

Possibility of sugar beet yield increase by earlier drilling in Belgium

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Summary

Since 2011, when weather conditions allow it, IRBAB conducts sugar beet trials with different drilling dates (2 or 3 dates) combined with different harvesting dates (2 or 3 dates). Different growth periods are thus obtained. They generally range between 150 and 250 growth days. Due to global warming and the variety improvement, 250 growth days are currently the maximum that can be achieved in Belgium in practice (drilling on March 10th and harvesting on November 15th). Based on four year trials, the evolution of the sugar yield according to the growing period increases linearly.

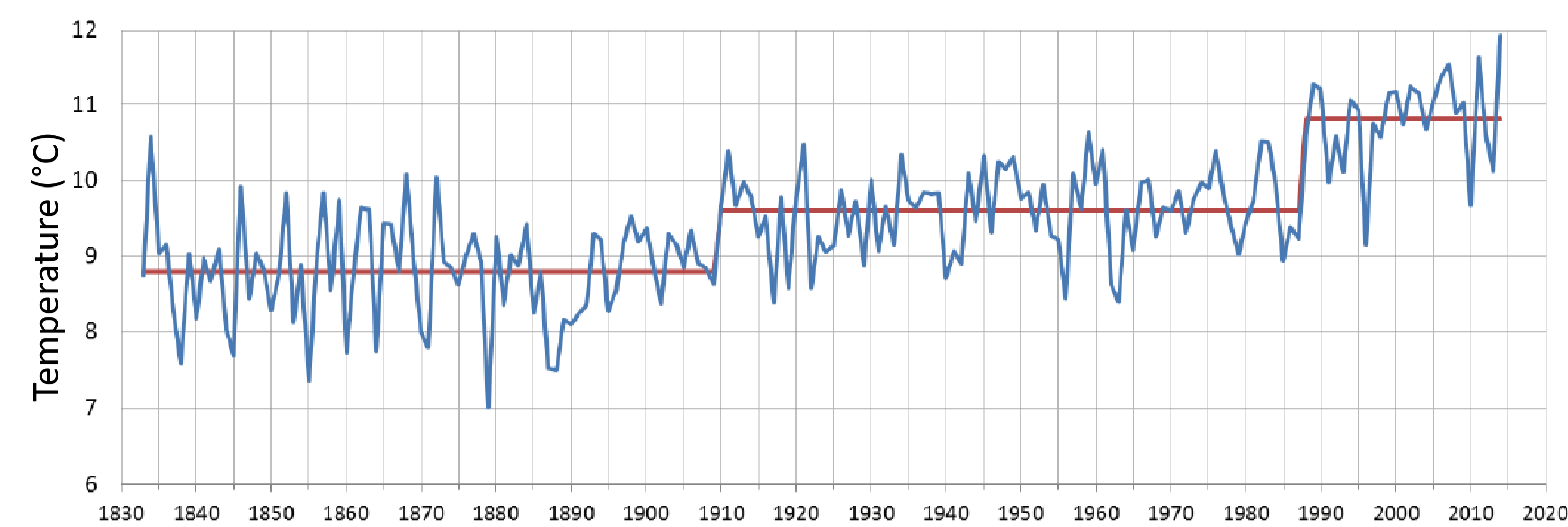


Figure 1. Evolution of the average yearly temperature in Belgium, from 1833 until 2014 (IRM, Brussels)

Legend:

From ±1830, the average annual temperature in Belgium was ±9°C. Since then, it increased with +1°C on average by ±1910 and again with +1°C by ±1990. The average yearly temperature is now > 11 °C.

