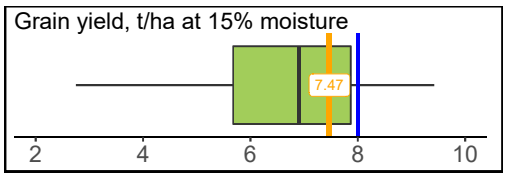
Entrant's Report

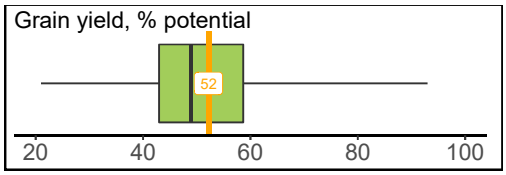
Harvest 2021

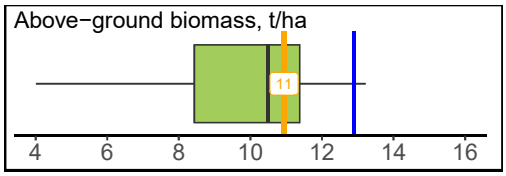
YEN User ID: [redacted]
Entrant name: [redacted]
Main contact email: [redacted]
Sponsor/supporter: [redacted]
Sponsor/Supporter email: [redacted]

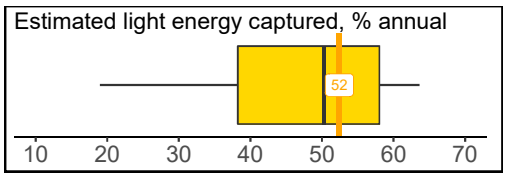
Field/Site name: [redacted]
Location: [redacted]
Incident energy Apr-Aug 21: 22 TJ/ha
Available water: 400 mm
Crop: Spring Barley
Variety: LG Diablo

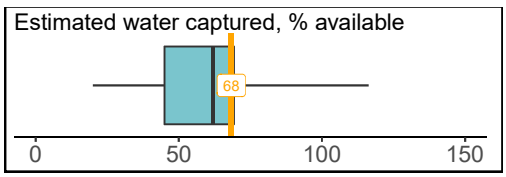
SUMMARY: YEN entries were completed from 24 fields in 2021. Headline results for your entry are shown in benchmark diagrams below. Your yield of 7.5 t/ha ranked 9th within all Spring barley entries. This represents 52% of its estimated yield potential of 14.3 t/ha, which ranked 11th within all Spring barley entries.

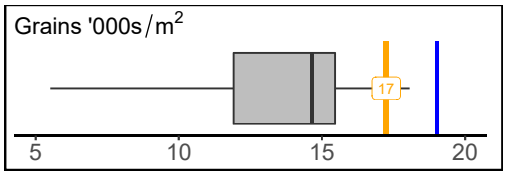






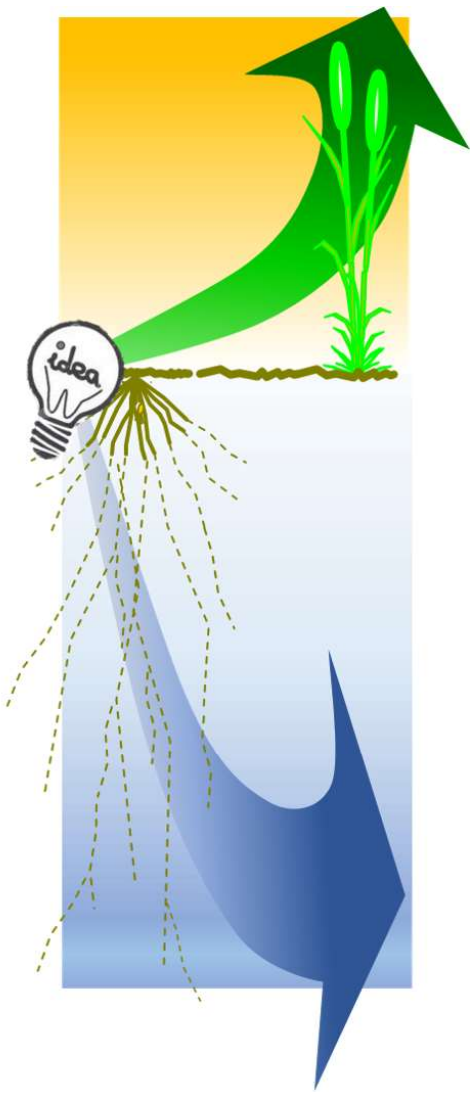






Spring Barley yield rank: **9th**

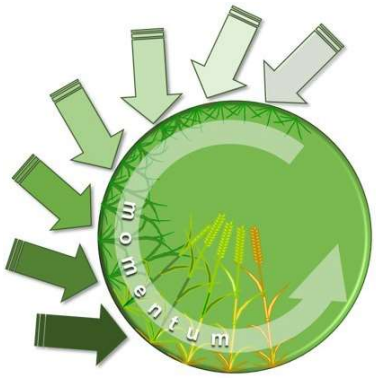
Spring Barley potential yield rank: **11th**



CONTENTS

Our detailed analysis of your yield result is provided in the following pages, including comparisons with other YEN entries and with benchmarks taken from the AHDB Barley Growth Guide, AHDB Nutrient Management Guide (RB209) and the Teagasc Spring Barley Guide. We hope that this helps you to identify aspects of your husbandry and growing conditions that offer possible routes to further yield enhancement on your land.

Our approach in this report is to consider yield potentials and growing conditions for crops in the 2021 season, then the conditions of your crop, its development, its basic resources (light energy, water and nutrients), its success in capturing these and in converting them to grain. Lastly, we use grain analysis to provide a post-mortem on your crop's limiting components and nutrition.



"The YEN exists to help you to enhance your yields."

The key to high yields amongst YEN entries has been called 'momentum' – maximising growth by avoiding setbacks. So, our approach to enhancing yields is to work out what limits growth – light energy, water, nutrients, or storage capacity – and then develop ideas to build better canopies, better roots, more stores, or supply deficient nutrients accordingly.

To estimate potential yields, we assume a theoretically 'perfect' variety grown with 'inspired' husbandry on your land with its 2021 weather, achieving either:

(i) **60% capture of light energy** through this season (including some in August), and its conversion to 1.4 tonnes of biomass per terajoule, or

(ii) **Capture of 75% of the available water** held in the soil to 1.5 m depth (or to rock if less) plus all rainfall from April to August, and conversion of each 18 mm into a tonne of biomass per hectare.

