postharvest*
477 *Biology and Technology* 2023;195:112137.
478 <https://doi.org/10.1016/j.postharvbio.2022.112137>.

- 479 [15] Shan T, Jin P, Zhang Y, Huang Y, Wang X, Zheng Y. Exogenous glycine betaine treatment
480 enhances chilling tolerance of peach fruit during cold storage. *Postharvest Biology and*
481 *Technology* 2016;114:104–10. <https://doi.org/10.1016/j.postharvbio.2015.12.005>.
- 482 [16] Fonseca SC, Oliveira FA, Brecht JK. Modelling respiration rate of fresh fruits and
483 vegetables for modified atmosphere packages: a review. *Journal of Food Engineering*
484 2002;52:99–119.
- 485 [17] Contador L, Díaz M, Millanao M, Hernández E, Shinya P, Sáenz C, et al. A proposal for
486 determining the flesh softening of peach and nectarine in postharvest through simplified
487 targeted modeling. *Scientia Horticulturae* 2016;209:47–52.
488 <https://doi.org/10.1016/j.scienta.2016.06.015>.
- 489 [18] Zhang B, Chen X, Wang N, Guo S, Jiang W, Yu M, et al. Effects of Harvest Maturity on the
490 Fruit Quality of Different Flesh-Type Peach Stored at Near-Freezing Point Temperature.
491 *Foods* 2022;11. <https://doi.org/10.3390/foods11152200>.
- 492 [19] Crisosto CH, Mitchell FG, Ju Z. Susceptibility to Chilling Injury of Peach, Nectarine, and
493 Plum Cultivars Grown in California. *HortScience HortSci* 1999;34:1116–8.
494 <https://doi.org/10.21273/HORTSCI.34.6.1116>.
- 495 [20] Robertson JA, Meredith FI, Horvat RJ, Senter SD. Effect of cold storage and maturity on
496 the physical and chemical characteristics and volatile constituents of peaches (cv.
497 Cresthaven). *Journal of Agricultural and Food Chemistry* 1990;38:620–4.
498 <https://doi.org/10.1021/jf00093a008>.
- 499 [21] Bradford KJ, Dahal P, Van Asbrouck J, Kunusoth K, Bello P, Thompson J, et al. The dry
500 chain: Reducing postharvest losses and improving food safety in humid climates. *Food*
501 *industry wastes*, Elsevier; 2020, p. 375–89.
- 502 [22] Buonsenso F, Prencipe S, Valente S, Remolif G, de Barbeyrac J, Sardo A, et al. High
503 Humidity Storage Close to Saturation Reduces Kiwifruit Postharvest Rots and Maintains
504 Quality. *Horticulturae* 2025;11:883. <https://doi.org/10.3390/horticulturae11080883>.
- 505 [23] Gidado MJ, Gunny AAN, Gopinath SCB, Ali A, Wongs-Aree C, Salleh NHM. Challenges
506 of postharvest water loss in fruits: Mechanisms, influencing factors, and effective control
507 strategies – A comprehensive review. *Journal of Agriculture and Food Research*
508 2024;17:101249. <https://doi.org/10.1016/j.jafr.2024.101249>.
- 509 [24] Wang Y, Deng L, Meng J, Niu L, Pan L, Lu Z, et al. Transcriptomic and Metabolic
510 Analyses Reveal the Mechanism of Ethylene Production in Stony Hard Peach Fruit during
511 Cold Storage. *International Journal of Molecular Sciences* 2021;22.
512 <https://doi.org/10.3390/ijms222111308>.
- 513 [25] Belisle C, Phan UTX, Adhikari K, Chavez DJ. A Fruit Quality Survey of Peach Cultivars
514 Grown in the Southeastern United States. *HortTechnology* 2018;28:189–201.
515 <https://doi.org/10.21273/HORTTECH03870-17>.
- 516 [26] Prasanna V, Prabha ,T. N., and Tharanathan RN. Fruit Ripening Phenomena–An Overview.
517 *Critical Reviews in Food Science and Nutrition* 2007;47:1–19.
518 <https://doi.org/10.1080/10408390600976841>.
- 519 [27] Stanley CJ, Scofield C, Hallett IC, Schröder R. Dissecting the Role of Cell Wall Changes in
520 Chilling Injury-Induced Gel Formation, Rubberiness, and Mealiness in Apricots.
521 *Horticulturae* 2023;9. <https://doi.org/10.3390/horticulturae9101115>.
- 522 [28] Tatsuki M, Sawamura Y, Yaegaki H, Suesada Y, Nakajima N. The storage temperature
523 affects flesh firmness and gene expression patterns of cell wall-modifying enzymes in stony

