

# Preharvest application of phenylalanine induces red color in mango and apple fruit's skin

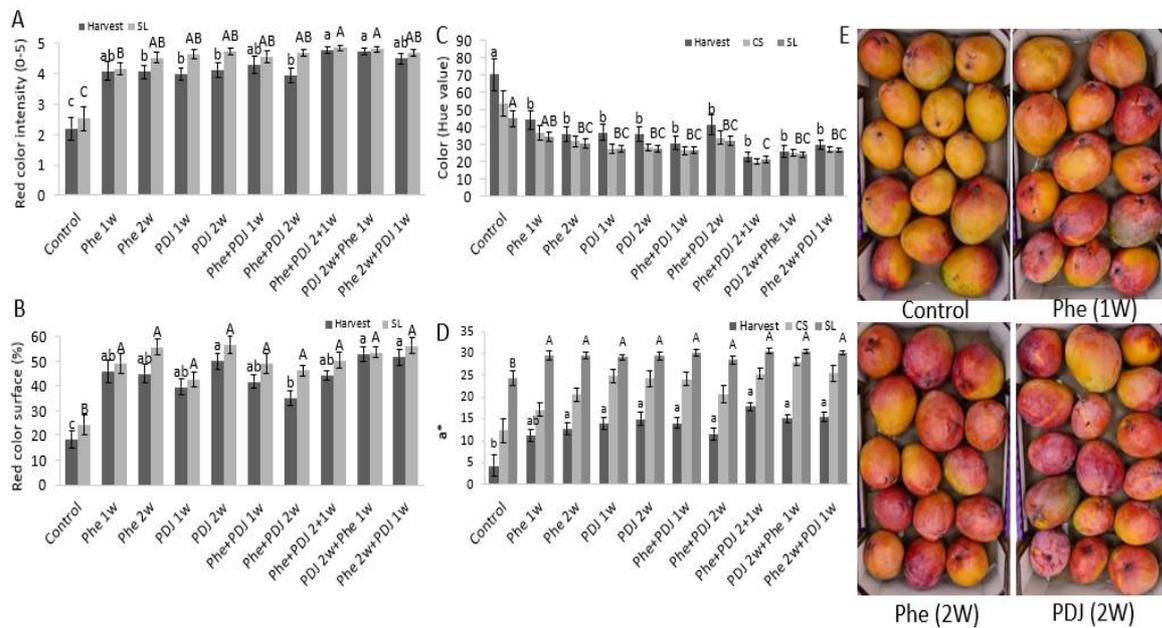
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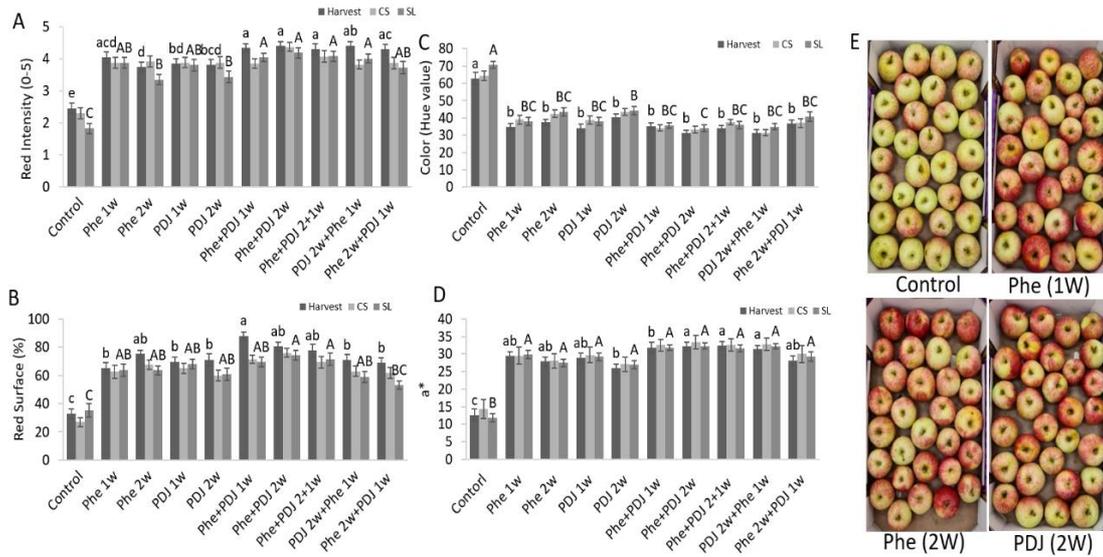
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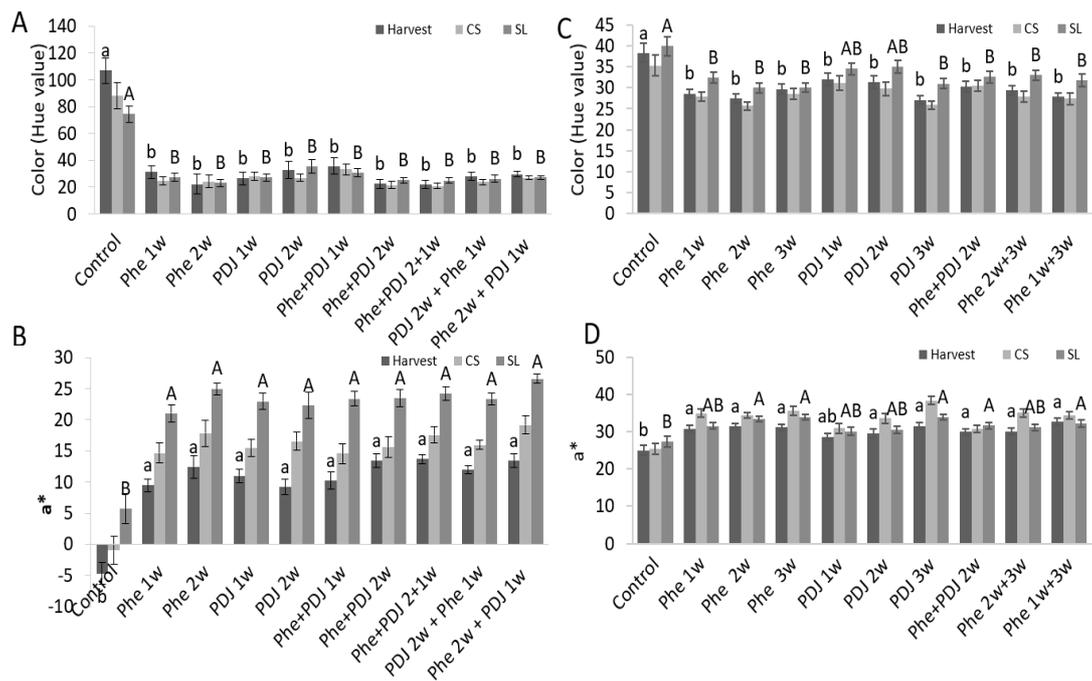
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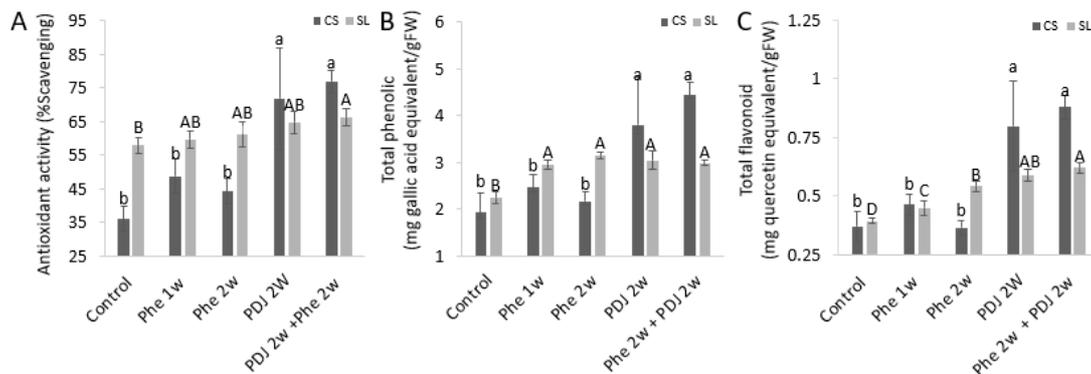
**Figure S1.** Red color evaluation of mango (cv. Shelly) peel. Shelly mango orchards were sprayed with 0.12% phenylalanine (Phe) or 0.2% prohydrojasmon (PDJ), one or two weeks preharvest. Different letters represent a significant difference ( $P \leq 0.05$ ).