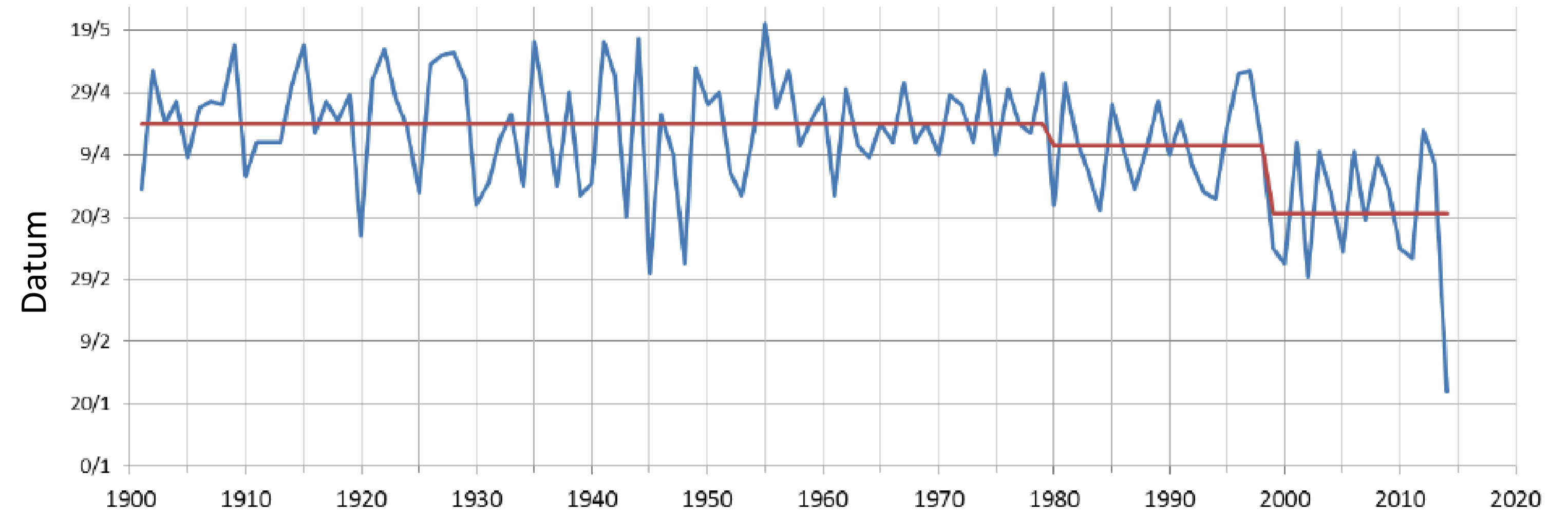


Figure 2. Evolution of the last day of frost in Belgium, from 1833 until 2014 (IRM, Brussels)

Legend:

From ±1830 until ±1980, the last day of frost was ± April 15th, until ±2000 it was ± April 10th, until ±2013 it was ± March 20th. In 2015, the last frost day was on the 3rd of March.

Material & Methods

Trials were conducted in 2011, 2012, 2014 and 2015, with 3 varieties (one NZ, one NE and one N), at common seed spacing (split-plot design with 4 replications). Combinations between different (early or not) drilling dates and (early or not) harvesting dates give different numbers of growth days.

| Site | Drilling date | Harvesting date | Growth days | Sugar yield kg/ha |
|---------------|---------------|-----------------|-------------|-------------------|
| Lens St Rémy | 11/03 | 06/09 | 179 | 15 879 |
| 2011 | 11/03 | 04/10 | 207 | 18 880 |
| | 11/03 | 29/10 | 232 | 20 108 |
| | 27/03 | 06/09 | 163 | 14 922 |
| | 27/03 | 04/10 | 191 | 18 542 |
| | 27/03 | 29/10 | 216 | 19 499 |
| | 07/04 | 06/09 | 152 | 14 175 |
| | 07/04 | 04/10 | 180 | 15 790 |
| 07/04 | 29/10 | 205 | 17 444 | |
| Merdorp 2012 | 16/03 | 21/09 | 189 | 16 334 |
| | 16/03 | 09/11 | 238 | 19 678 |
| | 06/04 | 21/09 | 168 | 14 435 |
| Merdorp 2014 | 06/04 | 09/11 | 217 | 17 838 |
| | 10/03 | 15/09 | 189 | 17 547 |
| | 10/03 | 16/10 | 220 | 19 743 |
| | 26/03 | 15/09 | 173 | 16 667 |
| | 26/03 | 16/10 | 204 | 18 703 |
| Vechmaal 2015 | 11/04 | 15/09 | 157 | 14 386 |
| | 11/04 | 16/10 | 188 | 15 796 |
| | 14/03 | 21/09 | 191 | 17 899 |
| | 14/03 | 21/10 | 221 | 19 321 |
| | 14/03 | 06/11 | 237 | 20 989 |
| | 10/04 | 21/09 | 164 | 15 740 |
| 10/04 | 21/10 | 194 | 17 445 | |
| 10/04 | 06/11 | 210 | 18 466 | |

| Year | Bolters / ha (average 3 varieties) | | |
|------|--|--|---|
| | Drilling period | | |
| | March 10 th -20 th | March 20 th -30 th | April 1 st -10 th |
| 2011 | 0 | 0 | 0 |
| 2012 | 0 | - | 0 |
| 2014 | 18 | 18 | 27 |
| 2015 | 407 | - | 0 |

