BYC Report 2020/21

The BYC provides a unique opportunity to put commercial crops under the microscope in order to monitor their performance against that predicted by the UK sugar beet growth model. A massive vote of thanks is due to you and all the other BYC growers who allowed their crops to be followed in such a challenging year.

Unfortunately, it is a truism that often it is in the face of adversity that we learn the most, leading to us identifying some interesting trends in the 2020 data. However, interactions between the different factors such as dry soil conditions, virus yellows and foliar disease have made it an especially complicated task to analyse data. Crops tended to be in one of two groups: either performing well where there was a low incidence of virus yellows or poorly where the incidence of virus yellows was higher. To a degree, it was a season of extremes and we should be mindful that many of the average values reported mask this wide range.

Thanks also go the BBRO BYC team of Conor Perry, Georgina Barratt, Francesca Broom and Toby Townsend (now ADAS). Thanks also are due to the BYC Steering team for their invaluable guidance.

Hope you find this of interest.

Simon Bowen

Some key facts and figures from the 2020 BYC crops:

- **Overall Yields –** the average drilling & emergence dates were 28th March and 14th April . Nine crops were harvested before the end of October and 11 after January 2021. BYC crops returned an average yield of 74.3t/ha (15.9% sugar content) but the range was 48-102t/ha**.**
- **Predicted yields-** based on the model, the estimated average potential yield was only 98.5t/ha. This was 21t/ha lower than average potential yield of the three previous BYC seasons, highlighting the impact of the weather alone in 2020 (dry spring, summer drought, dull and wet autumn).
- **Actual yields as a percentage of their potential -** these ranged from 45-100% with an average of 75%.
- **Virus and yield –** 46% of crop had a virus yellows incidence >30%. The average yield difference between these and those with less virus incidence was 20.9t/ha (25.1%).
- **Plant populations -** were lower (average 89,000 plants/ha) than previous seasons. Data clearly showed that higher plant populations were associated with better yields and a lower incidence of virus yellows symptoms. Crops with a plant population above the optimum of 100,000 plants/ha yielded on average 24% higher than other crops.
- **Soil types** - 53% of the 2020 BYC fields were sandy loams, 40% were clay or silt loams and 7% were organic soil types. The average yield of the two main soil types were broadly similar (sands/sandy loams 75.8t/ha, clays & silts 71.8t/ha). Plant populations were slightly lower on clay-based soil types.

- **Canopy cover –** canopies were slow to develop in the dry spring conditions with only an average of 76% crop cover at the end of June and in most cases less than the predicted canopy cover and the target of 100%. The average canopy cover pre-harvest was 65%
- **Use of organic manure** - 19 (67%) of the BYC crops in 2020 received organic manure. Seven of these also had an overwinter cover crop. The average plant population in crops which received organic manures was 94,368 plants/ha. This was 14% higher than crops where no organic manure was applied. The average plant population of crops where both organic manure and a cover crops were used was 100,280 plants/ha. June crop cover was 11% higher and yield increased by 32% on average. 15% of crops where organic manures were applied had >30% incidence of virus yellows compared to 77% of crops where no organic manure was applied.
- **Irrigation** – 7 (25%) of the BYC crops were irrigated in 2020. This was more than usual in the BYC. Most irrigated crops had 2-3 applications in the spring and the early summer, providing an average of 50-60 mm in total. The average effect of irrigation was to increase established plant population by 4%, canopy cover by 14% and yield by 12%. Only 2 of the 7 irrigated crops had a virus yellows incidence of >30%.
- **Variety effects** - there were 13 different varieties grown across the 28 crops, so it was not possible to analyse varietal performance.
- **Autumn yield production-** the model (in the absence of virus yellows and foliar disease) indicated that there was limited opportunity for crops to increase yield in the autumn due to the wet and overcast weather. The growth model estimated this as only an additional 14t/ha potential yield between the end of October and end of campaign. The actual yield increase achieved was 10t/ha.
- **Foliar disease -** Moderate or severe foliar disease was recorded in 42% of the BYC crops. From pre-harvest photos, cercospora appeared to be the main foliar disease present. On average 2 spray fungicide programmes were used but appeared not to be very effective. The difference between crops with high and low level of cercospora and foliar disease was less than expected (-6%).
- **Virus yellow & foliar disease -** of the crops which had moderate or high levels of foliar disease, 70% also had virus yellows infections covering more than 30% of the crop. . The average yield of these crops was 61.6t/ha compared to 73.5t/ha in crops with lower virus incidence and moderate/severe foliar disease levels.

Virus yellows and cercospora symptoms (left) and poor late season canopy growth (right)

The table below shows the performance of the BYC crops in 2020 average and compares this with the previous three BYC years.