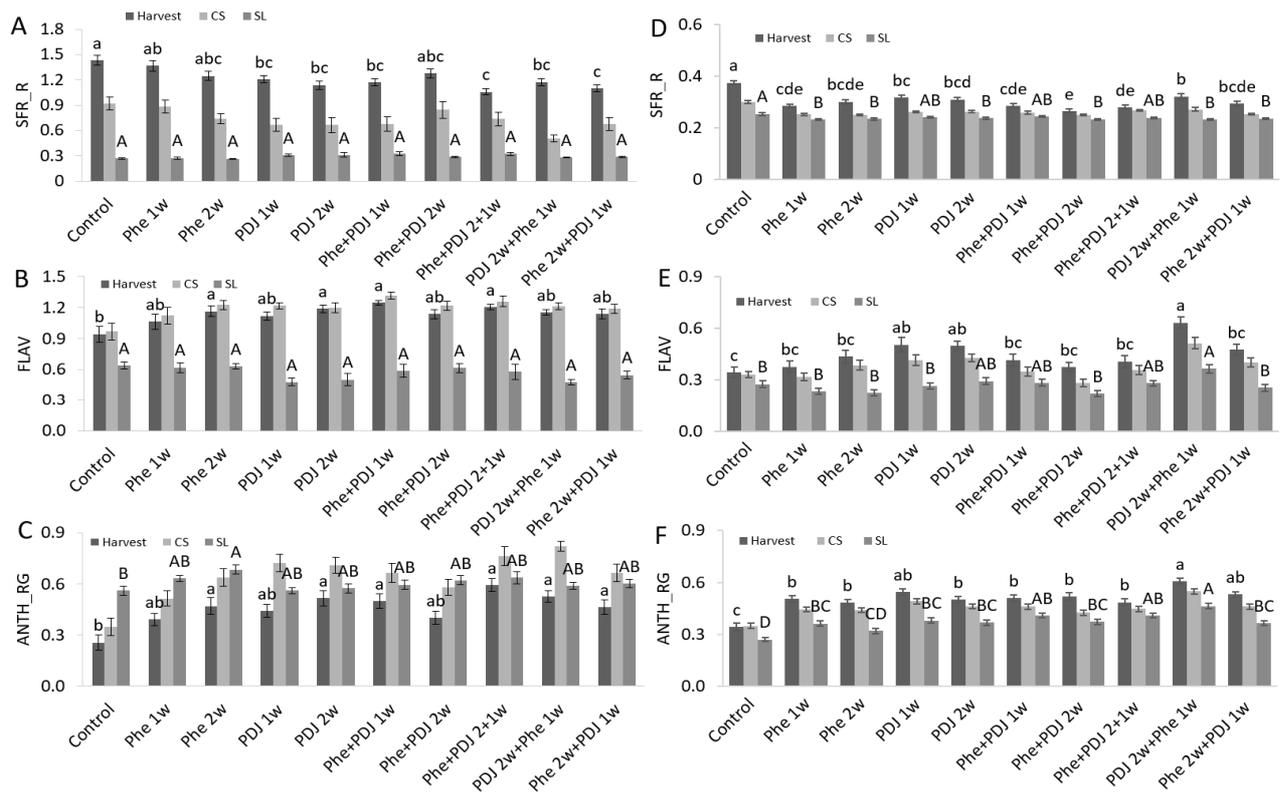
**Figure S2.** Red color evaluation of apple (cv. Gala) peel. The fruit was treated preharvest with spraying of 0.12% Phenylalanine and/or 0.2% prohydrojasmon (PDJ). The fruit was evaluated at 3-time points: at harvest (T0), after cold storage (2 months at 2°C), and shelf life (7 days at 22°C). Different letters represent a significant difference ( $P \leq 0.05$ ).