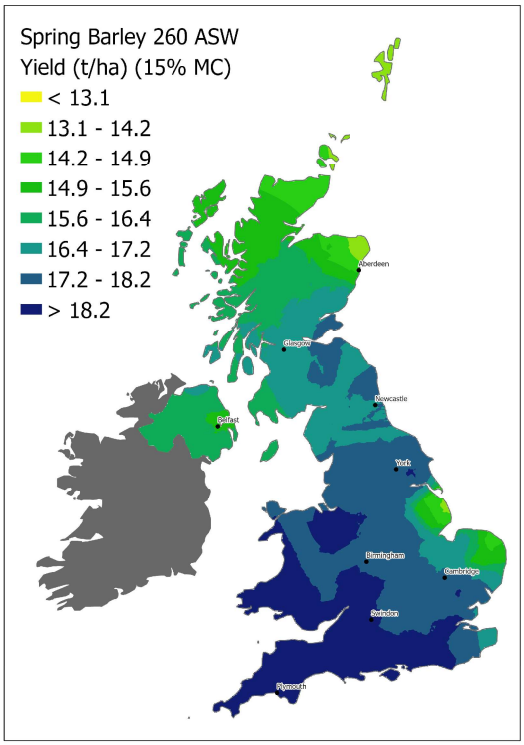
Taking the lesser of these two biomass amounts, we assume that a maximum of 60% can be used to form grain, this is the 'harvest index'. Note that we assume average temperatures for the UK, and no damage from waterlogging, frost, heat, or lodging.

NB: Our new model of potential yield for 2021 estimates growth and limiting resources daily (not monthly); impacts from water limitation are increased and more common than in previous YEN reports.

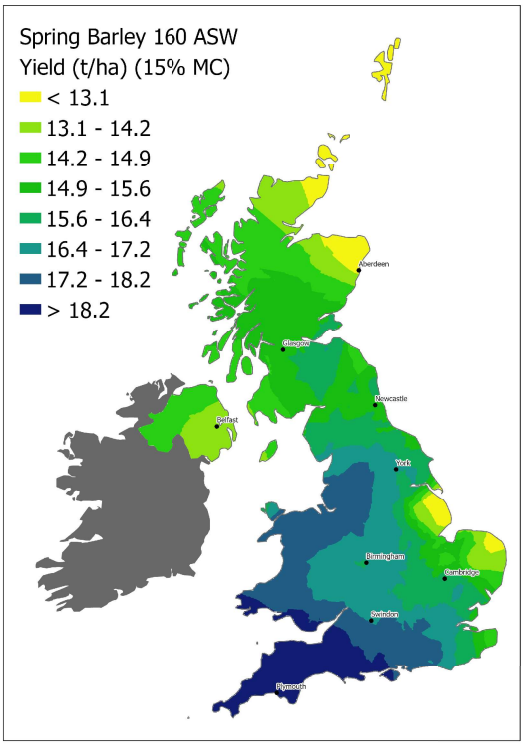
The maps below show the potential grain yields for spring sown crops on retentive and light soils in 2021. For this we assume deep soils with no irrigation. They ranged from 12 t/ha upwards so, on most soils, high yields were theoretically possible almost everywhere.

2021 Potential yields

2021 Retentive soil (260 mm AWC)



2021 Light soil (160 mm AWC)



We are using weather data from DTN™ in 2021. Note we do not have long term met data from DTN so cannot show a map of long-term average yield potentials.

The season's weather

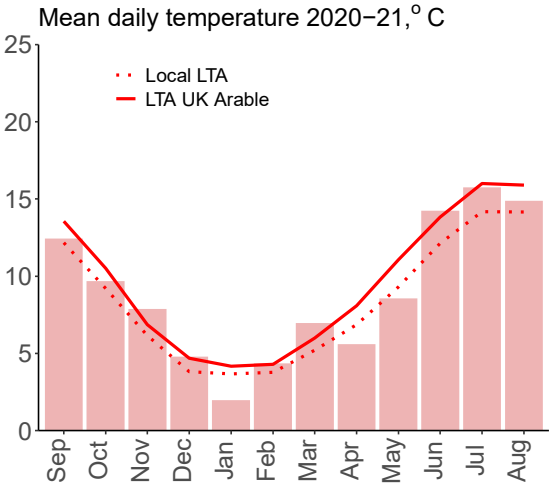
The adjacent graphs show the monthly temperatures, rainfall and total solar radiation for your area in 2020-21 compared to your regional long-term average (LTA) and the average for all UK arable areas (1981-2010, from the Met Office).

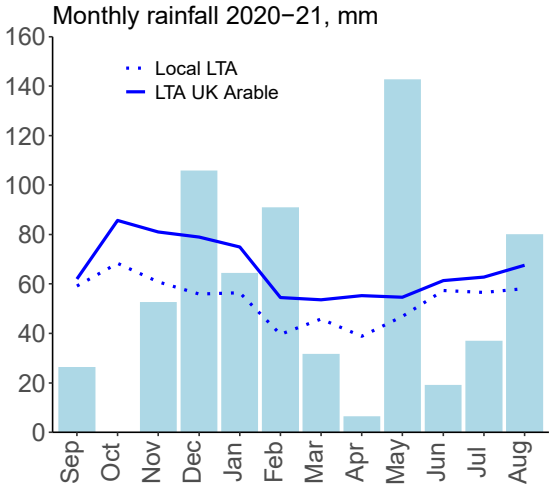
Many spring barley crops were drilled into good conditions, leading to even establishment except in late drilling scenarios where seedbeds were particularly cold.

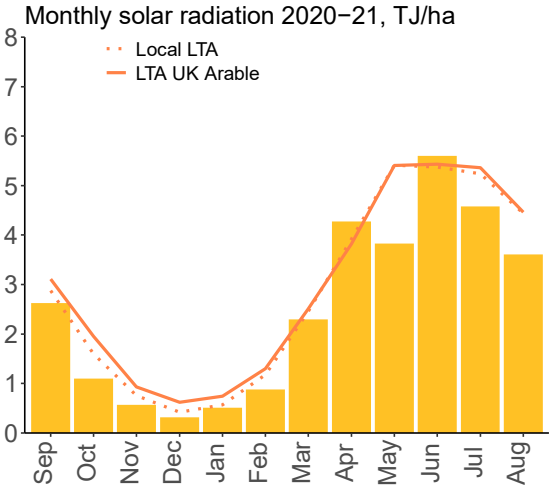
Crops were hit with very dry spring conditions, which coupled with the cold temperatures (the UK's April was the frostiest in at least 60 years, with an average of 13 days of air frost reported) would have restricted tillering, and delayed emergence in later drilled crops. The cold weather also delayed emergence of weeds. Emergence of broadleaved and wild oats was protracted and some escaped control leading to increased worries over herbicide resistance. Early N uptake may have been restricted, however, this was likely compensated for by the wet weather which arrived in May, leading to conditions promoting good tiller retention.
The dry spring meant that disease pressure was initially low, however high rainfall in May promoted net blotch and rhynchosporium late in the season. The warm temperatures promoted brown rust, and ramularia was also seen to affect some spring barley crops. BYDV risk was considered low as aphid migration in the spring was delayed by several weeks due to the cold conditions in January and February. Most spring barley crops would have reached GS 31 by the time of aphid migration.