BYC year	Plant population '000/ha	Canopy cover (end of June) % crop cover	Yield Adjusted t/ha	Sugar content %	Potential yield *adjusted t/ha* (% achieved in brackets)
2017	99,800	92	96.5	17.4	130 (74%)
2018	100,500	86	90.1	17.3	120 (75%)
2019	98,000	90	90.0	17.0	108 (83%)
2020 average	89,000	76	74.3	15.9	98 (76%)*
					* Range 45-100%
2020 Finalists	95,500	93	100.1	15.9	(100%)
	102,000	41	83.3	16.9	(96%)
	65,800	85	87.4	15.8	(86%)
	83,000	89	62.5	14.9	(62%)

Commentary

Does better plant population and uniformity within field result in lower virus yellows incidence?

The data indicates that higher plant populations were associated with lower virus yellows incidence and higher yields. This effect was most pronounced when comparing crops with <80,000 plant/ha with those with >100,000 plant/ha. Plant population was measured in the late spring, so this was not due to plants dying as the season progressed. Our assessment of fields with lower plant populations typically showed fields to be very variable and patchy rather than fewer plants uniformly across the field. This is highlighted by two 2020 BYC fields below. Poorer areas of plant population tended to be associated with different soil types/more cloddy seedbeds and soil compaction.

Previous research has shown that lower plant populations are linked to a higher incidence of virus yellows (Heathcote, 1974) and aphids are known to be more attracted to visual contrast, especially between green crop and soil (Doring, 2014) Virus transmission has also been shown to be greater around gaps and patches (Davis *et al*, 2009) In 2020, aphids migrated into crops in March/April when crops were just emerging and the difference between areas of high and low populations were most visible.

Whilst, seedbed cultivation was very challenging in the dry conditions of 2020, it reinforces this as one of the key areas of improvement. Better seedbeds will result in improved plant populations and

uniformity across the field, and this will have clear benefit. We should also consider being more flexible in our choice of seed rate, possibly using a higher rate when the forecast is for an early aphid migration and/or using variable rate drilling approach to address high moisture deficits area of field (different soil types).

Improved crop performance following use of organics manure and irrigation.

Whilst the BYC is not a rigorous test of cause & effect and other factors may be involved, the use of organic manure and irrigation improved plant populations and earlier canopy development. The associated lower virus incidence may in part be due to the improved and more uniform plant populations and making crops less visible to aphids as well supporting faster canopy growth in June and disguising earlier symptoms. Previous BYC results have also strongly associated the use of organic manures with improved soil resilience to stress. This will be in part due to better moisture retention in the soil but also possibly with improved plant vigour and health. The large yield increase of 19.7t/ha where organic manures/cover crops were used, compared to the smaller yield response of 9t/ha with irrigation, indicates that the response is not down to better water availability alone.

Did a high incidence of virus yellows increase the incidence and severity of foliar diseases such as cercospora?

The 2020 data indicates an interaction between virus yellows and foliar disease, with increased susceptibility to foliar disease and more moderate & severe symptoms associated with a higher incidence of virus yellows. Cercospora symptoms were very evident and progressive from about mid-late August onwards, resulting in rapid leaf senescence and foliage turning brown in October. It is possible that it was easier for Cercospora to infect and develop on virus-infected plants. The data indicated the effect of foliar disease on yield *per se* was not as significant as expected. This may be explained that the infected plants were already yield constrained significantly by the virus yellows symptoms and there was little additive yield reduction although visually the effect was drastic. Whilst crops with lower virus levels may be less likely to develop more severe foliage disease, it should not be assumed that non-virus crops will not be affected.

Autumn growth potential

The data shows that the autumn weather did not provide the opportunity for much yield improvement in 2020. Unlike previous BYC seasons when this has been shown to be worth an additional 30-40% of yield, this was only 15% in 2020. The importance of maintaining a healthy and vigorously growing canopy is key to unlocking autumn yield potential. It is interesting to speculate that if 2020 autumn had been drier with more sunshine how crops either with or without higher levels of virus would have responded? Autumn regrowth of canopies was observed in some BYC crops infected with virus yellows and cercospora symptoms although after a period, virus symptom did begin to develop in the regrowth.

This is the first season where cercospora has been this prevalent in the UK. Whilst warm temperatures and high humidity encouraged the epidemic, a high incidence of virus yellows may also be a risk factor and this need to be considered. All foliar diseases need to be controlled at an early stage to ensure crops benefit from autumn growth potential. The BYC reinforces the need for a modified approach to foliar disease control. This should involve a more risk-based approach to fungicide choice, timings, rates & number of sprays. BBRO will be providing a new cercospora-risk warning system in 2021.