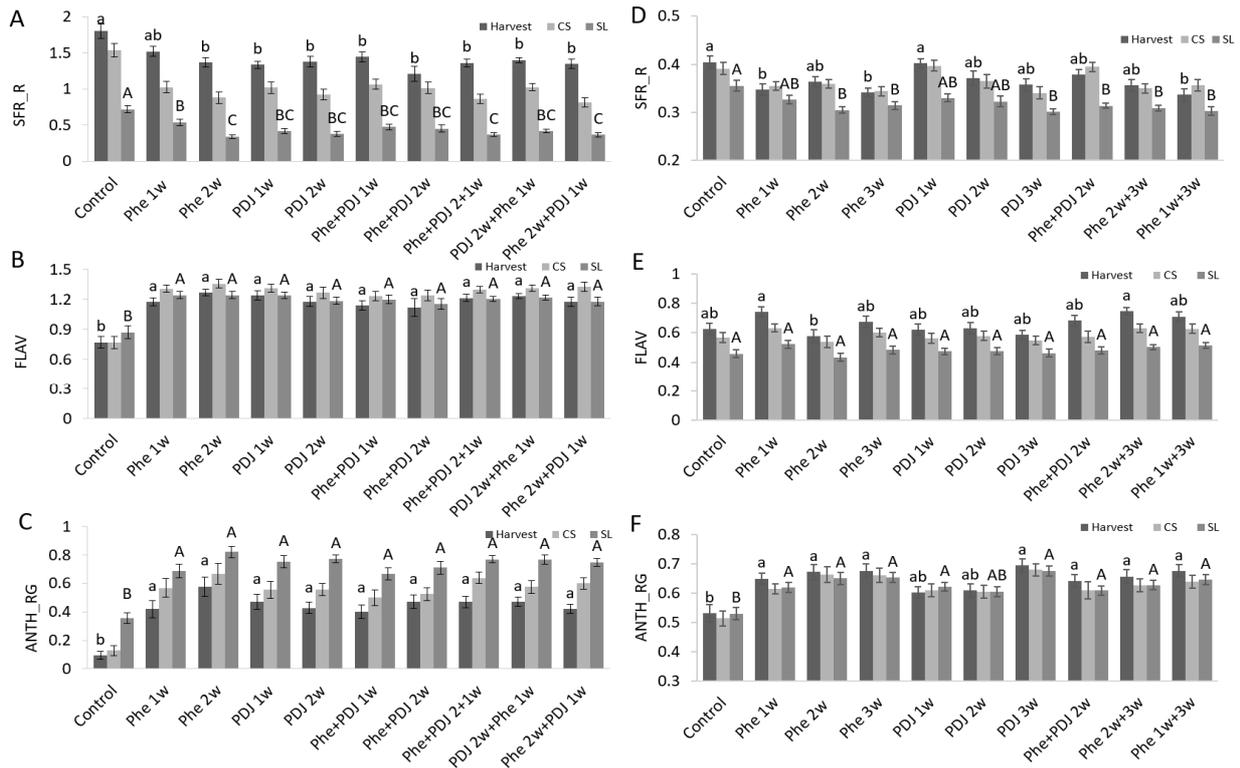
**Figure S3.** Quantification of red color parameters in 'Kent' mango and 'Cripps pink' apples. The fruit was treated preharvest with spraying of 0.12% Phenylalanine and/or 0.2% prohydrojasmon (PDJ). Different letters represent significant differences ( $P \leq 0.05$ ).



**Figure S4.** Effect of one or two weeks preharvest treatment on mango (cv. Shelly) fruit with 0.12% Phenylalanine or 0.2% PDJ after harvest, cold storage (CS), and shelf-life (SL). A. Antioxidant activity, B. Total phenolic and C. Total flavonoid content was evaluated from mango peels (cv. Kent). Different letters represent significant differences ( $P \leq 0.05$ ).

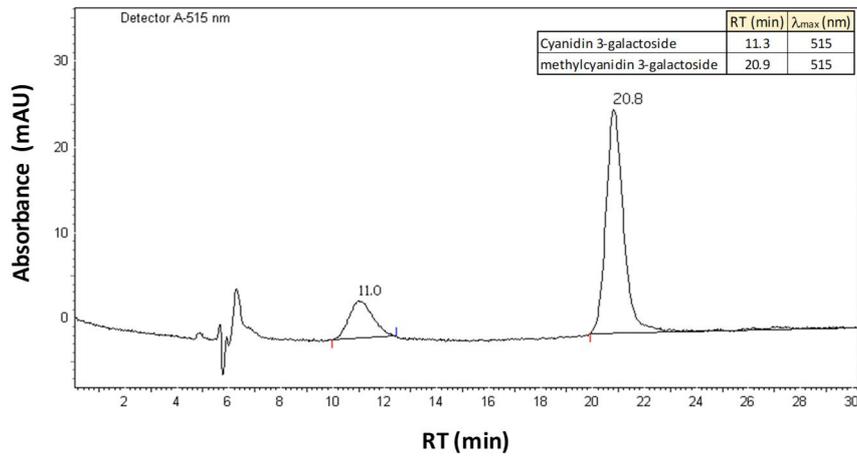


**Figure S5.** Fruit peel fluorescence. ‘Shelly’ mango and ‘Galla’ apple orchards were sprayed with 6mM phenylalanine (Phe) or 0.2% prohydrojasmon (PDJ), one or two weeks preharvest. Fruit peel fluorescence was measured at the reddest point of ‘Shelly’ mango (A-C) and ‘Galla’ apple (D-F) at harvest, after cold storage (CS), and after shelf life (SL). A, D. Chlorophyll (SFR\_R). B, E. Flavonoids (FLAV). C, F. Anthocyanin (ANTH\_RG). Different letters represent a significant difference ( $P \leq 0.05$ ).

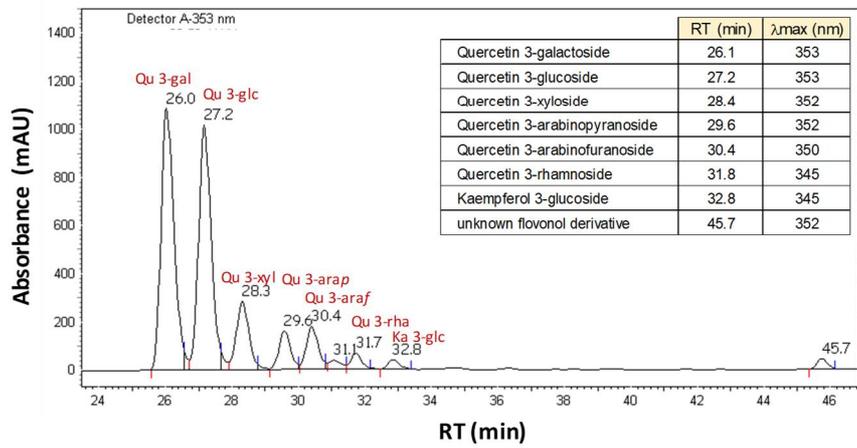


**Figure S6.** Fruit peel fluorescence. 'Kent' mango and 'Cripps pink' apple orchards were sprayed with 6mM phenylalanine (Phe) or 0.2% prohydrojasmon (PDJ), one or two weeks preharvest. Fruit peel fluorescence was measured at the reddest point of 'Kent' mango (A-C) and 'Cripps pink' apple (D-F) at harvest, after cold storage (CS), and after shelf life (SL). A, D. Chlorophyll (SFR\_R). B, E. Flavonoids (FLAV). C, F. Anthocyanin (FER\_RG). Different letters represent statistically significant differences ( $P \leq 0.05$ ).