As crops moved into summer, flowering was met with warm, sunny (in some areas) and dry conditions. Conditions in July varied with warm and sunny conditions in some areas supporting good rates of grain filling, and warmer duller conditions hampering grain fill in other regions. Rainfall in July caused significant lodging in some crops. For later drilled crops, and those whose canopies persisted well into August, the dull to average levels of sunshine may have limited photosynthesis rates and hence significant contributions to grain filling. The dry August conditions meant that late lodging and brackling was not widespread, minimising losses at harvest. However, the dull weather meant that moistures were slow to come down, which prolonged harvest for many. In general grain N% for malting were on the low side, explained in part by good yields and dilution. Grain size was generally good, but specific weights were on the low side.

Overall, the 2021 weather conditions supported good yield potential with generally good plant establishment, good tiller retention but modest grain filling conditions.

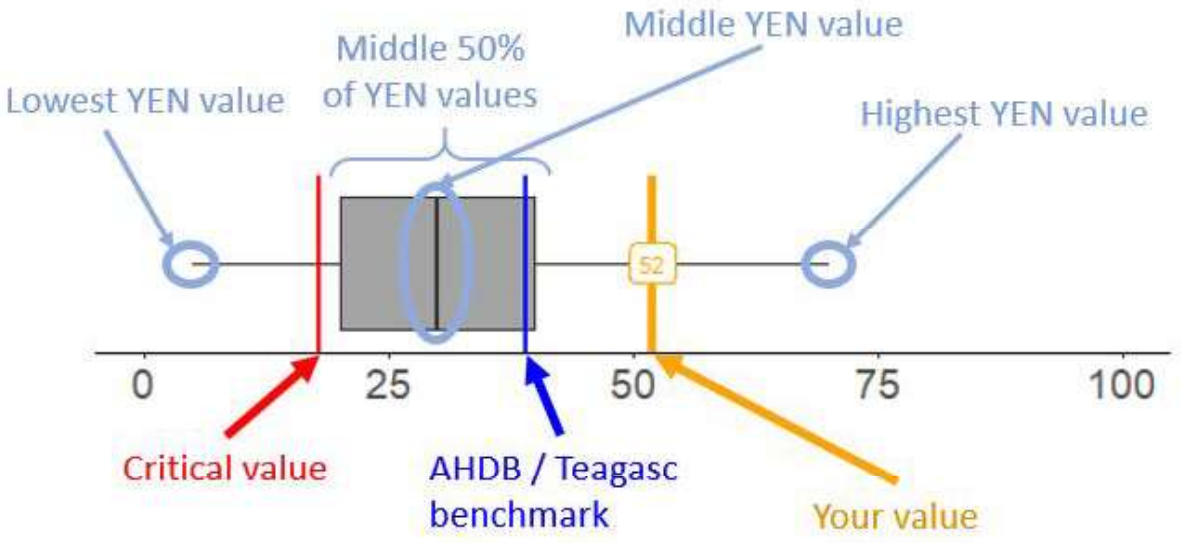






YEN Benchmarking charts – What do they mean?

YEN is much more than a competition – it provides a full set of metrics whereby you can gauge the performance of your crop against all other YEN crops. This has provided the principle value of YEN to most participants. We do this with benchmark charts. These compare your value with everyone else's in 2021 and with standard benchmarks and critical values, if available and appropriate. The key is as follows:



The 'whiskers' show the range of YEN values in 2021 whilst the grey box shows the middle half of YEN 2021 values, with a line for the mid-value. The orange line shows the value for your entry, and the red line is a limit beyond which yield may be adversely affected; crops with values beyond this merit further investigation. Blue lines indicate benchmark values e.g. from the AHDB's Barley Growth Guide or from the Teagasc Spring Barley Guide. The Teagasc guide is based on data collected through a detailed programme of assesments which was carried out on replicated field plots of a two-row spring barley variety (Quench) at three sites (Carlow, Wexford and Cork) in Ireland from 2011-2013. "Benchmarks" have been taken from the Teagasc guide in instances where data was not available from the UK. The average yield of these benchmark crops was 8.3 t/ha, and as such these shouldn't be used as targets, but more as indicators of the characteristics of these crops. Benchmarks taken from the Teagasc Spring Barley uide are indicated witha an * next to the text. For some parameters, the dataset is very small, so please treat results with caution.

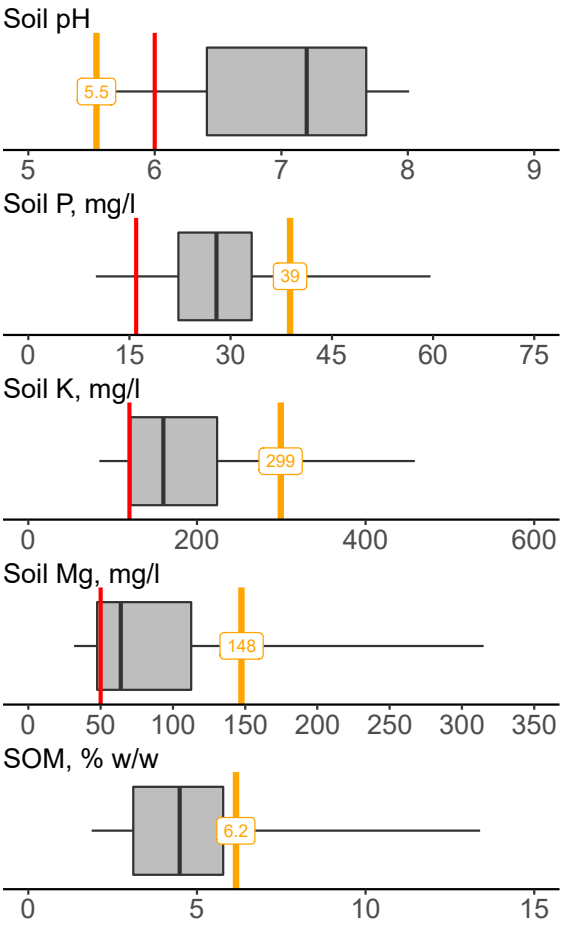
Soil description and nutrition analysis

Your soil's capacity to hold available water is critical in determining your potential yields. We rely on entrants describing the soil where their YEN entry grew, we can use the UK Soil Observatory map viewer to check whether this complies with the surrounding land.

