

**Table S1.** The DOP index and  $\Sigma$ DOP determined from leaf macro and micro-nutrition concentration of studied grafted-pear rootstocks grown under different soil types in four studied years (2015, 2016, 2017 and 2018)

| Σ DOP             | 2728.60 <sup>a</sup> |      |      | 2433.03 <sup>b</sup> |      |      | 2029.01 <sup>a</sup> |      |                      | 3071.38 <sup>a</sup> |                      |                | 2629.45 <sup>a</sup> |      |      | 2369.64 <sup>a</sup> |      |      |      |    |                      |                      |                      |                    |      |      |                |    |    |      |      |      |                      |                      |                      |                      |      |      |      |      |    |      |  |      |                      |                      |                      |                |  |  |      |      |      |                    |      |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |    |      |  |  |                      |                      |                      |                |  |  |     |    |    |      |  |  |                      |                      |                      |                |  |  |    |   |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |    |     |      |  |  |                      |                      |                      |                |  |  |     |    |    |      |  |  |                      |                      |                      |                |  |  |    |     |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |    |   |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |   |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |   |     |     |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |    |     |      |  |  |                      |                      |                      |                |  |  |   |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |    |     |    |      |  |  |                      |                      |                      |                |  |  |    |    |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |    |     |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |   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|-------------------|----------------------|------|------|----------------------|------|------|----------------------|------|----------------------|----------------------|----------------------|----------------|----------------------|------|------|----------------------|------|------|------|----|----------------------|----------------------|----------------------|--------------------|------|------|----------------|----|----|------|------|------|----------------------|----------------------|----------------------|----------------------|------|------|------|------|----|------|--|------|----------------------|----------------------|----------------------|----------------|--|--|------|------|------|--------------------|------|--|----------------------|----------------------|----------------------|----------------|--|--|----|----|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|----|----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|----|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|----|---|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|----|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|----|-----|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|----|---|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|----|----|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|----|----|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|---|----|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|---|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|----|----|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|----|----|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|----|----|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|---|----|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|----------------------|----------------------|----------------------|----------------|--|--|-----|-----|-----|------|--|--|---------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|                   | 2018                 | 2017 | 2016 | 2018                 | 2017 | 2016 | 2018                 | 2017 | 2016                 | 2018                 | 2017                 | 2016           | 2018                 | 2017 | 2016 | 2018                 | 2017 | 2016 |      |    |                      |                      |                      |                    |      |      |                |    |    |      |      |      |                      |                      |                      |                      |      |      |      |      |    |      |  |      |                      |                      |                      |                |  |  |      |      |      |                    |      |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |     |      |  |  |                      |  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    |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |   |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |   |     |     |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |    |     |      |  |  |                      |                      |                      |                |  |  |   |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |    |     |    |      |  |  |                      |                      |                      |                |  |  |    |    |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |    |     |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |