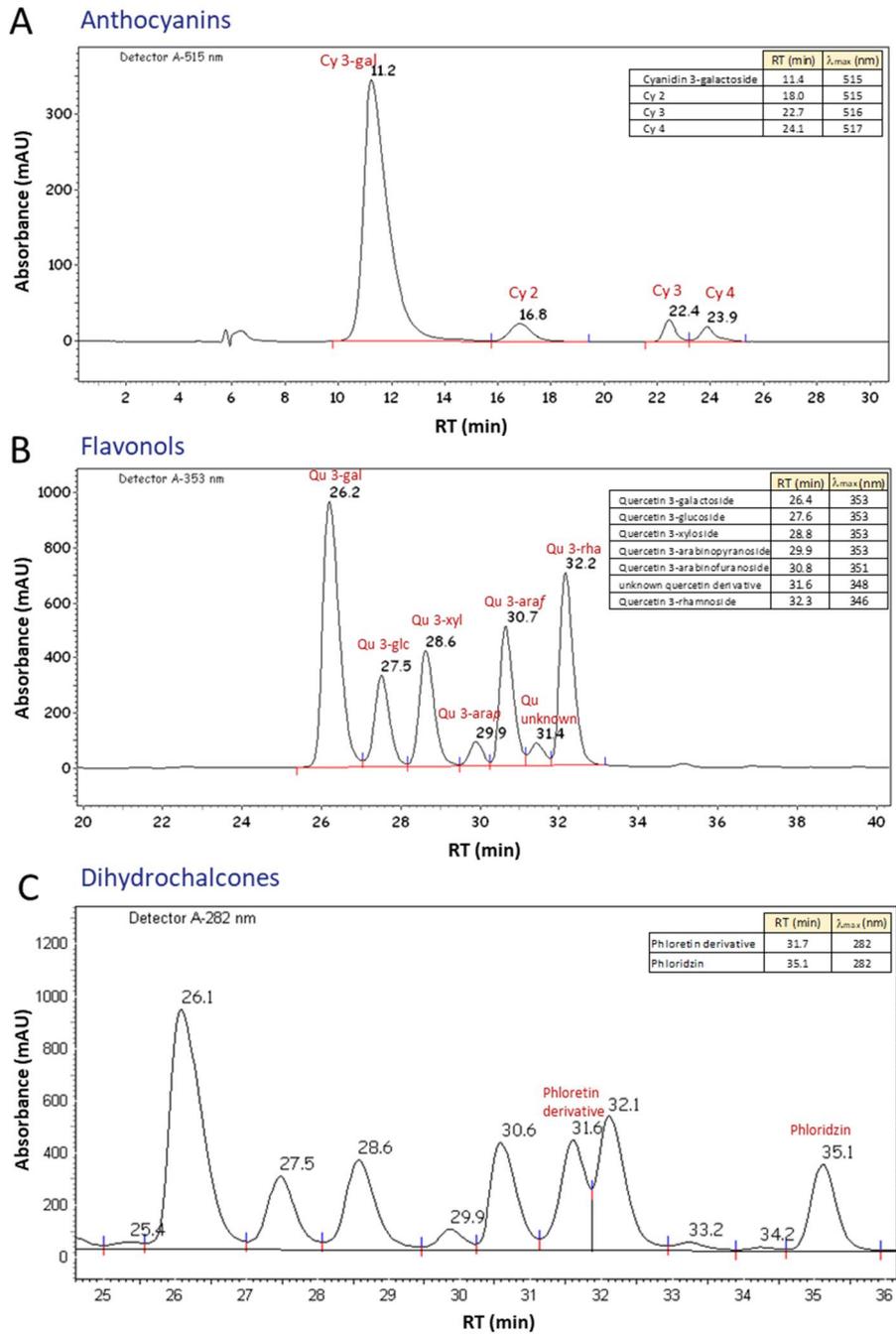
## A Anthocyanins



## B Flavonols



**Figure S7.** Chromatogram of mango (cv. Kent) fruit peel extract using HPLC. (A) Anthocyanins, (B) Flavonols.



**Figure S8.** Chromatogram of apple (cv. Cripps pink) fruit peel extract using HPLC. (A) Anthocyanins, (B) Flavonols, (C) Dihydrochalcones.

**Table S1.** Effect of preharvest application of phenylalanine on the red color of mango (cv. 'Shelly') fruit (2021).

|                       | Red surface (%) |               | Red intensity (index 0-5) |                | Color (hue)   |                 | a' value      |               | SFR_R          |              | FLAV         |              | ANTH_RG       |              |
|-----------------------|-----------------|---------------|---------------------------|----------------|---------------|-----------------|---------------|---------------|----------------|--------------|--------------|--------------|---------------|--------------|
|                       | T0              | SL            | T0                        | SL             | T0            | SL              | T0            | SL            | T0             | SL           | T0           | SL           | T0            | SL           |
| Control               | 34.39 ± 2.73c   | 32.27 ± 2.58b | 2.53 ± 0.16d              | 2.45 ± 0.17d   | 67.29 ± 8.38a | 32.81 ± 2.59a   | 5.54 ± 1.98b  | 33.45 ± 0.92a | 1.13 ± 0.06a   | 0.36 ± 0.06a | 0.85 ± 0.05b | 0.54 ± 0.11a | 0.33 ± 0.04c  | 0.49 ± 0.06a |
| Phe 2w 0.01%          | 35.89 ± 3.6c    | 36.41 ± 3.38b | 2.31 ± 0.24d              | 2.81 ± 0.14d   | 70.50 ± 6.42a | 31.85 ± 2.84ab  | 3.41 ± 1.04b  | 28.14 ± 2.23a | 1.15 ± 0.07a   | 0.34 ± 0.05a | 0.93 ± 0.07b | 0.65 ± 0.12a | 0.30 ± 0.04c  | 0.59 ± 0.07a |
| Phe 2w 0.06%          | 43.28 ± 3.48bc  | 58.75 ± 3.45a | 3.50 ± 0.15c              | 4.33 ± 0.09b   | 17.02 ± 3.37b | 23.47 ± 2.81abc | 18.88 ± 1.48a | 29.60 ± 2.30a | 0.95 ± 0.05abc | 0.33 ± 0.03a | 1.24 ± 0.06a | 0.66 ± 0.13a | 0.70 ± 0.06ab | 0.58 ± 0.07a |
| Phe 2w 0.12%          | 55.57 ± 3.21ab  | 63.17 ± 2.51a | 4.42 ± 0.12a              | 4.80 ± 0.09ac  | 22.63 ± 2.51b | 22.21 ± 3.11abc | 22.95 ± 2.69a | 29.19 ± 1.95a | 0.88 ± 0.05bc  | 0.29 ± 0.01a | 1.25 ± 0.04a | 0.66 ± 0.07a | 0.69 ± 0.03ab | 0.68 ± 0.06a |
| Phe 2w 0.24%          | 58.13 ± 2.63a   | 60.37 ± 2.49a | 4.34 ± 0.13ab             | 4.74 ± 0.11a   | 21.17 ± 3.62b | 20.17 ± 3.22bc  | 23.18 ± 2.02a | 31.70 ± 2.50a | 0.75 ± 0.04c   | 0.27 ± 0.01a | 1.26 ± 0.04a | 0.53 ± 0.07a | 0.75 ± 0.05a  | 0.61 ± 0.06a |
| Flowering + 2w 0.12%  | 57.30 ± 2.14a   | 63.76 ± 2.27a | 4.11 ± 0.13bc             | 4.36 ± 0.08b   | 22.88 ± 4.23b | 19.62 ± 2.24c   | 16.45 ± 1.59a | 28.48 ± 1.71a | 1.06 ± 0.03bc  | 0.31 ± 0.03a | 1.27 ± 0.03a | 0.83 ± 0.09a | 0.64 ± 0.03ab | 0.75 ± 0.04a |
| Flowering (Phe 0.12%) | 55.57 ± 2.05ab  | 60.68 ± 2.20a | 4.11 ± 0.11abc            | 4.74 ± 0.10a   | 21.97 ± 3.43b | 23.24 ± 2.97abc | 17.53 ± 1.37a | 32.11 ± 0.70a | 1.01 ± 0.04ab  | 0.35 ± 0.04a | 1.21 ± 0.05a | 0.57 ± 0.1a  | 0.54 ± 0.05b  | 0.60 ± 0.07a |
| Phe 0.12% 2w+4w       | 57.29 ± 1.74a   | 59.38 ± 1.90a | 4.34 ± 0.17ab             | 4.59 ± 0.24abc | 19.78 ± 3.22b | 25.23 ± 1.80abc | 19.30 ± 1.66a | 31.61 ± 1.10a | 0.88 ± 0.03ab  | 0.28 ± 0.02a | 1.28 ± 0.04a | 0.62 ± 0.13a | 0.60 ± 0.03ab | 0.59 ± 0.08a |