524 hard peaches. *Postharvest Biology and Technology* 2021;181:111658.
525 <https://doi.org/10.1016/j.postharvbio.2021.111658>.
526 [29] Sun L, Liu S, Fan Z, Li Y, Wang J, Zhong Y, et al. The impact of storage temperature on
527 fruit quality and chilling injury of 'Okubao' peaches. *International Journal of Food and*
528 *Bioscience* 2018;1:12–8.
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531 **Tables/Figures**

Table 1. Harvest dates for the three peach cultivars used in this study.

Cultivar	Date of Harvest
'O'Henry'	July 20, 2023
'Blazeprince'	June 15, 2024
'Rich Pride'	June 15, 2024

532

Table 2. Color values L*, a*, and b* for ‘Blazeprince’, ‘Rich Pride’, and ‘O’Henry’ peaches stored for 7, 14, 21, and 28 days at 1.1, 5.5, and 10°C at 90% RH.

Day	Color Value	Storage Temperature	‘Blazeprince’	‘Rich Pride’	‘O’Henry’
7	L*	1.1°C	63.4 ± 1.56 a	61.1 ± 1.23 a	74.7 ± 1.05 a
		5.5°C	68.6 ± 1.46 a	60.1 ± 1.26 a	77.4 ± 0.49 a
		10°C	62.6 ± 2.30 a	62.7 ± 1.52 a	77.2 ± 0.74 a
14		1.1°C	65.9 ± 1.78 a	63.9 ± 2.08 a	74.9 ± 0.84 a
		5.5°C	60.9 ± 1.85 a	60.6 ± 1.96 a	73.1 ± 0.65 a
		10°C	63.9 ± 0.89 a	61.3 ± 1.60 a	74.9 ± 0.73 a
21		1.1°C	63.9 ± 0.80 ab	67.4 ± 1.86 a	74.1 ± 1.32 a
		5.5°C	62.9 ± 1.46 b	66.2 ± 1.30 a	69.0 ± 1.62 b
		10°C	66.8 ± 0.41 a	61.5 ± 1.86 a	71.4 ± 0.85 ab
28		1.1°C	64.6 ± 1.33 a	65.3 ± 1.52 a	70.2 ± 1.38 a
		5.5°C	64.6 ± 1.33 a	68.9 ± 1.17 a	67.7 ± 1.89 a
		10°C	65.4 ± 1.48 a	61.2 ± 0.74 b	65.4 ± 1.07 a
7	a*	1.1°C	5.23 ± 1.26 a	11.4 ± 1.38 a	1.00 ± 0.77 a
		5.5°C	4.66 ± 0.74 a	11.5 ± 1.23 a	0.58 ± 0.29 a
		10°C	5.65 ± 0.95 a	10.7 ± 1.16 a	-0.43 ± 0.59 a
14		1.1°C	4.92 ± 0.98 a	10.2 ± 1.76 a	3.12 ± 0.64 b
		5.5°C	6.72 ± 1.03 a	13.5 ± 1.35 a	5.45 ± 0.45 a
		10°C	5.72 ± 0.63 a	10.5 ± 1.18 a	1.29 ± 0.29 c
21		1.1°C	7.42 ± 1.18 a	6.2 ± 1.56 b	6.96 ± 2.15 a
		5.5°C	6.04 ± 0.63 a	9.3 ± 1.02 ab	7.34 ± 0.99 a
		10°C	5.13 ± 0.57 a	11.3 ± 1.15 a	5.70 ± 0.84 b
28		1.1°C	5.81 ± 0.61 a	7.1 ± 1.29 ab	6.28 ± 0.88 b
		5.5°C	5.81 ± 0.61 a	5.7 ± 0.55 b	7.34 ± 0.99 ab
		10°C	4.72 ± 0.53 a	9.3 ± 0.73 a	10.9 ± 1.58 a
7	b*	1.1°C	51.1 ± 1.68 a	49.5 ± 2.39 a	54.8 ± 1.35 a
		5.5°C	54.4 ± 1.29 a	50.1 ± 2.03 a	54.9 ± 0.63 a
		10°C	50.7 ± 2.96 a	55.8 ± 2.47 a	54.7 ± 1.38 a
14		1.1°C	47.1 ± 1.72 ab	51.9 ± 2.16 a	52.5 ± 1.35 a
		5.5°C	43.5 ± 1.71 b	48.4 ± 2.10 a	51.8 ± 1.12 a
		10°C	49.1 ± 0.99 a	52.2 ± 1.89 a	51.6 ± 0.96 a

