

Beet growers take up the challenge

“There’s scope to use precision techniques to manage in-field variability.”

Roots Beet Yield Challenge

2017 was the inaugural year for BBRO’s Beet Yield Challenge, a competition where growers are judged on the how close they come to achieving their crop’s yield potential. *CPM* finds out what it’s revealed and where there’s room for improvement.

By Lucy de la Pasture

With a yield potential of 130t/ha or more, most sugar beet yields fall well short of the mark. In an attempt to nudge yields closer to the crop’s full potential, the Beet Yield Challenge (BYC) was primarily designed to help improve understanding of some of the key drivers of yield, explains BBRO’s Dr Simon Bowen, as well find areas where growers can improve their attention to detail.

The challenge works along very similar lines as the Yield Enhancement Network (YEN) in wheat and oilseed rape, he explains. “Comparing commercial yields to an estimate of the potential yield of a crop was considered an appropriate approach,

accounting for the varying yield potential of different soil types and allowing for benchmarking against other crops.”

Yield potential is calculated using a crop growth model originally developed at Broom’s Barn and subsequently updated by AB Sugar. This model assumes that high-quality crop management is maintained throughout with 100,000 plants per ha evenly distributed across the field, and all pests, diseases and weeds controlled.

Record season

There’s a certain irony that 2017 proved to be a very high yielding year, if not a record season for many crops of sugar beet. The average yield of all the fields entered in the BYC was 97t/ha, realising on average 73% of the estimated potential yield.

“There was a wide range of actual and the percentage of potential yields achieved which, despite the good weather, suggested there are many other opportunities to drive yields further. Interestingly, there were few differences in the performance of crops on the various soil types represented, suggesting that the weather effectively neutralised this effect.”

The main areas highlighted by the data collected during the course of the BYC may come as no surprise to beet growers, says Simon, with managing in-field variation of particular importance.

The BYC works at a whole field level

rather than using estimates of yield based on test digs which can be subject to huge variances. “This allows the challenge to better identify intra-field variation and the impact of headlands and tramlines on yield. We can then help pinpoint practices to improve production in these areas,” he adds.

“Getting good establishment and the right number of plants/ha is crucial but we found from drone images that there was a huge variation in plant population across fields. Last season this was mostly due to changes in soil type and lapses in weed control, with late fat-hen and weed beet proving problematic on some farms. But in another ▶



Simon Bowen says the BYC highlights the importance of achieving a target population of 100,000 plants/ha.

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Beet Yield Challenge



Making sure canopy growth isn't checked so a full canopy is reached by the longest day will maximise photosynthesis.

▶ year other factors may contribute to patchy establishment.”

Establishment in the BYC participants' beet crops ranged from 85,000-120,000 plants/ha, corresponding to 69-98% emergence, with an average plant count of 95,000 plants/ha. As many as 34% of participants had lower plant counts than the recommended 100,000 plants/ha, while 17% had less than 90,000 plants/ha.

“The BYC has clearly identified the impact of field variability on establishment and shown that, even in a high-yielding year, between 12-17% of potential yield was lost as a result of patchy establishment in 2017,” says Simon.

Problems can often be traced back to cultivations, points out Simon. “Several fields showed patchiness of establishment. There

are several reasons why this could be the case with the dry weather in spring being one of the main reasons. But where there are localised patches of poor establishment throughout the rotation, it suggests that targeted soil preparation and higher seed rate may help.”

For the 2018 BYC, Simon says there will be more detailed data collection to identify variations in soil health which will help BBRO pinpoint key factors so that areas within fields can be managed differently.

“There's scope to use precision techniques to manage in-field variability, but interestingly none of the participants last year used variable seed rates. Growers often increase seed rate on headlands and the same logic can be applied to heavier areas within fields,” he says.



Aerial photography was used in last year's Challenge and showed up considerable crop variability within fields.



Many crops had problems with cercospora last season. It was patchier than rust in its distribution, suggesting field factors may be important.

Cultivation strategy is dictated by soil type and it is difficult to identify the relative merits of different approaches from just one year of the BYC, he concedes. “As more crops are entered over successive seasons, this should become possible. In 2017, patience and timing of the final cultivation was key, especially on heavier soils. Multiple cultivation passes to produce sufficient tilth resulted in drying out of the soil and producing cloddy seedbeds.

Another key driver of yield is maximising the photosynthetic capability of the canopy by ensuring the crop has reached full canopy by 21 June. “This year achieving full canopy by the longest day will be particularly important because of the ▶

Key points gleaned from the 2017 BYC

- **Seedbed quality** - establishing a uniform 100,000 plant/ha across the field is key to optimising yields. The challenge is to identify the causes. In many crops, this was related to soil type and the ability to produce a good moisture-retentive seedbed tilth in the spring.
- **Seed rates** – there's an indication that higher seed rate BYC crops resulted in better yielding crops in 2017, providing some compensation for the difficult early season conditions. Where poor seedbeds are unavoidable, adjusting seed rates in areas where lower establishment is expected such as with changing soil type, is worthy of consideration. The use of higher seed rates on headlands and increasingly in tramlines is something that is currently practiced. As well as adjusting seed rates, ensuring drills are placing at the right spacing and depth is important.
- **pH levels** – sugar beet is sensitive to pH and this can have a large effect on yield. There was an indication of increasing yield at higher

pH in the BYC. It is worthwhile to check fields for variability in more detail and to ensure all areas of the field meet the target pH.