**Table S2.** Effect of preharvest application of phenylalanine on the red color of mango (cv. 'Tommy Atkins') fruit.

|                       | Red surface (%) |               |                | Red intensity (index 0-5) |               |               | Color (hue)    |               | a* value       |                | SFR_R         |              | FLAV          |              | ANTH_RG       |              |
|-----------------------|-----------------|---------------|----------------|---------------------------|---------------|---------------|----------------|---------------|----------------|----------------|---------------|--------------|---------------|--------------|---------------|--------------|
|                       | T0              | CS            | SL             | T0                        | CS            | SL            | T0             | SL            | T0             | SL             | T0            | SL           | T0            | SL           | T0            | SL           |
| Control               | 46.01 ± 1.94b   | 46.14 ± 2.5b  | 47.62 ± 2.18b  | 1.94 ± 0.10d              | 3.36 ± 0.19d  | 3.68 ± 0.12c  | 29.78 ± 12.27a | 25.14 ± 7.03a | 7.01 ± 2.32b   | 18.36 ± 2.26b  | 1.51 ± 0.08a  | 0.65 ± 0.09a | 1.02 ± 0.05b  | 0.82 ± 0.07a | 0.60 ± 0.09b  | 0.69 ± 0.05a |
| Phe 2w 0.06%          | 56.90 ± 2.77a   | 58.26 ± 4.11a | 59.52 ± 3.65a  | 4.48 ± 0.12b              | 4.3 ± 0.15bc  | 4.23 ± 0.17b  | 11.98 ± 2.48a  | 16.55 ± 1.79a | 9.66 ± 1.04ab  | 21.02 ± 1.05ab | 1.41 ± 0.07ab | 0.59 ± 0.08a | 1.12 ± 0.06ab | 0.84 ± 0.06a | 0.70 ± 0.08ab | 0.83 ± 0.03a |
| Phe 2w 0.12%          | 64.86 ± 1.65a   | 63.89 ± 2.93a | 67.069 ± 1.80a | 4.7 ± 0.08ab              | 4.72 ± 0.11a  | 4.79 ± 0.08a  | 4.20 ± 3.14a   | 10.2 ± 1.54a  | 10.31 ± 0.71ab | 21.89 ± 1.51ab | 1.43 ± 0.08ab | 0.46 ± 0.04a | 1.13 ± 0.04ab | 0.63 ± 0.06a | 0.68 ± 0.06ab | 0.78 ± 0.04a |
| Phe 2w 0.24%          | 60.52 ± 2.02a   | 65 ± 2.59a    | 66.43 ± 2.44a  | 4.62 ± 0.09b              | 4.61 ± 0.16ab | 4.52 ± 0.13ab | 10.11 ± 2.56a  | 21.43 ± 3.19a | 8.66 ± 0.70ab  | 21.45 ± 2.29ab | 1.28 ± 0.09ab | 0.62 ± 0.09a | 1.16 ± 0.05ab | 0.91 ± 0.09a | 0.70 ± 0.07ab | 0.73 ± 0.06a |
| Flowering + 2w 0.12%  | 59.66 ± 2.34a   | 58.5 ± 2.74a  | 60.24 ± 2.2a   | 4.59 ± 0.12b              | 4.55 ± 0.14ac | 4.62 ± 0.15ab | 24.34 ± 4.70a  | 19.59 ± 3.1a  | 9.94 ± 1.32ab  | 21.86 ± 2.22ab | 1.37 ± 0.06ab | 0.55 ± 0.14a | 1.17 ± 0.02ab | 0.74 ± 0.08a | 0.71 ± 0.05ab | 0.70 ± 0.04a |
| Flowering (Phe 0.12%) | 59.33 ± 1.45a   | 62.35 ± 2.19a | 55 ± 2.26a     | 4.3 ± 0.09c               | 3.82 ± 0.13d  | 4.68 ± 0.10ab | 11.38 ± 2.08a  | 18.03 ± 1.52a | 13.72 ± 0.85a  | 27.78 ± 1.15a  | 1.28 ± 0.04ab | 0.39 ± 0.02a | 1.24 ± 0.03a  | 0.82 ± 0.07a | 0.76 ± 0.05ab | 0.74 ± 0.04a |
| Phe 0.12% 2w+4w       | 65.44 ± 1.48a   | 61.21 ± 2.07a | 65 ± 2.1a      | 4.84 ± 0.05a              | 4.57 ± 0.1ac  | 4.68 ± 0.08a  | 5.57 ± 4.21a   | 25.34 ± 3.74a | 10.93 ± 0.51ab | 23.52 ± 1.38ab | 1.15 ± 0.08b  | 0.45 ± 0.04a | 1.16 ± 0.03ab | 0.76 ± 0.07a | 0.83 ± 0.07a  | 0.80 ± 0.04a |

**Table S3.** Effect of preharvest application of phenylalanine on the red color of apple (cv. 'Cripps pink') fruit after 3w in CS (2021).

