

Table S1. Chemical attributes in the 0-0.20 and 0.20-0.40 m soil depths in apple orchards (A and B), before the installation of the experiments.

| Orchard | Cultivar | Soil depth | Clay | pH | P | K | OM | Al | Ca | Mg | Ca/Mg |
|---------|------------|------------|--------------------|------------------|--------------------|--------------------|----|-----------------------|------|-----|-------|
| | | m | g kg ⁻¹ | H ₂ O | mg dm ³ | g kg ⁻¹ | | cmolc dm ³ | | | |
| A | Royal Gala | 0-0.20 | 710 | 7.1 | 40.0 | 143 | 45 | 0 | 10.7 | 2.8 | 3.9 |
| | R. Gala | 0.20-0.40 | 770 | 5.9 | 15.8 | 117 | 42 | 0 | 7.6 | 2.5 | 3.0 |
| | F. Suprema | 0-0.20 | 720 | 6.8 | 36.5 | 161 | 43 | 0 | 9.9 | 2.7 | 3.7 |
| | F. Suprema | 0.20-0.40 | 770 | 5.7 | 8.5 | 111 | 37 | 0 | 6.6 | 2.2 | 2.9 |
| B | R. Gala | 0-0.20 | 820 | 6.1 | 26.3 | 209 | 48 | 0 | 8.4 | 3.3 | 2.8 |
| | R. Gala | 0.20-0.40 | 850 | 5.9 | 8.5 | 118 | 47 | 0 | 6.6 | 3.0 | 2.3 |
| | F. Suprema | 0-0.20 | 820 | 6.5 | 13.3 | 165 | 43 | 0 | 8.1 | 3.0 | 2.8 |
| | F. Suprema | 0.20-0.40 | 820 | 6.3 | 6.5 | 65 | 41 | 0 | 8.2 | 2.0 | 4.2 |

OM: organic matter.

Table S2. Nutrient concentration in leaves and pulp of 'Fuji Suprema' and 'Royal Gala' apple trees cultivated in two orchards and subjected to nitrogen fertilization for four years.

| Nutrients in leaves | | | | | | | | | | |
|---------------------|------------|--------------------|------|-------|-------|---------------------|--------|--------|--------|-------|
| Orchard | Cultivar | N | P | K | Ca | Mg | Fe | Mn | Zn | B |
| | | g kg ⁻¹ | | | | mg kg ⁻¹ | | | | |
| A | F. Suprema | 26.40 | 1.66 | 13.04 | 11.27 | 2.33 | 210.17 | 199.52 | 39.75 | 28.71 |
| | R. Gala | 27.29 | 1.43 | 14.74 | 10.53 | 2.77 | 201.57 | 344.95 | 56.32 | 30.27 |
| B | F. Suprema | 29.16 | 1.59 | 14.13 | 13.68 | 2.30 | 84.85 | 315.71 | 66.63 | 34.35 |
| | R. Gala | 27.25 | 1.60 | 15.02 | 14.42 | 3.68 | 169.02 | 425.92 | 159.12 | 33.46 |

| Nutrients in pulp | | | | | | | | | | |
|-------------------|------------|---------------------|--------|---------|-------|-------|------|-------|---------|--|
| Orchard | Cultivar | N | P | K | Ca | Mg | N/Ca | K/Ca | K+Mg/Ca | |
| | | mg kg ⁻¹ | | | | | | | | |
| A | F. Suprema | 395.49 | 107.63 | 1122.30 | 41.29 | 42.73 | 9.74 | 25.58 | 28.62 | |
| | R. Gala | 365.02 | 111.98 | 1039.96 | 48.11 | 52.20 | 7.68 | 23.37 | 24.46 | |
| B | F. Suprema | 391.12 | 120.10 | 1231.38 | 45.30 | 45.68 | 9.02 | 27.84 | 28.86 | |
| | R. Gala | 355.18 | 111.97 | 1045.66 | 55.85 | 51.38 | 6.65 | 19.32 | 20.29 | |

Table S3. Trunk diameter of 'Fuji Suprema' and 'Royal Gala' apple trees cultivated in two orchards (A and B) and submitted to nitrogen fertilization for four seasons.

| Orchard | Cultivar | Crop season | Trunk Diameter ± sd (cm) |
|---------|------------|-------------|--------------------------|
| A | F. Suprema | 1 | 12.93 ± 0.67 |
| | | 2 | 14.32 ± 0.73 |
| | | 3 | 17.14 ± 0.91 |
| | | 4 | 18.64 ± 1.08 |
| | | Average | 15.76 ± 2.41 |
| | R. Gala | 1 | 11.61 ± 0.90 |
| | | 2 | 12.26 ± 1.06 |
| | | 3 | 14.01 ± 1.31 |
| | | 4 | 14.73 ± 1.66 |
| | | Average | 13.15 ± 1.78 |

| | | | |
|---|------------|---------|------------------|
| | | 1 | 13.82 ± 0.69 |
| | F. Suprema | 2 | 15.94 ± 0.80 |
| | | 3 | 19.12 ± 1.18 |
| | | 4 | 20.40 ± 0.87 |
| B | | Average | 17.32 ± 2.76 |
| | | 1 | 15.61 ± 1.01 |
| | R. Gala | 2 | 16.22 ± 1.11 |
| | | 3 | 18.16 ± 1.26 |
| | | 4 | 18.93 ± 1.20 |
| | | Average | 17.23 ± 1.77 |