21	1.1°C	45.3 ± 1.95 b	52.1 ± 1.32 a	55.1 ± 2.87 ab
	5.5°C	45.8 ± 1.44 b	52.6 ± 1.14 a	48.1 ± 3.29 b
	10°C	53.8 ± 0.99 a	52.9 ± 2.21 a	62.7 ± 1.46 a
28	1.1°C	42.7 ± 1.25 a	50.7 ± 1.69 a	51.9 ± 2.59 ab
	5.5°C	42.7 ± 1.25 a	51.5 ± 1.81 a	48.1 ± 3.29 b
	10°C	47.0 ± 1.20 a	48.7 ± 1.02 a	60.3 ± 1.43 a

Note: Different letters are assigned where storage temperatures significantly affected the measured parameters (p-value < 0.05).

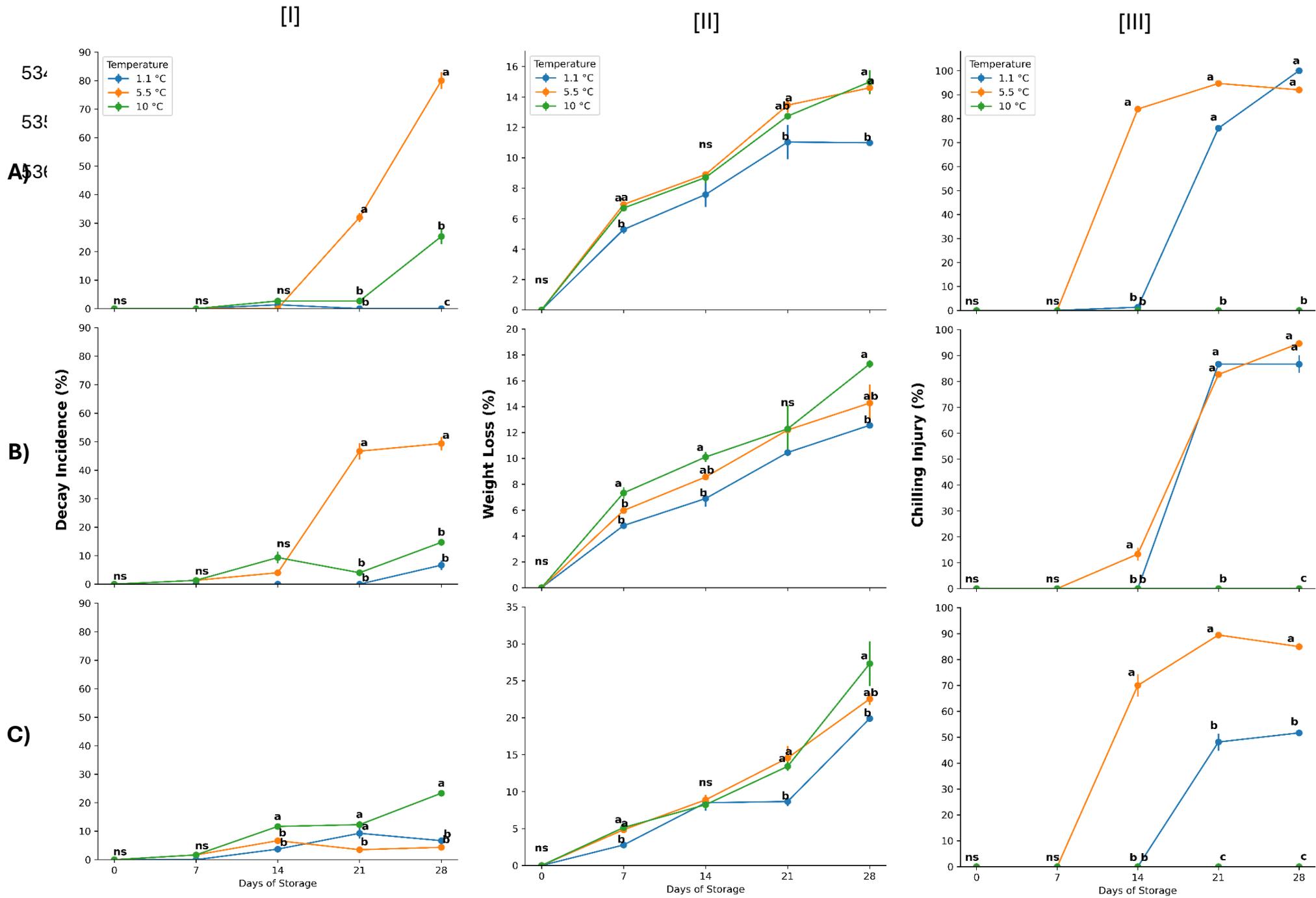


Figure 1.