Good soil descriptions are vital in allowing us to estimate soil water holding capacity and, along with summer rainfall, the water available to your crop (see Benchmark charts in the section on 'Resources & their Capture').

Topsoil analyses provided by NRM also tell us about soil status for pH, P, K and Mg, as reported on the next page. A few sites show low values for soil pH, P, K or Mg. If these are unexpected, they may need further checks, either by repeating soil analysis and by checking both leaf and grain analyses later in this report. Previous YEN leaf and grain nutrient data have indicated that UK cereal crops often experience deficiencies in one or more nutrients, and sometimes this is despite soil levels being satisfactory. So, by combined use of soil, leaf and grain analysis, the YENs now help to diagnose whether nutrient shortfalls are arising from poor supply, or poor capture by the root system.

Soil analysis



High pH soils may require that special attention is paid to phosphorus (P) and micro-nutrient levels in leaf and grain (see later).

Only a small difference separates P Index 0 (<=9) and 2 (>=16). High yields are possible at P index 1 but fresh P is also usually required. Use grain P (see page 21) to check if P was sufficient.

Soil potassium (K) analysis checks on whether K supplies are likely to have been deficient for average crops. However, high yielding crops require very large amounts of K.

Magnesium (Mg) is a key component of chlorophyll so deficient plants show striking inter-veinal yellowing. Temporary deficiencies often occur in springs with dry topsoils.

NRM determines soil organic matter by 'loss on ignition'. Beware that SOM by other methods can give somewhat lower values.

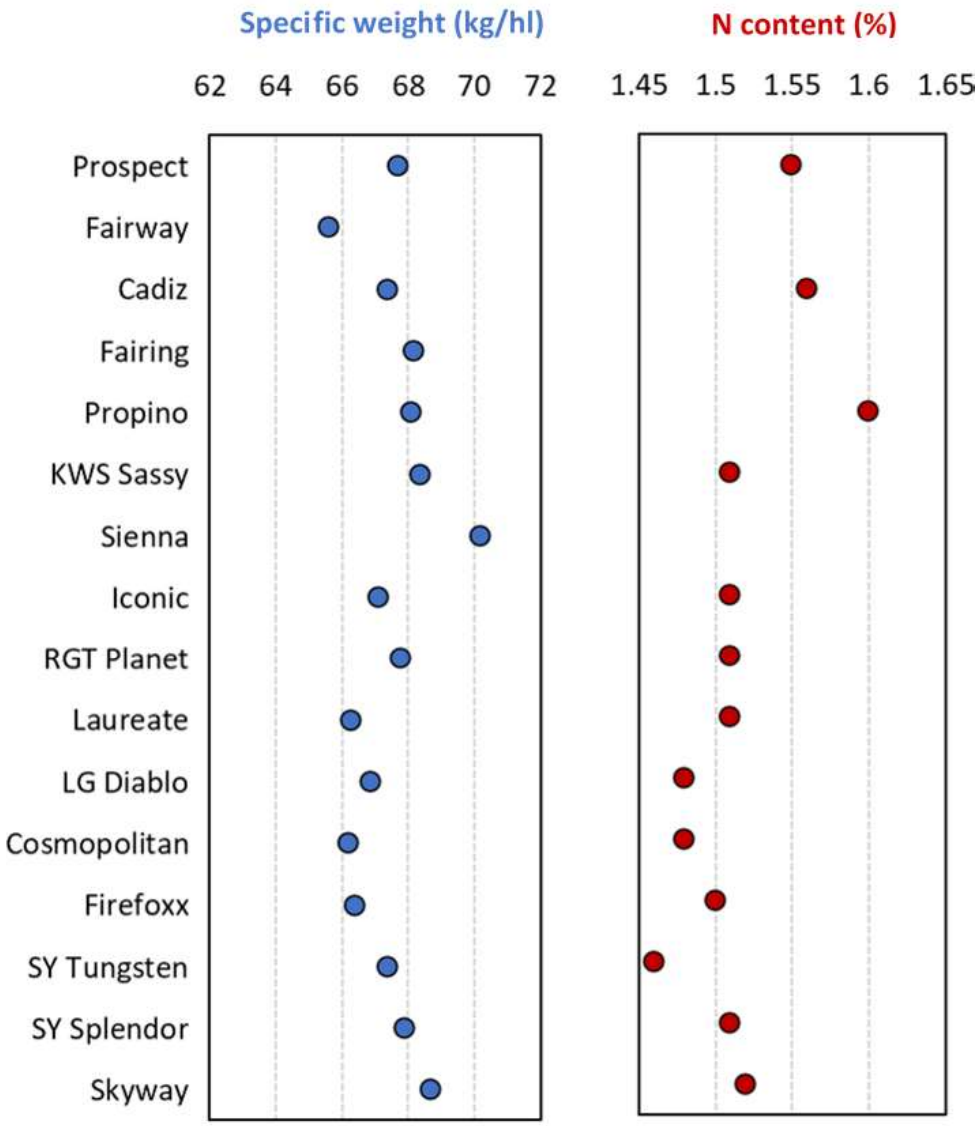
The spring barley database is growing, but it is too early to analyse the data comprehensively. Analysis of Cereal YEN data accumulated over the YEN's first eight seasons has shown that, although season has the largest effect on yields, farms are relatively consistent in their performance. Hence it should be possible to learn from the best performing farms, and the YEN is beginning to indicate husbandry practices that are associated with high yields.

High yields are possible anywhere and are not restricted to just one part of the UK. We believe that attention to detail is important.

The following charts show how the husbandry of your entry related to all other YEN entries in 2020-21 season.

Variety

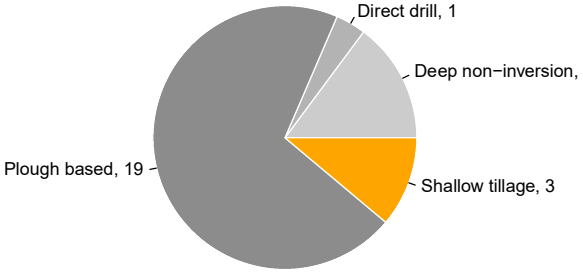
The Spring Barley YEN sees a wide range of varieties entered into the competition, in 2020-21 a total of 10 different varieties were submitted. The graphs below indicate the array of specific weights and grain N contents seen in Recommended List varieties, which are important to consider based on the crop's end market.