|                  | Red surface (%)  | Red intensity (index 0-5) | Color (hue)      | a* value         | SFR_R         | FLAV           | ANTH_RG       |
|------------------|------------------|---------------------------|------------------|------------------|---------------|----------------|---------------|
| Control          | 50.53 ± 1.38f    | 2.35 ± 0.08f              | 39.64 ± 3.28a    | 25.39 ± 1.86d    | 0.34 ± 0.01a  | 0.35 ± 0.04b   | 0.44 ± 0.03b  |
| Phe 0.01% 6W     | 56.18 ± 1.70ef   | 2.54 ± 0.10ef             | 35.67 ± 2.55abc  | 28.30 ± 1.55cd   | 0.34 ± 0.01a  | 0.50 ± 0.03ab  | 0.51 ± 0.03ab |
| Phe 0.01% 4W     | 58.66 ± 1.55cde  | 2.91 ± 0.09bc             | 32.12 ± 2.20abcd | 30.96 ± 1.47abcd | 0.30 ± 0.01ab | 0.44 ± 0.03 ab | 0.52 ± 0.02ab |
| Phe 0.01% 2W     | 58.38 ± 1.44de   | 2.47 ± 0.09ef             | 36.08 ± 2.27ab   | 27.80 ± 1.52cd   | 0.31 ± 0.01ab | 0.38 ± 0.03ab  | 0.44 ± 0.03b  |
| Phe 6w 0.12%     | 60.40 ± 1.32bcde | 3.07 ± 0.09c              | 27.97 ± 1.75bcd  | 33.16 ± 1.19abc  | 0.32 ± 0.01ab | 0.53 ± 0.03a   | 0.60 ± 0.03a  |
| Phe 4w 0.12%     | 59.66 ± 1.28bcde | 3.01 ± 0.10c              | 32.60 ± 2.96abcd | 31.05 ± 1.89abcd | 0.30 ± 0.01b  | 0.47 ± 0.04ab  | 0.53 ± 0.03ab |
| Phe 2w 0.12%     | 67.78 ± 1.29a    | 3.15 ± 0.08bc             | 24.31 ± 0.95d    | 37.00 ± 0.69a    | 0.28 ± 0.01b  | 0.50 ± 0.04ab  | 0.60 ± 0.03a  |
| Phe 4+6w 0.12%   | 67.91 ± 1.09a    | 3.47 ± 0.07a              | 28.08 ± 1.50bcd  | 34.30 ± 1.11abc  | 0.29 ± 0.01b  | 0.47 ± 0.03ab  | 0.58 ± 0.03a  |
| Phe 2+6w 0.12%   | 65.16 ± 1.40abc  | 3.40 ± 0.09a              | 25.38 ± 2.16cd   | 35.28 ± 1.37ab   | 0.29 ± 0.01b  | 0.53 ± 0.03a   | 0.62 ± 0.03a  |
| Phe 2+4w 0.12%   | 63.59 ± 1.48abcd | 3.38 ± 0.09ab             | 29.87 ± 2.14abcd | 33.19 ± 1.48abc  | 0.30 ± 0.01b  | 0.44 ± 0.03ab  | 0.55 ± 0.02ab |
| Formulation 1 6W | 65.85 ± 1.30ab   | 3.36 ± 0.08ab             | 27.31 ± 1.01bcd  | 36.28 ± 0.87ab   | 0.29 ± 0.01b  | 0.43 ± 0.03ab  | 0.57 ± 0.02ab |
| Formulation 1 4W | 63.27 ± 1.44abcd | 3.14 ± 0.09bc             | 34.17 ± 2.79abcd | 30.08 ± 1.84bcd  | 0.30 ± 0.01ab | 0.46 ± 0.04ab  | 0.53 ± 0.03ab |
| Formulation 1 2W | 63.05 ± 1.06bcd  | 2.72 ± 0.09de             | 30.24 ± 1.32abcd | 32.43 ± 1.17abc  | 0.31 ± 0.01ab | 0.42 ± 0.03ab  | 0.53 ± 0.03ab |

**Table S4.** Effect of preharvest application of phenylalanine on the red color of apple (cv. 'Starking Delicious') fruit.

|                | Red surface (%) | Red intensity (index 0-5) | Color (hue)    | a* value       | SFR_R        | FLAV          | ANTH_RG       |
|----------------|-----------------|---------------------------|----------------|----------------|--------------|---------------|---------------|
| Control        | 33.56 ± 17.16d  | 1.96 ± 1.01d              | 64.31 ± 3.60a  | 10.80 ± 1.50e  | 0.54 ± 0.01a | 0.29 ± 0.05b  | 0.31 ± 0.02c  |
| Phe 4w 0.01%   | 51.60 ± 22.16c  | 2.79 ± 1.15c              | 46.22 ± 3.08bc | 18.56 ± 1.43cd | 0.56 ± 0.01a | 0.41 ± 0.05ab | 0.37 ± 0.03c  |
| Phe 2w 0.01%   | 56.30 ± 23.46c  | 3.06 ± 1.23c              | 49.39 ± 4.86b  | 17.69 ± 2.22cd | 0.54 ± 0.01a | 0.38 ± 0.05ab | 0.39 ± 0.03c  |
| Phe 2+4w 0.01% | 42.16 ± 14.87d  | 2.76 ± 0.76c              | 51.85 ± 3.01b  | 16.26 ± 1.31de | 0.54 ± 0.02a | 0.45 ± 0.06ab | 0.34 ± 0.02c  |
| Phe 4w 0.12%   | 81.62 ± 14.87ab | 4.60 ± 0.57ab             | 34.42 ± 1.72cd | 24.97 ± 0.99ab | 0.54 ± 0.01a | 0.36 ± 0.05ab | 0.54 ± 0.02b  |
| Phe 2w 0.12%   | 77.85 ± 10.93b  | 4.40 ± 0.66b              | 35.25 ± 2.67b  | 22.61 ± 1.16ac | 0.59 ± 0.01a | 0.52 ± 0.05ab | 0.53 ± 0.02b  |
| Phe 2+4w 0.12% | 81.74 ± 10.39ab | 4.70 ± 0.57a              | 29.15 ± 1.23d  | 27.21 ± 0.83ab | 0.53 ± 0.02a | 0.46 ± 0.06ab | 0.61 ± 0.02ab |