|                   | 2015                 | 2015 | 2015 | 2015                 | 2015 | 2015 | 2015                 | 2015 | 2015                 | 2015                 | 2015                 | 2015           | 2015                 | 2015 | 2015 | 2015                 | 2015 | 2015 |      |    |                      |                      |                      |                    |      |      |                |    |    |      |      |      |                      |                      |                      |                      |      |      |      |      |    |      |  |      |                      |                      |                      |                |  |  |      |      |      |                    |      |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |    |      |  |  |                      |                      |                      |                |  |  |     |    |    |      |  |  |                      |                      |                      |                |  |  |    |   |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |    |     |      |  |  |                      |                      |                      |                |  |  |     |    |    |      |  |  |                      |                      |                      |                |  |  |    |     |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |    |   |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |   |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |   |     |     |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |    |     |      |  |  |                      |                      |                      |                |  |  |   |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |    |     |    |      |  |  |                      |                      |                      |                |  |  |    |    |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |    |     |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |
| Zn                |                      |      | 2015 | 2016                 | 2017 | Fe   |                      |      | 2015                 | 2016                 | 2017                 | 2018           | B                    |      |      | 2015                 | 2016 | 2017 | 2018 | Mg |                      |                      | 2015                 | 2016               | 2017 | 2018 | Ca             |    |    | 2015 | 2016 | 2017 | 2018                 | K                    |                      |                      | 2015 | 2016 | 2017 | 2018 | P  |      |  | 2015 | 2016                 | 2017                 | 2018                 | N              |  |  | 2015 | 2016 | 2017 | 2018               | Soil |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |    |      |  |  |                      |                      |                      |                |  |  |     |    |    |      |  |  |                      |                      |                      |                |  |  |    |   |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |    |     |      |  |  |                      |                      |                      |                |  |  |     |    |    |      |  |  |                      |                      |                      |                |  |  |    |     |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |    |   |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |   |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |   |     |     |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |    |     |      |  |  |                      |                      |                      |                |  |  |   |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |              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          |                      |                |  |  |    |     |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |            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   |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |
| Daregazi*seedling |                      |      | A    | B                    | C    | Mean |                      |      | 3014.83 <sup>b</sup> |                      |                      |                |                      |      |      |                      |      |      |      |    |                      |                      |                      |                    |      |      | Daregazi*OHF69 |    |    | A    | B    | C    | Mean                 |                      |                      | 2396.95 <sup>c</sup> |      |      |      |      |    |      |  |      |                      |                      |                      |                |  |  |      |      |      | Daregazi*pyrodwarf |      |  | A                    | B                    | C                    | Mean           |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |    |      |  |  |                      |                      |                      |                |  |  |     |    |    |      |  |  |                      |                      |                      |                |  |  |    |   |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |    |     |      |  |  |                      |                      |                      |                |  |  |     |    |    |      |  |  |                      |                      |                      |                |  |  |    |     |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |    |   |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |   |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |   |     |     |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |    |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |    |     |      |  |  |                      |                      |                      |                |  |  |   |    |    |      |  |  |                      |                      |                      |                |  |  |     |     |    |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |                      |                      |                |  |  |    |     |    |      |  |  |                      |                      |                      |                |  |  |    |    |     |      |  |  |                      |                      |                      |                |  |  |     |     |     |      |  |  |                      |            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    |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |                      |                      |                      |                |  |  |   |   |   |      |  |  |