- **Early canopy growth** – the stand-out feature and base for the high yields in 2017, once seed had germinated, was the very rapid canopy establishment in May and June. Crops reaching higher crop cover scores by June 21 (the longest day of the year) had the largest yields.
- **Weed control** – the aerial photography showed how the incidence of weeds in some crops can impact on the canopy cover across a field. Early identification of the weeds present allows selection and tailoring of herbicide programmes to be more targeted. Many weeds tend to be patchy in their distribution so knowing where these are and perhaps using some patch treatments may be an approach to getting a more uniform canopy distribution. Weed beet evidently need controlling before they compete with the crop and reduce yields.

- **Foliage disease** – foliage disease was clearly a yield-limiting factor in many of the BYC crops. The incidence of disease, initially rust and then cercospora, had a marked impact on canopy productivity. Whilst most crops received two fungicides, the levels of disease suggested that foliage disease control could be improved. Early identification of disease and good canopy penetration and coverage of sprays are areas to address. Research work is focusing on understanding varietal susceptibility and which fungicides programme is most effective against cercospora.
- **Later harvesting** – the ability to maximise yield potential by leaving crops for later harvesting is challenging. The trend for yield to increase at later harvest is clear but to maximise the potential requires attention to managing the interaction of a number of factors. The importance of protecting the foliage for later harvested crops should be a focus.




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Beet Yield Challenge



The growers who came closest to their crop's potential in last year's BYC all applied two fungicides.

► widespread late drilling. But drilling date isn't the only factor affecting canopy growth," he says.

"Nutrition plays a very important role in maintaining growth. Starter fertilisers may help in the early growth stages, and manganese and other trace elements may become particularly important during rapid



If a late harvest is planned, the 'right' crop needs to be selected to avoid decreases in the percentage of yield potential achieved.

growth, when transient deficiencies can often occur.

"This season the growth during June is likely to be phenomenal, so making sure the crop doesn't suffer any setbacks by staying ahead of nutritional demands will be important," he stresses.

Once the canopy is in place, protecting it from disease becomes important but foliar disease control is another area where there's scope for improvement in attention to detail, says Simon. "From the limited data we've managed to capture it looks as if there's an opportunity to be more precise with fungicide timings."

Foliage diseases

Within the BYC, 10% of the fields were shown to have foliage disease levels on more than 40% of plants and 33% with diseases on between 5-40% of the plants. The main diseases were rust and cercospora, with rust more uniformly distributed across fields whereas cercospora was patchier in its distribution, suggesting field factors may be important, he comments.

There was no relationship between the level of foliage disease and the varieties grown in the BYC, comments Simon, but BBRO has identified some consistent differences between varieties and this is worthy of consideration when deciding on fungicide programmes.

Fungicide timing is becoming even more critical since cercospora has become established in the UK over the past two seasons, proving to be a particular problem last year, he says. "It's a disease that likes high temperatures and humidity and it needs a mindset more like potato growers have towards controlling potato blight when it comes to making sure protection is in place before infection occurs," he suggests.

Date of harvesting is another factor which

has an influence on yield potential. In the BYC, the earliest lifted crop was on the 27 Sept, while the last lifted crops were in mid-March. On average, the competition fields were lifted on 12 Dec. Where crops are left in the ground and harvested late it can be challenging to optimise the yield potential, says Simon.

"While there was a trend of actual yields increasing with later harvesting, this was less clear when yields were expressed as a % of their potential. This tended to decrease throughout the harvest period.

"This is to be expected as crops are subject to a number of stresses such as diseases, leaf senescence and cold and frosty weather. Some sugar in the root may be remobilised to maintain canopy growth in this period. The longer that the beet is left in the ground, the more care that must be taken to provide a healthy canopy."

Five out of the 13 crops harvested after mid-Nov had three fungicides and eight had two fungicides applied. There was a trend for an increase in yield with the number of fungicide applications made.

"Selecting the right crop to harvest later can help optimise yield," comments Simon. "New data on varieties and their growth habits is currently being collected but selecting crops with vigorous and healthy canopies with an upright canopy architecture are indicators. Depending on the level of active disease, a third fungicide spray for later harvested crops is a worthwhile consideration."

Another prime consideration when selecting crops suitable for later harvesting is soil type. "Ensure soils are in good condition where harvesting is likely to be later. This will help reduce the impact of water logging on growth, as well as the need for aggressive cleaning at later harvesting dates when weather is likely to be less than ideal." ■



As part of the Challenge, crops were assessed for losses at harvest.

And the winner of BYC 2017 is...?

All four of the 2017 BYC finalists have in common:-

- Crop drilled in March on sandy loam & silt soil types
- Achieved >100,000 established plants/ha
- Had uniformly distributed plants & canopy across the field
- Crop had a more advanced canopy development on the 21 June
- A programme of two fungicide sprays was used in crops harvested after Oct (harvest dates 30 Sept-7 Feb)

Find out more at...

Cereals Event, 13 June – the finalists will be announced at the NFU stand as part of their 'Sugar Hour' 10:30 – 11:30am. Growers will be able to collect their individual reports and discuss findings with the BBRO team.

BBRO Morley Innovation Day, 21 June - repeat of above for those unable to attend Cereals.

Royal Norfolk Show, 27 June - announcement of the 2017-18 Champion Grower at 14:00 at the Innovation Hub stand (sponsored by BBRO).