**Table S5.** Effect of preharvest application of phenylalanine on the red color of apple (cv. 'Anna') fruit.

|                | Red surface (%) |               | Red intensity (index 0-5) |              | Color (hue)   |               | a* value      |               | SFR_R         |               | FLAV         |              | ANTH_RG      |              |
|----------------|-----------------|---------------|---------------------------|--------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|--------------|--------------|--------------|
|                | T0              | SL            | T0                        | SL           | T0            | SL            | T0            | SL            | T0            | SL            | T0           | SL           | T0           | SL           |
| Control        | 24.09 ± 2.84b   | 31.54 ± 5.33b | 1.70 ± 0.14b              | 2.54 ± 0.28b | 68.38 ± 4.88a | 62.52 ± 4.42a | 7.03 ± 1.69b  | 12.84 ± 1.92b | 0.53 ± 0.01a  | 0.52 ± 0.01a  | 0.81 ± 0.04a | 0.65 ± 0.03a | 0.30 ± 0.04b | 0.37 ± 0.03b |
| Phe 4w 0.12%   | 56.55 ± 2.44a   | 70.75 ± 5.00a | 3.33 ± 0.14a              | 4.05 ± 0.26a | 36.06 ± 3.41b | 35.73 ± 3.31b | 20.10 ± 1.23a | 25.01 ± 0.96a | 0.41 ± 0.02b  | 0.38 ± 0.02c  | 0.76 ± 0.03a | 0.60 ± 0.02a | 0.59 ± 0.04a | 0.54 ± 0.03a |
| Phe 2w 0.12%   | 49.06 ± 2.88a   | 54.78 ± 6.16a | 3.27 ± 0.15a              | 3.70 ± 0.28a | 46.93 ± 5.0b  | 41.85 ± 4.11b | 15.80 ± 1.78a | 20.99 ± 1.51a | 0.47 ± 0.02ab | 0.44 ± 0.01b  | 0.86 ± 0.04a | 0.67 ± 0.03a | 0.46 ± 0.04a | 0.56 ± 0.03a |
| Phe 2+4w 0.12% | 53.40 ± 2.64a   | 64.67 ± 4.47a | 3.54 ± 0.15a              | 3.73 ± 0.25a | 39.66 ± 4.10b | 38.11 ± 2.81b | 17.02 ± 1.45a | 22.41 ± 1.14a | 0.46 ± 0.02b  | 0.43 ± 0.02bc | 0.74 ± 0.03a | 0.58 ± 0.03a | 0.52 ± 0.04a | 0.54 ± 0.03a |

**Table S6.** Effect of preharvest application of phenylalanine decay parameters in mango (cv. Kent, Shelly, and Tommy) fruit.

| Cultivar                    | Treatment             | SER           |                | Side decay      |                | Total rotten fruit |
|-----------------------------|-----------------------|---------------|----------------|-----------------|----------------|--------------------|
|                             |                       | Index         | Decay (%)      | Index           | Decay (%)      | Decay (%)          |
| Mango<br>(cv. Kent), 2020   | Control               | 0.91 ± 0.50a  | 11.62 ± 3.28ab | 0.11 ± 0.03a    | 11.36 ± 2.66ab | 22.98 ± 3.22ab     |
|                             | 1W Phe                | 0.05 ± 0.03a  | 5.41 ± 2.76b   | 1.30 ± 0.72a    | 20.52 ± 3.76a  | 20.52 ± 3.76ab     |
|                             | 2W Phe                | 0.43 ± 0.24a  | 5.81 ± 2.91b   | 0.36 ± 0.28a    | 8.37 ± 0.40ab  | 14.18 ± 3.27b      |
|                             | 1W PDJ                | 0.45 ± 0.09a  | 10.83 ± 2.10   | 0.21 ± 0.21a    | 2.08 ± 2.08b   | 12.92 ± 3.49b      |
|                             | 2W PDJ                | 1.37 ± 0.23a  | 16.74 ± 0.81ab | 1.51 ± 0.21a    | 19.31 ± 1.93a  | 36.05 ± 1.49a      |
|                             | 1W Phe+PDJ            | 0.48 ± 0.24a  | 4.76 ± 2.38ab  | 0.83 ± 0.17a    | 21.43 ± 4.12a  | 23.81 ± 6.3ab      |
|                             | 2W Phe+PDJ            | 0.42 ± 0.24a  | 5.56 ± 2.78b   | 0.28 ± 0.28a    | 2.78 ± 2.78b   | 8.33 ± 4.81b       |
|                             | 2+1W Phe+PDJ          | 0.28 ± 0.25a  | 4.95 ± 2.48b   | 0.58 ± 0.46a    | 14.65 ± 4.14ab | 19.60 ± 2.70ab     |
|                             | 2W PDJ+1W Phe         | 1.82 ± 0.18a  | 19.41 ± 2.01ba | 0.02 ± 0.02a    | 2.38 ± 2.38b   | 21.79 ± 3.81ab     |
| 2W Phe+1W PDJ               | 0.63 ± 0.15a          | 9.73 ± 2.83ab | 0.42 ± 0.19a   | 12.11 ± 2.74ab  | 19.46 ± 5.66ab |                    |
| Mango<br>(cv. Shelly), 2020 | Control               | 0.00 ± 0.00a  | 5.56 ± 0.00b   | 0.06 ± 0.03a    | 0.00 ± 2.94a   | 5.56 ± 2.94a       |
|                             | 1W Phe                | 0.02 ± 0.02a  | 0.00 ± 2.08ab  | 0.00 ± 0.00a    | 2.08 ± 0.00a   | 2.08 ± 2.08a       |
|                             | 2W Phe                | 1.16 ± 0.29a  | 2.56 ± 3.14a   | 0.26 ± 0.26a    | 12.91 ± 2.56a  | 15.47 ± 4.77a      |
|                             | 1W PDJ                | 1.18 ± 0.26a  | 0.00 ± 2.63ab  | 0.00 ± 0.00 a   | 11.79 ± 0.00a  | 11.79 ± 2.63a      |
|                             | 2W PDJ                | 0.99 ± 0.15a  | 0.00 ± 1.55ab  | 0.00 ± 0.00a    | 9.88 ± 0.00a   | 9.88 ± 1.55a       |
|                             | 1W Phe+PDJ            | 0.15 ± 0.15a  | 0.00 ± 3.03ab  | 0.00 ± 0.00a    | 3.03 ± 0.00a   | 3.03 ± 3.03a       |
|                             | 2W Phe+PDJ            | 0.30 ± 0.27a  | 4.95 ± 2.68ab  | 0.14 ± 0.11a    | 5.34 ± 2.48a   | 10.29 ± 2.57a      |
|                             | 2+1W Phe+PDJ          | 0.65 ± 0.34a  | 4.46 ± 2.76a   | 0.33 ± 0.18a    | 12.10 ± 2.25a  | 14.19 ± 3.57a      |
|                             | 2W PDJ+1W Phe         | 0.82 ± 0.13a  | 2.56 ± 1.97ab  | 0.26 ± 0.26a    | 11.49 ± 2.56a  | 14.06 ± 0.84a      |
|                             | 2W Phe+1W PDJ         | 0.22 ± 0.22a  | 8.35 ± 2.22ab  | 0.08 ± 0.02a    | 2.22 ± 2.09a   | 10.57 ± 2.36a      |
| Mango<br>(cv. Shelly), 2021 | Control               | -             | -              | 4.78 ± 0.92ab   | 92.71 ± 4.29a  | -                  |
|                             | Phe 0.01% 2w          | -             | -              | 4.30 ± 0.52ab   | 78.13 ± 8.57ab | -                  |
|                             | Phe 0.06% 2w          | -             | -              | 4.06 ± 0.89ab   | 88.89 ± 5.56ab | -                  |
|                             | Phe 0.12% 2w          | -             | -              | 3.67 ± 1.02ab   | 85.00 ± 7.64ab | -                  |
|                             | Phe 0.24% 2w          | -             | -              | 4.02 ± 0.74a    | 82.50 ± 6.85ab | -                  |
|                             | Phe 0.12% 2+4w        | -             | -              | 1.62 ± 0.25b    | 60.32 ± 3.17b  | -                  |
|                             | Phe 0.12% 2w + flower | -             | -              | 4.54 ± 0.23a    | 92.26 ± 4.49a  | -                  |
| Phe 0.12% flower            | -                     | -             | 4.92 ± 0.92ab  | 81.55 ± 6.76ab  | -              |                    |
| Mango<br>(cv. Tommy), 2021  | Control               | 0.18 ± 0.13a  | 7.16 ± 3.00a   | 0.40 ± 0.07ab   | 34.73 ± 0.13a  | 40.76 ± 5.54a      |
|                             | Phe 0.06% 2W          | 0.00 ± 0.00a  | 0.00 ± 0.00a   | 0.39 ± 0.07b    | 28.81 ± 0.00a  | 28.81 ± 3.14a      |
|                             | Phe 0.12% 2W          | 0.03 ± 0.03a  | 3.13 ± 3.13a   | 0.03 ± 0.03c    | 3.13 ± 0.03a   | 6.25 ± 3.61a       |
|                             | Phe 0.24% 2W          | 0.05 ± 0.04a  | 4.76 ± 4.12a   | 0.15 ± 0.01d    | 15.08 ± 0.04a  | 15.08 ± 0.79a      |
|                             | Phe 0.12% 2+4W        | 0.05 ± 0.05a  | 5.00 ± 5.00a   | 0.16 ± 0.03cd   | 16.18 ± 0.05a  | 18.68 ± 4.60a      |
|                             | Phe 0.12% Flower+ 2W  | 0.00 ± 0.00a  | 0.00 ± 0.00a   | 0.14 ± 0.08abcd | 14.29 ± 0.00a  | 14.29 ± 8.25a      |
| Phe 0.12% Flower            | 0.00 ± 0.00a          | 0.00 ± 0.00a  | 0.18 ± 0.04ad  | 17.86 ± 0.00a   | 17.86 ± 3.57a  |                    |