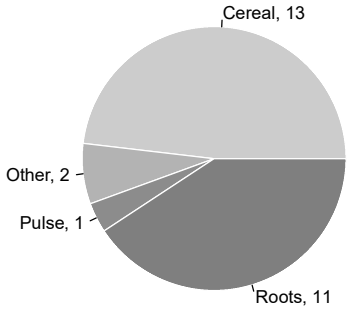
Husbandry

Orange segments or bars in the following diagrams indicate the agronomy of your crop, if known, and shows how common this practice was amongst all YEN entries.

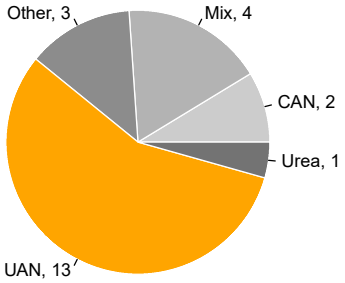
Main cultivation strategy



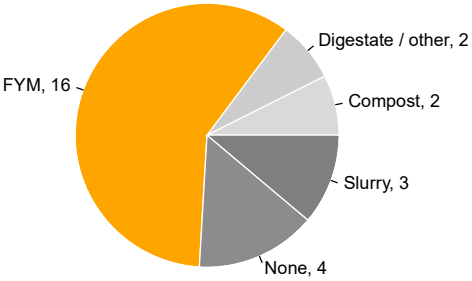
Previous Crop Type

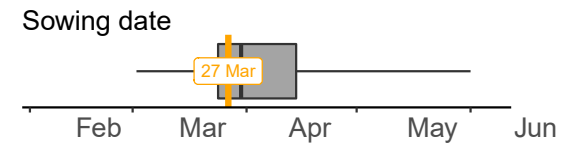


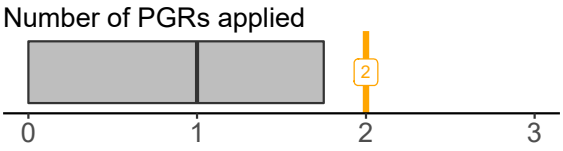
Main form of N applied

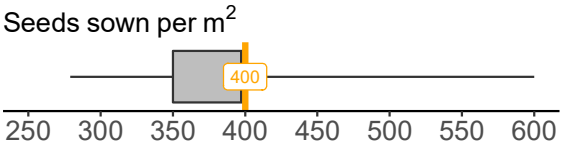


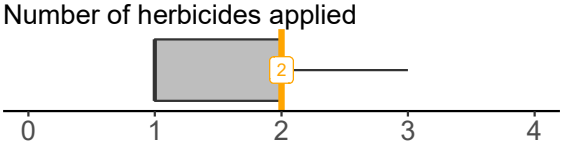
Predominant organic materials applied

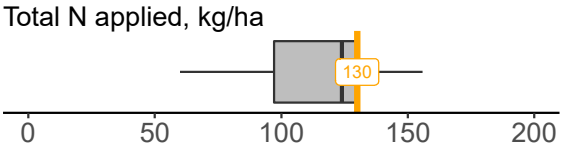


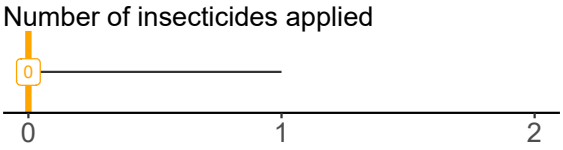


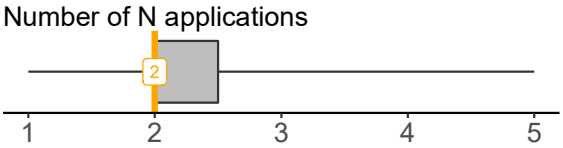


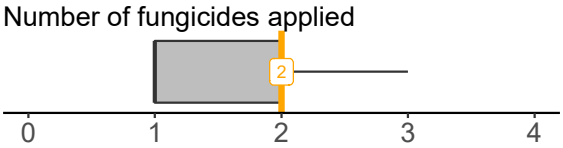


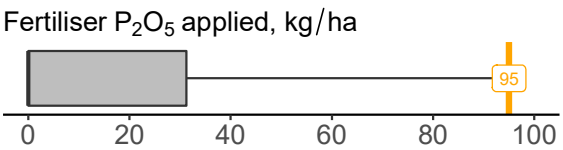


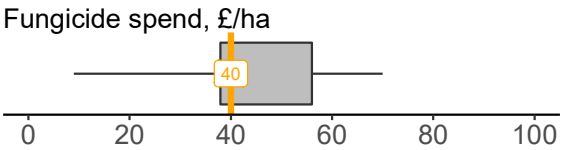


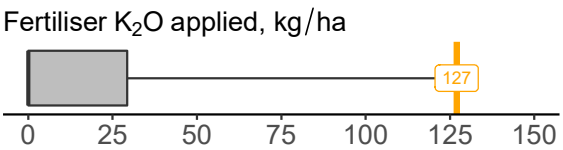


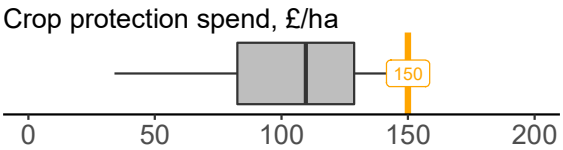


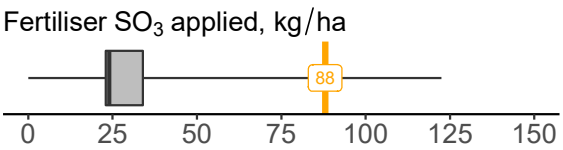










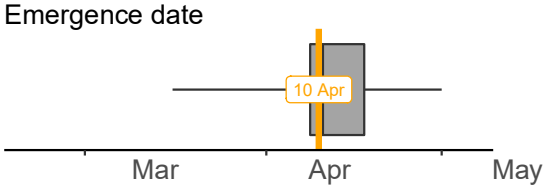


CROP DEVELOPMENT

The following charts show how your entry developed through the 2021 season, compared to all other YEN entries and Benchmarks. The cardinal stages of emergence (GS10), start of stem extension (GS31), flowering (GS61) and full senescence (GS87) determine the length of each phase for growth:

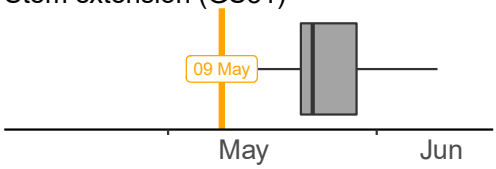
- Foundation, GS10-GS31 – when tillers and main root axes are formed,
- Construction, GS31-GS61 – when yield-forming leaves, ears and stems are formed, including soluble stem reserves
- Production, GS61-GS87 – when grains are filled, both with new assimilates and reserves redistributed from stems.