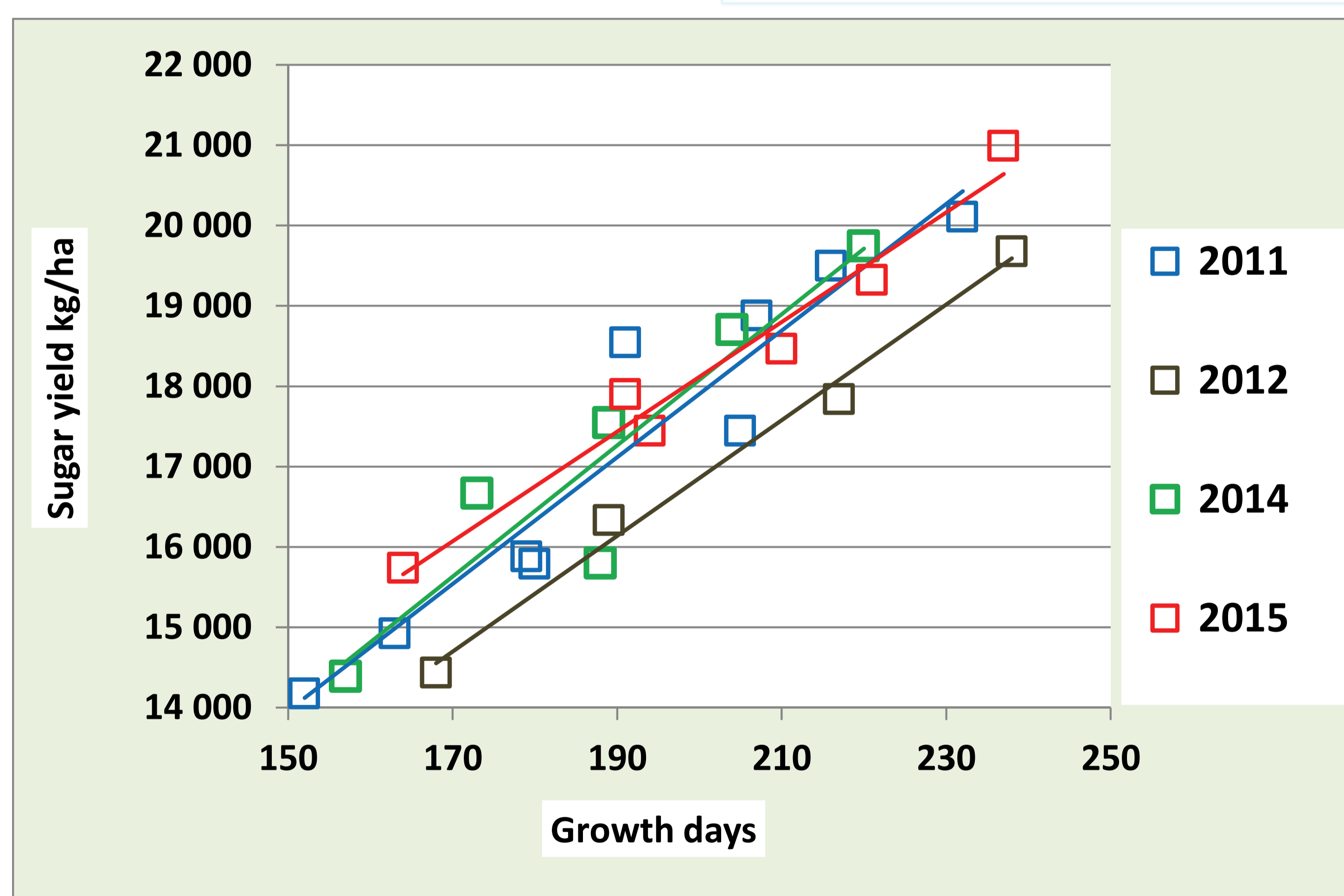


Figure 3. Evolution of sugar yield in relation to the number of growth days for the four trial years.