| Daregazi*seedling |                      |      | 50   | 47                   | 45   | Mean |                      |      | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |                      |      | 75   | 67                   | 45   | Mean |      |    | 3071.38 <sup>a</sup> | 2629.45 <sup>a</sup> | 2369.64 <sup>a</sup> | Daregazi*pyrodwarf |      |      | 18             | 16 | 15 | Mean |      |      | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69       |      |      | 53   | 52   | 50 | Mean |  |      | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 27   | 25   | 18   | Mean               |      |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 68 | 71 | 81 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 27 | -7 | -13 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 133 | 127 | 109 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 168 | 242 | 130 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 198 | 176 | 180 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -41 | -28 | 12 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -30 | 12 | 22 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -7 | 3 | 59 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 250 | 175 | 155 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 210 | 30 | 125 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 128 | -5 | 70 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 45 | -40 | 15 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -63 | -73 | -77 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -57 | -83 | -38 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 15 | 5 | 28 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 86 | 94 | 93 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 57 | 14 | -1 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -34 | -28 | -29 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -43 | -38 | -35 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 7 | 17 | 23 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -44 | -45 | -36 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 6 | -14 | -57 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 32 | -6 | 14 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 90 | 89 | 92 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 17 | 29 | 34 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -56 | -31 | -24 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -67 | -80 | -73 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 205 | 180 | 85 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 368 | 188 | 130 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 530 | 200 | 175 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 230 | 85 | 175 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 0 | -5 | 47 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -13 | -22 | -2 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -26 | -39 | -50 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -32 | -24 | -28 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 151 | 145 | 189 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 185 | 214 | 248 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 219 | 283 | 307 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 134 | 119 | 127 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -33 | -44 | -45 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -7 | -25 | 34 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 20 | -7 | 113 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 440 | 673 | 560 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | 91 | 113 | 82 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -1 | 44 | 22 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -94 | -25 | -38 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | -20 | -50 | -34 | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  | 2728.60 <sup>a</sup> | 2433.03 <sup>b</sup> | 2029.01 <sup>a</sup> | Daregazi*OHF69 |  |  | A | B | C | Mean |  |  |

|                        |               |               |                     |               |              |                         |               |               |                           |               |              |
|------------------------|---------------|---------------|---------------------|---------------|--------------|-------------------------|---------------|---------------|---------------------------|---------------|--------------|
| 3043.<br>452.7<br>10.1 | 2383.<br>70.1 | 2467.<br>70.2 | 2441.4<br>7.1       | 2928.<br>0.01 | 2971.<br>6.6 | 2121.<br>17.1           | 2509.<br>10.1 | 2618.<br>10.2 | 4175.7<br>6.2             | 3142.<br>76.6 | 2600.68<br>1 |
| 108                    | 44            | 78            | 68                  | 82            | 70           | 67                      | 80            | 80            | 113                       | 62            | 52           |
| 38                     | 37            | 27            | 50                  | 87            | 40           | 20                      | 45            | 56            | 88                        | 59            | 53           |
| -31                    | 31            | -24           | 32                  | 92            | 10           | -26                     | 11            | 31            | 64                        | 57            | 53           |
| 7                      | 26            | 46            | 10                  | -43           | -38          | 42                      | 82            | 122           | -17                       | -26           | -32          |
| 11                     | -10           | 69            | 0                   | 34            | 39           | 16                      | 52            | -20           | 13                        | 47            | 98           |
| -41                    | -52           | -13           | -47                 | -29           | -27          | -39                     | -20           | -60           | -40                       | -23           | 3            |
| -25                    | -41           | -44           | -37                 | -30           | -34          | -25                     | -22           | -33           | -28                       | -33           | -33          |
| -20                    | -6            | 8             | 33                  | -17           | -20          | 27                      | -1            | -29           | -54                       | -58           | -62          |
| 86                     | 97            | 91            | 94                  | 83            | 87           | 91                      | 81            | 80            | 87                        | 82            | 106          |
| 37                     | 52            | 41            | 41                  | 31            | 44           | 16                      | 33            | 22            | 48                        | 42            | 53           |