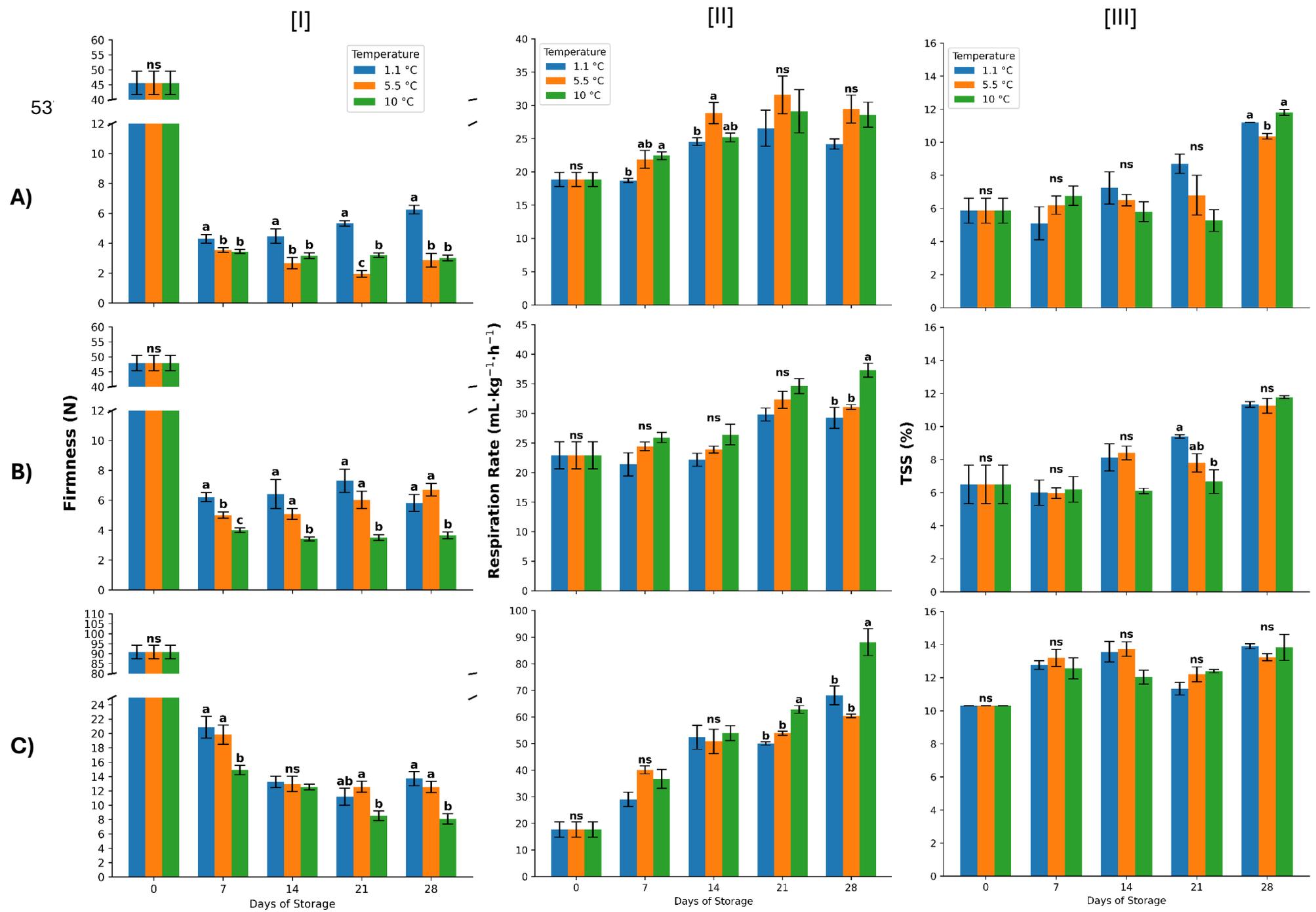