| Analysis of variance (GLM) 4 year trials 2011-2015 | | | | | | | | |
|--|------------|-----------|--------|--------|--------|--------|----------|-------------|
| P value | Root yield | Soil tare | S% | K | Na | aN | Extract. | Sugar yield |
| Drilling date | <.0001 | 0,0508 | 0,6029 | 0,0011 | 0,7783 | 0,5437 | 0,1263 | <.0001 |
| Harvesting date | <.0001 | <.0001 | <.0001 | <.0001 | 0,0202 | 0,1343 | 0,0008 | <.0001 |
| Harvesting*Drilling Date | 0,0908 | 0,1803 | 0,6598 | 0,3707 | 0,8114 | 0,6431 | 0,4944 | 0,0595 |

Current weather conditions allow earlier drilling of sugar beets

Results 2011, 2012, 2014, 2015

- Root yield, sugar yield, financial yield are significantly influenced by drilling date and harvesting date (growth period).
- Sugar content, extractability are significantly influenced by harvesting date only.
- For the four trial years, the evolution of sugar yield is linearly correlated with the growth days, even for late harvesting.
- Based on a yield potential of 100% at 250 growth days, this linear regression allows to calculate the relative sugar yield loss, for different combinations of drilling and harvesting dates.

| Drilling date | Harvesting date | Growth days | Sugar yield |
|---------------|-----------------|-------------|-------------|
| dd/mm | dd/mm | | |
| 10/03 | 15/11 | 250 | 100 |
| 10/03 | 31/10 | 235 | -5% |
| 25/03 | 15/11 | 235 | -5% |
| 10/03 | 16/10 | 220 | -10% |
| 25/03 | 31/10 | 220 | -10% |
| 09/04 | 15/11 | 220 | -10% |
| 10/03 | 01/10 | 205 | -15% |
| 25/03 | 16/10 | 205 | -15% |
| 09/04 | 31/10 | 205 | -15% |
| 24/04 | 15/11 | 205 | -15% |
| 10/03 | 16/09 | 190 | -21% |
| 25/03 | 01/10 | 190 | -21% |
| 09/04 | 16/10 | 190 | -21% |
| 24/04 | 31/10 | 190 | -21% |
| 10/03 | 01/09 | 175 | -26% |
| 25/03 | 16/09 | 175 | -26% |
| 09/04 | 01/10 | 175 | -26% |
| 24/04 | 16/10 | 175 | -26% |
| 25/03 | 01/09 | 160 | -31% |
| 09/04 | 16/09 | 160 | -31% |
| 24/04 | 01/10 | 160 | -31% |
| 09/04 | 01/09 | 145 | -36% |
| 24/04 | 16/09 | 145 | -36% |
| 24/04 | 01/09 | 130 | -41% |

Relation between the sugar yield (Y) and the number of growth days (X)

$$Y = 73,613 * X + 3065,1$$

| | Drilling date | Harvesting date | | | | | |
|--------------------|---------------|-----------------|--------|--------|--------|--------|----------|
| | | 01/09 | 16/09 | 01/10 | 16/10 | 31/10 | 15/11 |
| A | 10/03 | -5.1 | -4.1 | -3.1 | -2.1 | -1.0 | 20t S/ha |
| B | 25/03 | -6.2 | -5.1 | -4.1 | -3.1 | -2.1 | -1.0 |
| C | 09/04 | -7.2 | -6.2 | -5.1 | -4.1 | -3.1 | -2.1 |
| D | 24/04 | -8.2 | -7.2 | -6.2 | -5.1 | -4.1 | -3.1 |
| A - C = +30 days = | | + 2,06 | + 2,06 | + 2,06 | + 2,06 | + 2,06 | t Sha |

Conclusions

- Advancing the drilling date by 30 days (March 10th instead of April 9th) can increase the sugar yield with +2,06 tons/ha (for a yield potential of 20 tons/ha, see table right).
- Sugar beet fields drilled early and which have a good phytosanitary status should be kept for late harvesting.
- Early drilling guarantees a high production potential. It may allow earlier beet deliveries with sufficient root and sugar yield. Earlier field release is normally better for the following crop and for having good harvesting conditions.
- Earlier harvesting and deliveries limit the storage losses after New Year, which is beneficial to the beet-sugar sector.