| -12                    | 7             | -10           | -13                 | -20           | 0            | -60                     | -14           | -35           | 8                         | 3             | 0            |
| -50                    | -47           | -45           | -70                 | -6            | -37          | -60                     | -74           | -88           | -91                       | -92           | -93          |
| -30                    | 15            | 40            | 110                 | 60            | 105          | 15                      | 130           | 150           | 5                         | 0             | 85           |
| 98                     | 98            | 33            | 140                 | 215           | 208          | 10                      | 193           | 183           | 150                       | 140           | 175          |
| 225                    | 180           | 25            | 170                 | 370           | 310          | 5                       | 255           | 215           | 295                       | 280           | 265          |
| 345                    | 355           | 345           | 230                 | 410           | 130          | 380                     | 395           | 410           | 245                       | 215           | 190          |
| 39                     | -18           | -24           | 2                   | 27            | -5           | 21                      | -11           | -15           | 21                        | 2             | -24          |
| -10                    | -30           | -49           | -19                 | -8            | -32          | 5                       | -24           | -23           | -8                        | -19           | -32          |
| -58                    | -43           | -74           | -40                 | -43           | -58          | -10                     | -38           | -30           | -37                       | -40           | -39          |
| 32                     | -9            | -52           | -62                 | -38           | -43          | -46                     | -32           | -18           | -80                       | -82           | -83          |
| 172                    | 163           | 180           | 144                 | 144           | 183          | 136                     | 153           | 151           | 163                       | 127           | 180          |
| 181                    | 164           | 164           | 157                 | 126           | 195          | 191                     | 146           | 160           | 163                       | 141           | 162          |
| 189                    | 166           | 148           | 169                 | 110           | 208          | 246                     | 139           | 170           | 164                       | 156           | 143          |
| 168                    | 226           | 284           | 152                 | 71            | 193          | 241                     | 116           | -9            | -85                       | -86           | -87          |
| -47                    | -27           | -31           | -45                 | -46           | -53          | -27                     | -40           | -41           | -37                       | -33           | -47          |
| 13                     | -27           | -16           | -19                 | -26           | -27          | -3                      | -20           | 3             | -29                       | -20           | -33          |
| 73                     | -27           | 0             | 7                   | -7            | 0            | 20                      | 0             | 47            | -20                       | -7            | -20          |
| 740                    | 313           | 453           | 373                 | 600           | 620          | 213                     | 227           | 240           | 1813                      | 1007          | 227          |
| 65                     | 35            | -9            | 42                  | 41            | 44           | 28                      | 27            | 14            | 81                        | 75            | 51           |
| 20                     | 13            | -14           | 3                   | 17            | -14          | 6                       | 5             | -10           | 31                        | 26            | 14           |
| -25                    | -9            | -18           | -35                 | -7            | -71          | -15                     | -17           | -33           | -20                       | -23           | -23          |
| 47                     | 16            | -15           | -27                 | -8            | 26           | -13                     | -27           | -42           | -78                       | -81           | -83          |
| A                      | B             | C             | A                   | B             | C            | A                       | B             | C             | A                         | B             | C            |
| Louise Bonne *seedling |               |               | Louise Bonne *OHF69 |               |              | Louise Bonne *pyrodwarf |               |               | William Duchesse*Seedling |               |              |
| Mean                   |               |               | Mean                |               |              | Mean                    |               |               | Mean                      |               |              |
| 2631.50b               |               |               | 2780.6c             |               |              | 2416.17c                |               |               | 3306.23a                  |               |              |

|                            |          |     |     |          |  |  |          |  |  |
|----------------------------|----------|-----|-----|----------|--|--|----------|--|--|
| William uchesse            | 2707.26b |     |     | 2766.68a |  |  | 2308.98d |  |  |
|                            | 63       | 76  | 75  |          |  |  |          |  |  |
|                            | 37       | 49  | 49  |          |  |  |          |  |  |
|                            | 11       | 21  | 23  |          |  |  |          |  |  |