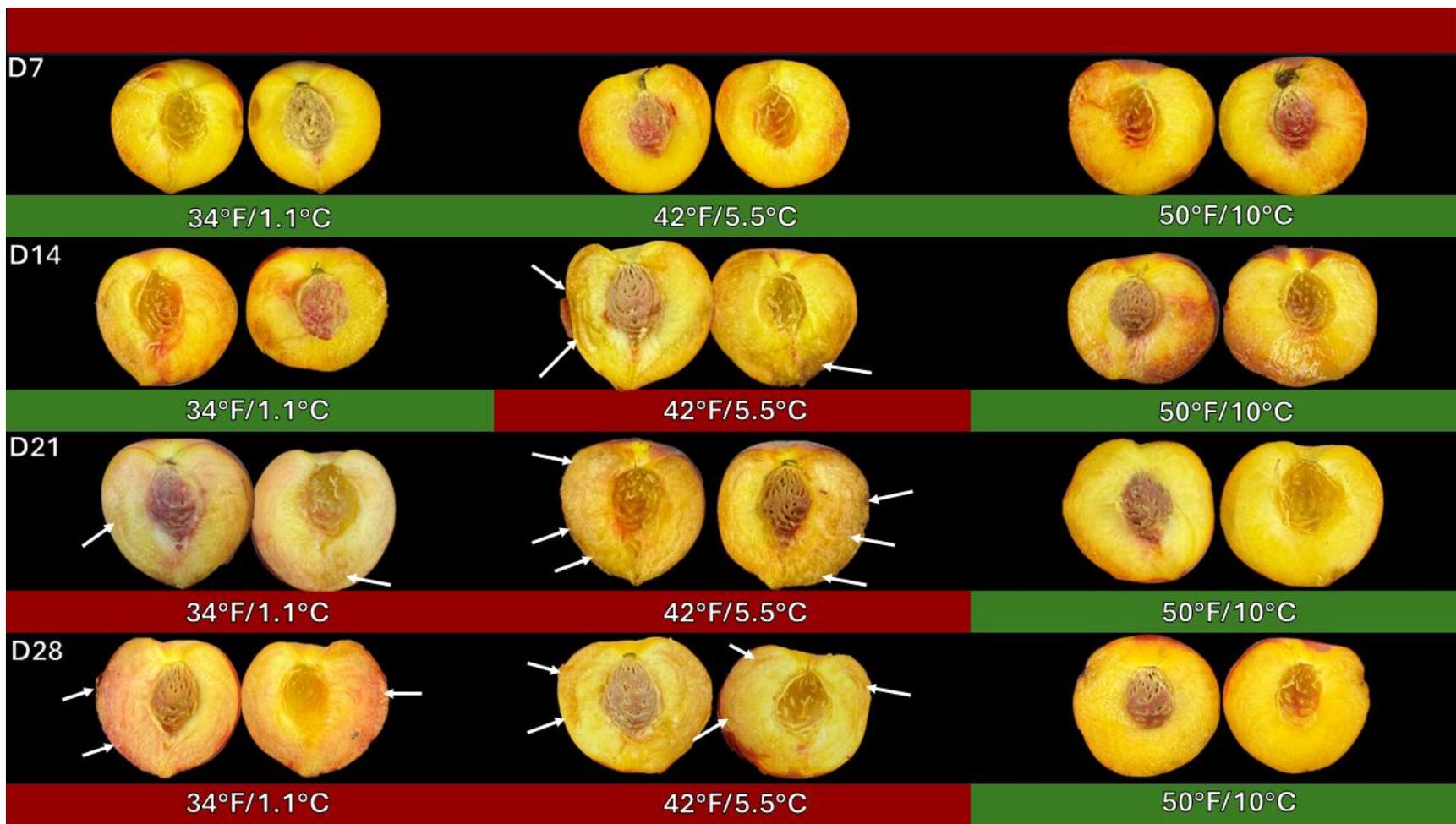