**Table S7.** Effect of preharvest application of phenylalanine decay parameters in apple (cv. Gala, Cripps pink and Starking Delicious) fruit.

| Cultivar                             | Treatment          | CS            |               | SL            |                |
|--------------------------------------|--------------------|---------------|---------------|---------------|----------------|
|                                      |                    | Index         | Decay (%)     | Index         | Decay (%)      |
| Apple (cv. Gala), 2020               | Control            | 0.40 ± 0.13a  | 14.85 ± 3.72a | 1.33 ± 0.34a  | 26.52 ± 2.05a  |
|                                      | 1W Phe             | 0.37 ± 0.06a  | 8.89 ± 1.92a  | 1.15 ± 0.04a  | 21.34 ± 1.62a  |
|                                      | 2W Phe             | 0.89 ± 0.15a  | 19.28 ± 3.60a | 1.62 ± 0.42a  | 23.79 ± 3.10a  |
|                                      | 1W PDJ             | 0.72 ± 0.09a  | 16.47 ± 3.09a | 1.48 ± 0.16a  | 26.90 ± 2.73a  |
|                                      | 2W PDJ             | 0.80 ± 0.30a  | 14.35 ± 3.88a | 1.83 ± 0.35a  | 24.71 ± 3.84a  |
|                                      | 1W Phe+PDJ         | 1.15 ± 0.33a  | 23.67 ± 5.61a | 2.09 ± 0.52a  | 28.54 ± 9.00a  |
|                                      | 2W Phe+PDJ         | 0.61 ± 0.12a  | 19.08 ± 3.44a | 1.24 ± 0.28a  | 19.18 ± 3.24a  |
|                                      | 2+1W Phe+PDJ       | 1.17 ± 0.14a  | 25.50 ± 7.05a | 2.06 ± 0.10a  | 28.66 ± 1.92a  |
|                                      | 2W PDJ +1W Phe     | 0.65 ± 0.10a  | 14.35 ± 1.25a | 1.24 ± 0.11a  | 23.17 ± 3.56a  |
| 2W Phe +1W PDJ                       | 1.03 ± 0.21a       | 24.55 ± 4.91a | 2.16 ± 0.44a  | 34.68 ± 4.93a |                |
| Apple (cv. Cripps pink), 2020        | Control            | -             | -             | 0.39 ± 0.04a  | 9.49 ± 1.71ab  |
|                                      | Phe 1W             | -             | -             | 0.69 ± 0.26a  | 13.06 ± 1.68ab |
|                                      | Phe 2W             | -             | -             | 0.02 ± 0.01a  | 2.08 ± 1.47c   |
|                                      | Phe 3W             | -             | -             | 0.12 ± 0.09a  | 3.33 ± 1.67bc  |
|                                      | PDJ 1W             | -             | -             | 0.22 ± 0.01a  | 5.51 ± 1.23abc |
|                                      | PDJ 2W             | -             | -             | 0.17 ± 0.05a  | 5.02 ± 0.43bc  |
|                                      | PDJ 3W             | -             | -             | 0.15 ± 0.05a  | 5.18 ± 1.42bc  |
|                                      | Phe+PDJ 2W         | -             | -             | 0.36 ± 0.06a  | 6.53 ± 1.18abc |
|                                      | Phe 2W+3W          | -             | -             | 0.27 ± 0.10a  | 6.79 ± 0.93abc |
|                                      | Phe 1W+3W          | -             | -             | 0.44 ± 0.08a  | 8.67 ± 0.86abc |
| Apple (cv. Starking Delicious), 2021 | Control            | -             | -             | 0.71 ± 0.20a  | 15.42 ± 4.7a   |
|                                      | Phe 2w 0.12%       | -             | -             | 0.52 ± 0.06a  | 8.36 ± 0.9a    |
|                                      | Phe 4w 0.12%       | -             | -             | 0.77 ± 0.23a  | 16.52 ± 2.23a  |
|                                      | Phe 2+4w 0.12%     | -             | -             | 0.86 ± 0.02a  | 10.87 ± 0.67a  |
|                                      | Phe 2w 0.01%       | -             | -             | 1.72 ± 1.25a  | 23.70 ± 15.19a |
|                                      | Phe 4w 0.01%       | -             | -             | 1.57 ± 1.36a  | 19.85 ± 14.30a |
|                                      | Phe 2+4w 0.01%     | -             | -             | 1.20 ± 0.36a  | 13.60 ± 5.15a  |
|                                      | Formulation 2 2+4W | -             | -             | 0.70 ± 0.45a  | 10.48 ± 2.64a  |
|                                      | Formulation 1 2+4W | -             | -             | 1.44 ± 0.06a  | 17.95 ± 1.28a  |
|                                      | Formulation 3 2+4W | -             | -             | 0.58 ± 0.48a  | 8.19 ± 5.02a   |