|                            | -17      | -17 | -17 |          |  |  |          |  |  |
|                            | -30      | -29 | -25 |          |  |  |          |  |  |
|                            | -62      | -61 | -59 |          |  |  |          |  |  |
|                            | -31      | -29 | -25 |          |  |  |          |  |  |
|                            | 142      | 170 | 198 |          |  |  |          |  |  |
|                            | 10       | 0   | -1  |          |  |  |          |  |  |
|                            | 9        | -33 | -29 |          |  |  |          |  |  |
|                            | 9        | -67 | -57 |          |  |  |          |  |  |
|                            | -80      | -74 | -69 |          |  |  |          |  |  |
|                            | 170      | 180 | 105 |          |  |  |          |  |  |
|                            | 165      | 183 | 83  |          |  |  |          |  |  |
|                            | 160      | 185 | 60  |          |  |  |          |  |  |
|                            | 450      | 195 | -55 |          |  |  |          |  |  |
|                            | -15      | -41 | -36 |          |  |  |          |  |  |
|                            | -25      | -44 | -36 |          |  |  |          |  |  |
|                            | -34      | -48 | -37 |          |  |  |          |  |  |
|                            | -43      | -39 | -34 |          |  |  |          |  |  |
|                            | 168      | 163 | 133 |          |  |  |          |  |  |
|                            | 174      | 172 | 132 |          |  |  |          |  |  |
|                            | 180      | 180 | 130 |          |  |  |          |  |  |
|                            | 176      | 218 | 261 |          |  |  |          |  |  |
|                            | 40       | 27  | 20  |          |  |  |          |  |  |
|                            | 50       | 20  | 7   |          |  |  |          |  |  |
|                            | 60       | 13  | -7  |          |  |  |          |  |  |
|                            | 227      | 360 | 507 |          |  |  |          |  |  |
|                            | 11       | 2   | -1  |          |  |  |          |  |  |
|                            | -7       | -15 | -13 |          |  |  |          |  |  |
|                            | -25      | -31 | -25 |          |  |  |          |  |  |
|                            | -28      | -25 | -3  |          |  |  |          |  |  |
|                            | A        | B   | C   |          |  |  |          |  |  |
| Mean                       |          |     |     |          |  |  |          |  |  |
| 2594.13c                   |          |     |     |          |  |  |          |  |  |
| William Duchesse*pyrodwarf | 3665.86a |     |     | 2851.25b |  |  | 1838.17d |  |  |
|                            | 62       | 65  | 90  |          |  |  |          |  |  |
|                            | 25       | 24  | 39  |          |  |  |          |  |  |
|                            | -12      | -17 | -11 |          |  |  |          |  |  |
|                            | -30      | -54 | 94  |          |  |  |          |  |  |
|                            | -13      | -12 | 51  |          |  |  |          |  |  |
|                            | -51      | -51 | -20 |          |  |  |          |  |  |
|                            | 19       | 8   | -11 |          |  |  |          |  |  |
|                            | 40       | 33  | -65 |          |  |  |          |  |  |
|                            | 93       | 80  | 74  |          |  |  |          |  |  |
|                            | 49       | 38  | 34  |          |  |  |          |  |  |
|                            | 5        | -5  | -6  |          |  |  |          |  |  |
|                            | -95      | -95 | -95 |          |  |  |          |  |  |
|                            | 155      | 90  | 15  |          |  |  |          |  |  |
|                            | 63       | 45  | 73  |          |  |  |          |  |  |
|                            | -30      | 0   | 130 |          |  |  |          |  |  |
|                            | -94      | -99 | -40 |          |  |  |          |  |  |
|                            | 16       | 18  | 21  |          |  |  |          |  |  |
|                            | -1       | -2  | -3  |          |  |  |          |  |  |
|                            | -18      | -21 | -26 |          |  |  |          |  |  |
|                            | 72       | 23  | -26 |          |  |  |          |  |  |
|                            | 209      | 183 | 180 |          |  |  |          |  |  |
|                            | 188      | 166 | 143 |          |  |  |          |  |  |
|                            | 168      | 148 | 107 |          |  |  |          |  |  |
|                            | 168      | 168 | -69 |          |  |  |          |  |  |
|                            | -40      | -43 | -43 |          |  |  |          |  |  |
|                            | 263      | 199 | -32 |          |  |  |          |  |  |
|                            | 567      | 440 | -20 |          |  |  |          |  |  |
|                            | 893      | 587 | 247 |          |  |  |          |  |  |
|                            | 42       | 36  | 31  |          |  |  |          |  |  |
|                            | 39       | 32  | 17  |          |  |  |          |  |  |
|                            | 37       | 27  | 4   |          |  |  |          |  |  |
|                            | 111      | 45  | -22 |          |  |  |          |  |  |
|                            | A        | B   | C   |          |  |  |          |  |  |
| Mean                       |          |     |     |          |  |  |          |  |  |
| 2785.09c                   |          |     |     |          |  |  |          |  |  |

\*\*For soil types A, B and C see section ‘materials and methods’; leaf composition standards for apple based on mid-shoot leaves sampled at 90 DAFB (Bergmann, 1991); sign (–) indicates deficiency level, while sign (+) indicates excessive level; the different small and capital letter in latest column indicate significant differences among  $\Sigma$ DOP indexes within each fertilizer and each cultivar ( $p \leq 0.05$  by LSD test), respectively.