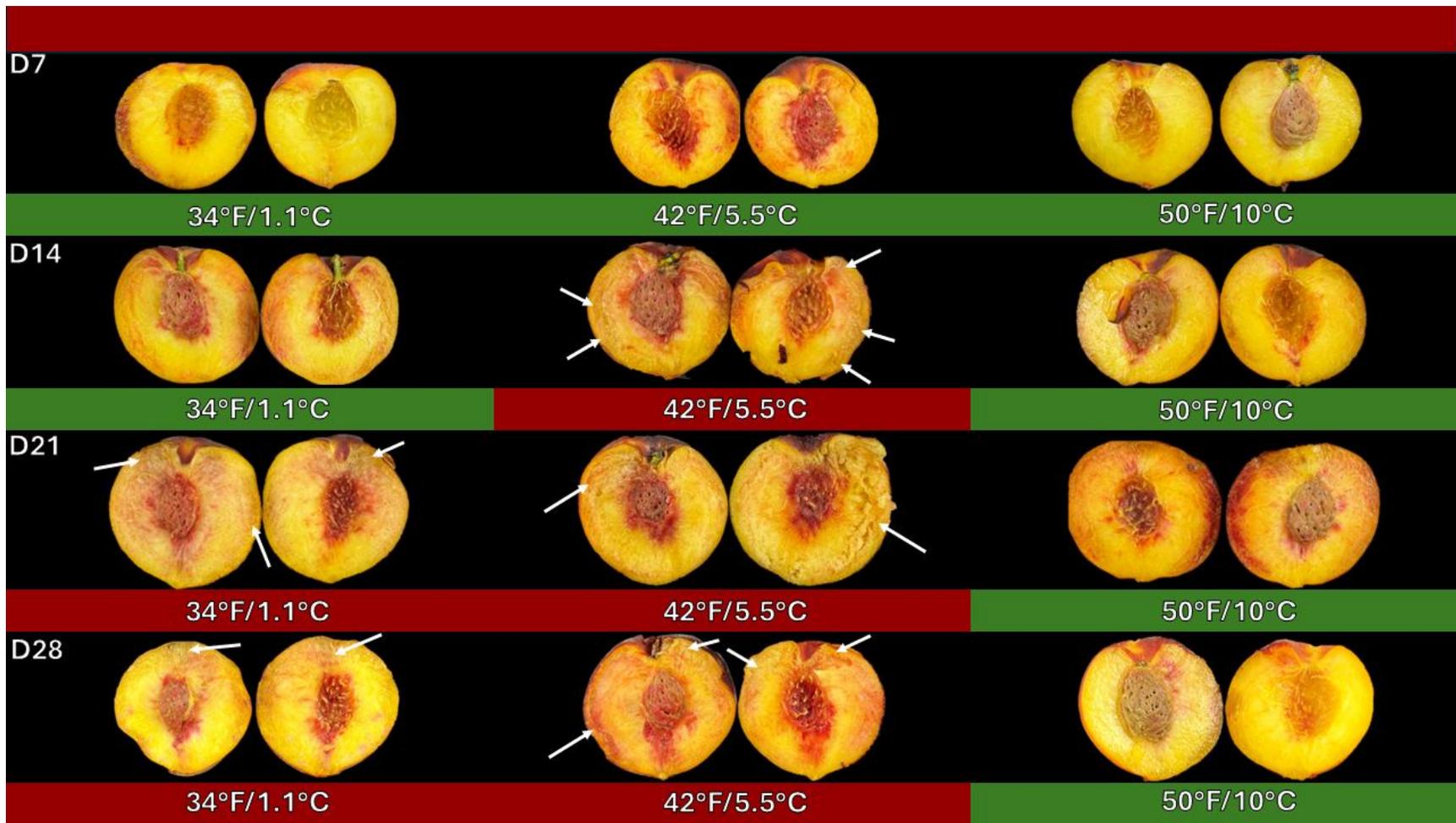
Figure 2.