Emergence date



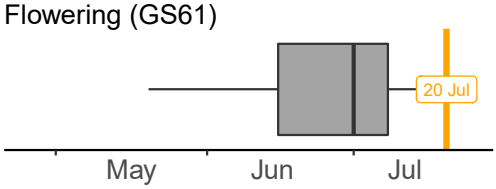
A warm and dry March saw many spring barley crops drilled into good conditions. However, the following cold and dry conditions may have led to delayed emergence in late drilled crops. Emergence for a crop drilled on 15th March was 2nd April*

Stem extension (GS31)



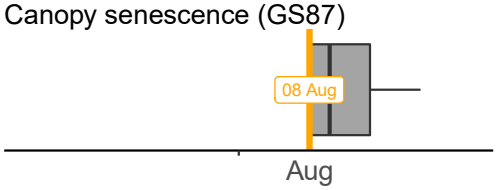
GS31 marks the end of tiller production and the start of tiller survival. The benchmark for a crop drilled on 15th March is 7th May*. Overall, stem extension appeared to be delayed this year, mainly due to the cold April and May conditions.

Flowering (GS61)



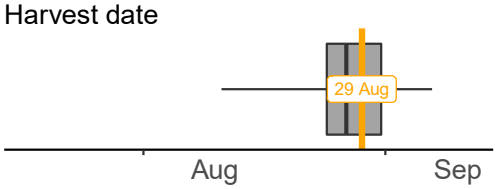
At GS61 'crop construction' and grain set finish and grain filling starts. Continuing cool weather in May caused the average flowering date to also be somewhat delayed. The large geographic spread of entries caused the large range in flowering dates.

Canopy senescence (GS87)



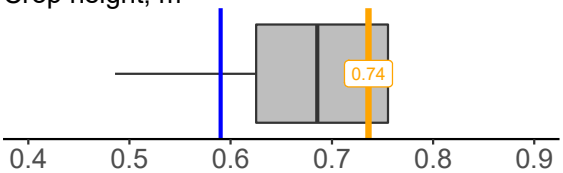
Ideally for high yields, canopies would stay mostly green for 45 days after flowering. The average senescence date was 47 days after flowering this year.

Harvest date



Harvest dates ranged from early August to Late September. The dull August prolonged harvest for many due to high grain moistures.

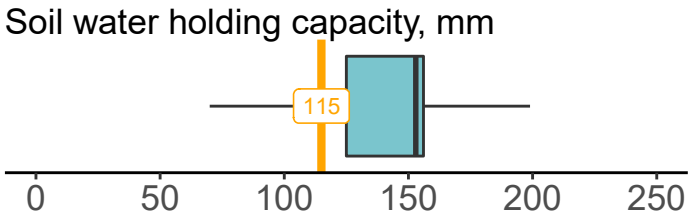
Crop height, m

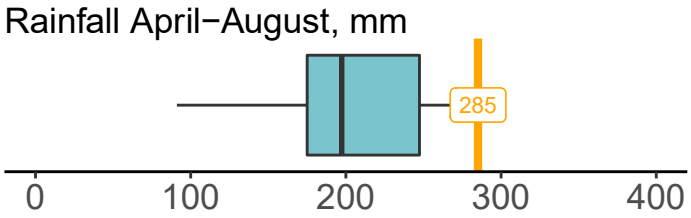


We measure height on the harvest 'grab' samples, and omit samples which look to have been cut above ground level. On average spring barley crops were taller than average this year.

Crop benchmarks taken from the Teagasc Irish Spring Barley guide are indicated with an * next to the text

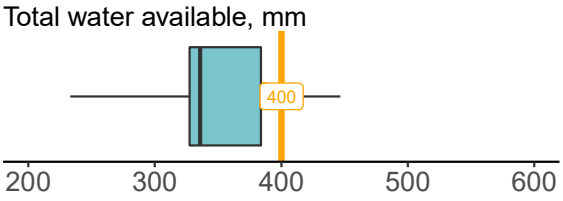
Water capture



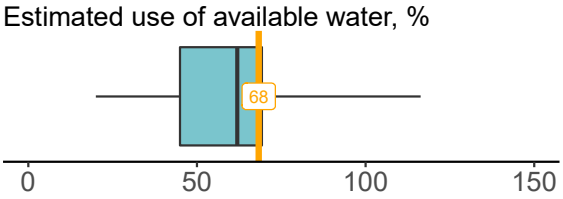


The soil water holding capacity assumes roots could access 75% of the soil water to 1.5 m. If enough roots didn't reach this depth, due to depth of soil or growing period, soil-available water would be accordingly less.

Whilst we cannot yet measure water captured by YEN crops individually, by assuming your crop's conversion of water to total biomass was 'normal' (20 mm water for each t/ha biomass), we have made crude estimates below of the likely success of your crop's root system in capturing water.



This sums your soil's water-holding capacity and your summer rainfall (both shown above). We assume that, with a good root system, the majority of this will be available to the crop.



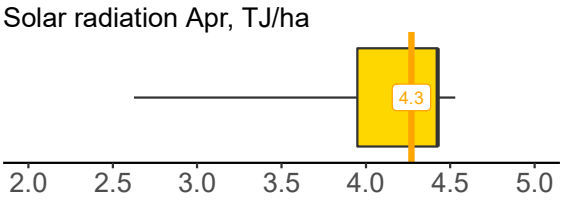
Low water use will sometimes have been due to less demand for canopy transpiration (e.g. because crop developed faster and matured earlier) or otherwise due to worse rooting.

A high yielding crop, growing say 15 t/ha of biomass (so yielding 9.5 t/ha grain at 54% harvest index), would need to capture ~300 mm water from soil plus summer rain. If your estimated use of available water exceeds the total water available, this may be good news! It either suggests that your crop's roots were more efficient than normal, or that your soil description was overly pessimistic: i.e. your soil apparently managed to provide more water than we estimated was possible from your soil's texture, stone content and depth.