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539 **Figure 3.**

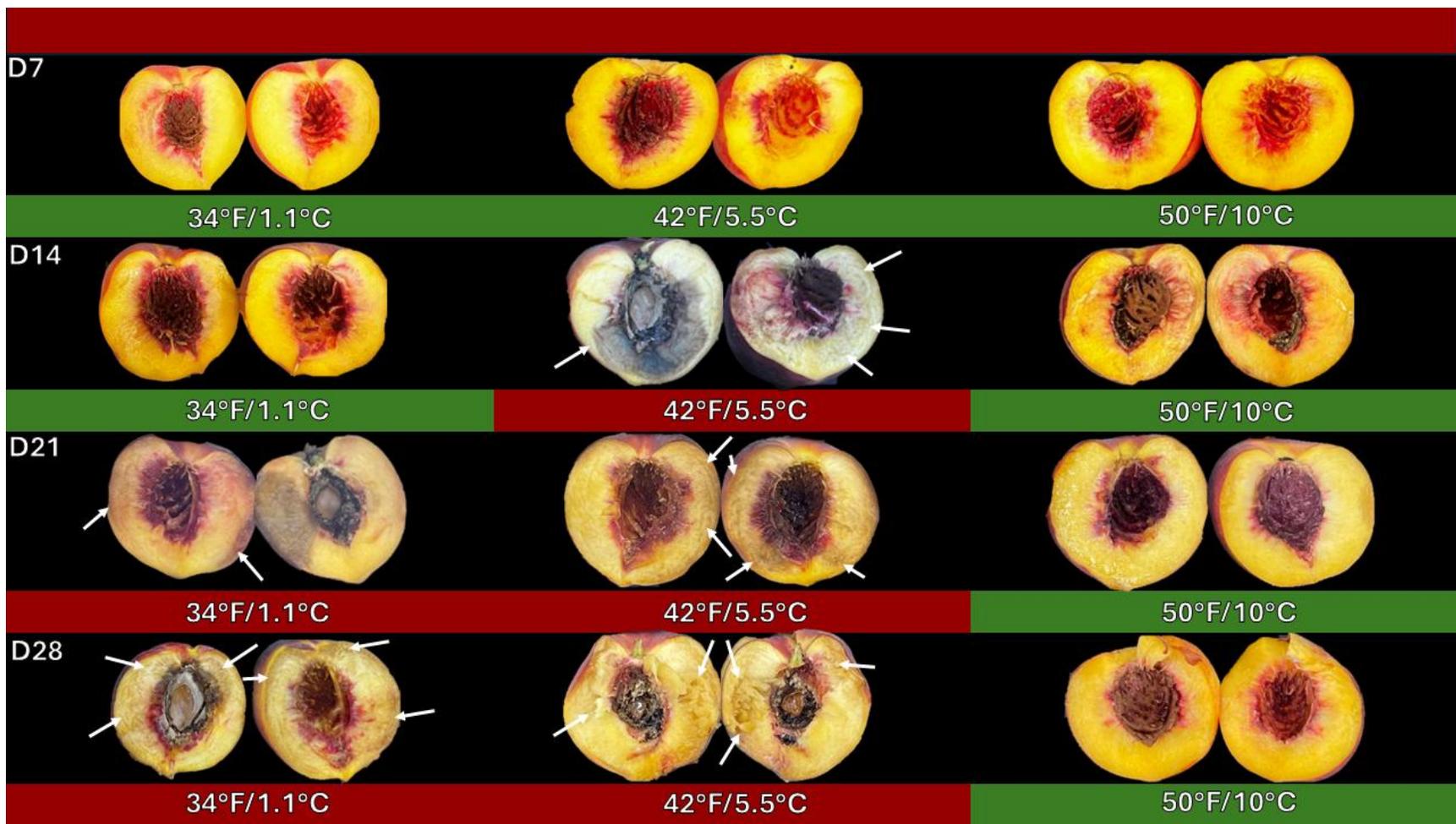
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542 **Figure 4.**

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545

Figure 5.

546 **List of Figure Captions**

547 **Figure 1.** Effects of three different storage temperatures (1.1, 5.5 and 10°C) on Decay Incidence (I), Weight Loss (II), and Chilling
548 Injury (III) of three peach cultivars ‘Blazeprince’ (A), ‘Rich Pride’ (B), and ‘O’Henry’ (C) during 28 days of storage. Data are shown
549 as means \pm standard error (n = 3). Different letters above the bars indicate significant differences among the storage temperatures
550 within each storage day (Tukey’s HSD, $p < 0.05$). ‘ns’ indicates no significant difference.

551 **Figure 2.** Effects of three different storage temperatures (1.1, 5.5 and 10°C) on Firmness (I), Respiration Rate (II), and Total Soluble
552 Solids (TSS) (III) of three peach cultivars ‘Blazeprince’ (A), ‘Rich Pride’ (B), and ‘O’Henry’ (C) during 28 days of storage. Data are
553 shown as means \pm standard error (n = 3). Different letters above the bars indicate significant differences among the storage
554 temperatures within each storage day (Tukey’s HSD, $p < 0.05$). ‘ns’ indicates no significant difference.

555 **Figure 3.** Visual appearance of cut peaches for ‘Blazeprince’ stored at three different storage temperatures (1.1, 5.5, and 10°C) over
556 four storage evaluation points (7, 14, 21, and 28 days). Representative fruits were selected to be shown for each temperature and day.
557 White arrows highlight the areas that have been affected by chilling injury symptoms, including internal breakdown, mealiness or
558 wooliness, lack of juiciness, and bleeding.

559 **Figure 4.** Visual appearance of cut peaches for ‘Rich Pride’ stored at three different storage temperatures (1.1, 5.5, and 10°C) over
560 four storage evaluation points (7, 14, 21, and 28 days). Representative fruits were selected to be shown for each temperature and day.
561 White arrows highlight the areas that have been affected by chilling injury symptoms, including internal breakdown, mealiness or
562 wooliness, lack of juiciness, and bleeding.

563 **Figure 5.** Visual appearance of cut peaches for ‘O’Henry’ stored at three different storage temperatures (1.1, 5.5, and 10°C) over four
564 storage evaluation points (7, 14, 21, and 28 days). Representative fruits were selected to be shown for each temperature and day.
565 White arrows highlight the areas that have been affected by chilling injury symptoms, including internal breakdown, mealiness or
566 wooliness, lack of juiciness, and bleeding.