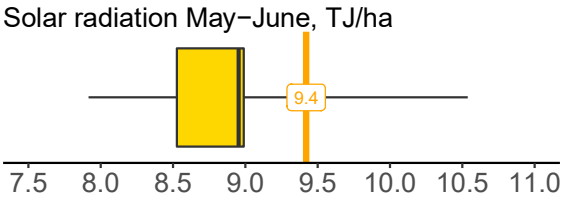
Energy capture

The benchmarking charts below show how 2021 weather affected light energy available for this entry and other YEN crops. Solar radiation has been divided into periods that roughly equate to the three key phases of crop development reported above:

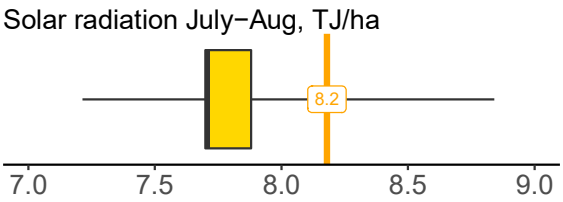
- Foundation – when tillers and main root axes are formed



- Construction – when yield-forming leaves, ears and stems are formed, including soluble stem reserves

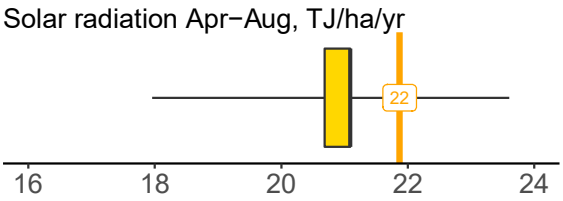


- Production – when grains are filled, both with new assimilates and reserves redistributed from stems.

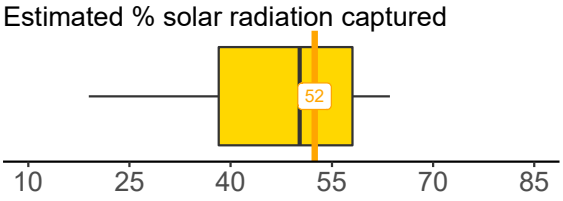


Solar radiation from April to August 2021 is displayed below. This assumes that the crop has emerged at the start of April and stays green until the end of August.

Whilst we cannot yet measure light capture by YEN crops individually, by assuming your crop's conversion of light-energy was 'normal' (1.2 tonnes/TJ), we have made a crude estimate below of the likely success of your crop's canopy in capturing total light-energy for the 12 months of this season.



Solar radiation from Apr-Aug was generally lower for YEN entries in 2021.



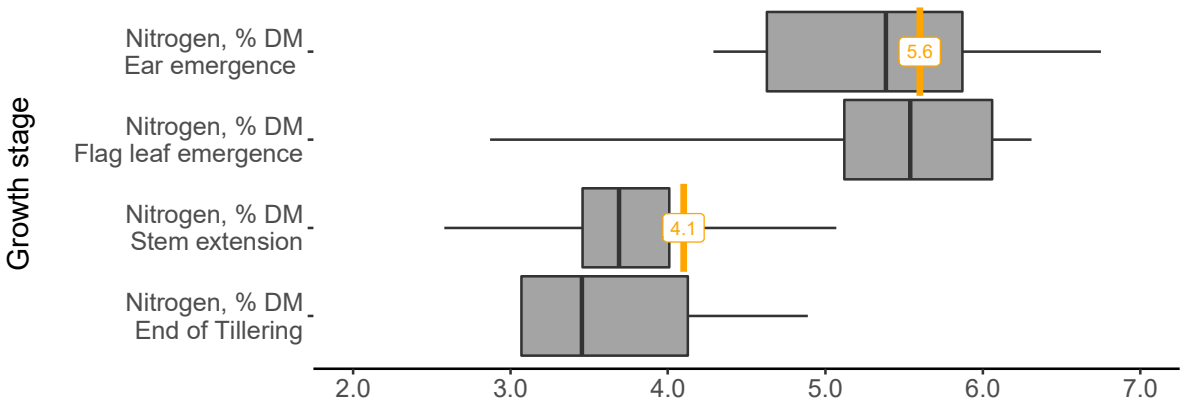
We take the biophysical limit of annual light interception as 60%. Spring barley crops entered into the YEN in 2021 intercepted more than 50% of the light on average.

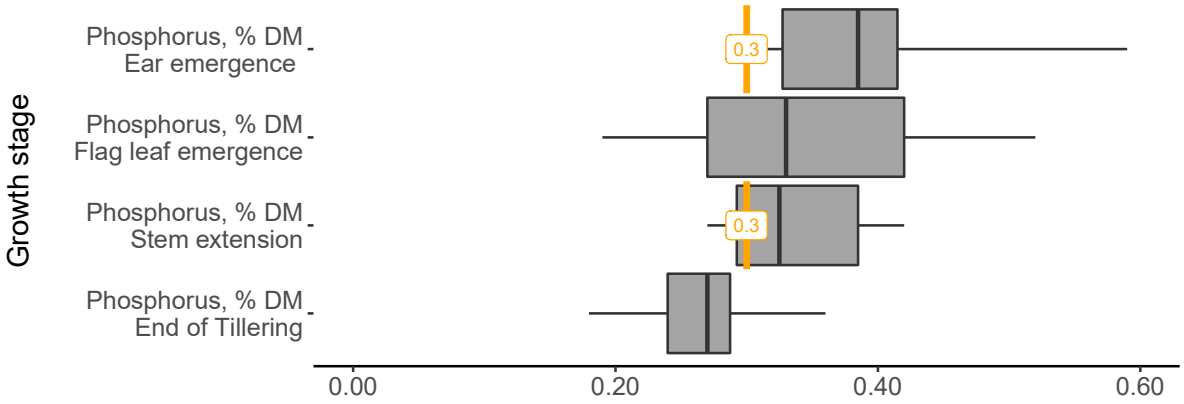
Nutrient capture

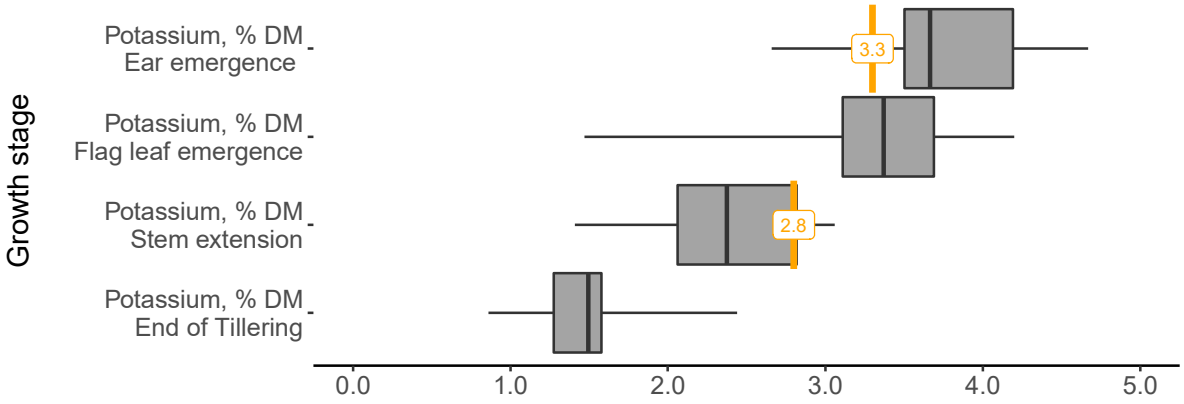
Whether nutrient capture was sufficient to support full conversion of light and water is best deduced from nutrient concentrations in crop tissues – both leaves (next three pages) and grains (later section).

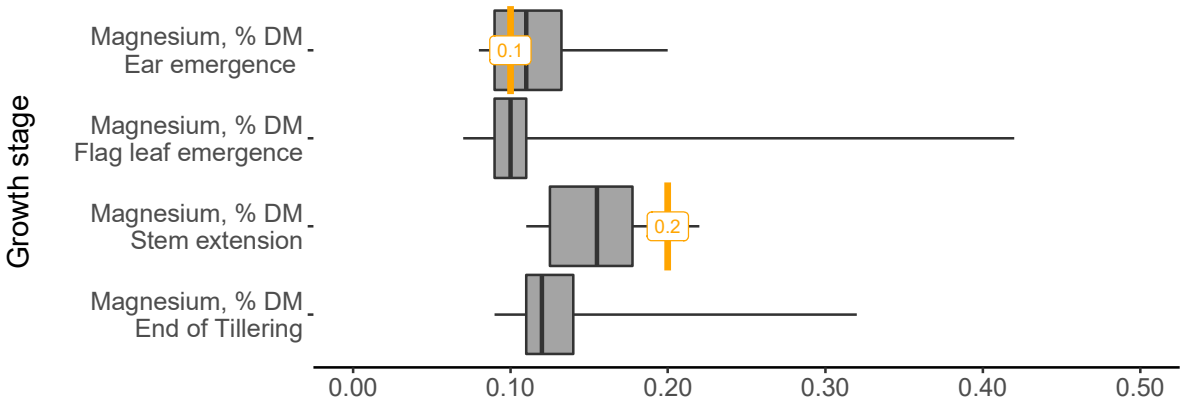
No critical thresholds or benchmarks are shown for leaf analyses because these change through a crop's life and are still uncertain. However, the benchmarking diagrams should enable you to compare your crop's levels with all other YEN entries in 2021, analysed at the same growth stages.

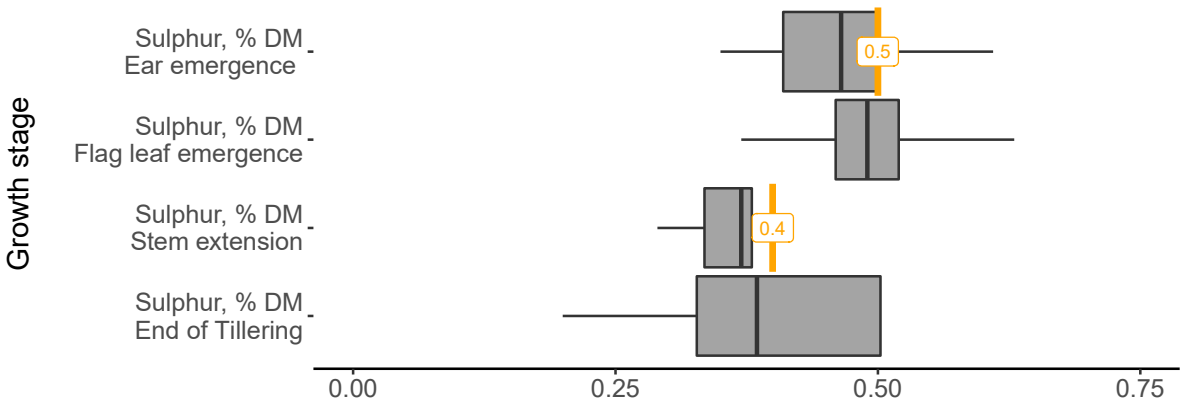
Lancrop Laboratories provide leaf analyses for YEN. Samples are of the newest fully expanded leaf.

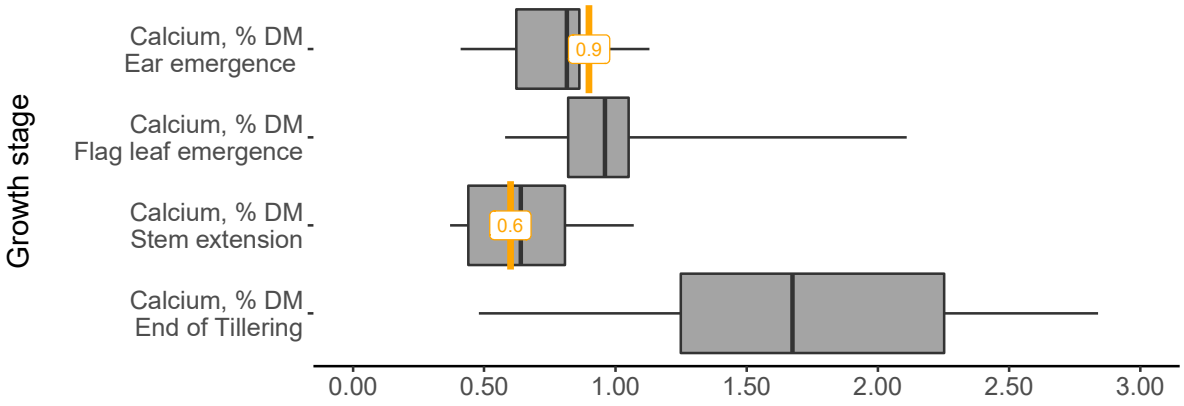

Growth stage
Nitrogen, % DM
Ear emergence
Nitrogen, % DM
Flag leaf emergence
Nitrogen, % DM
Stem extension
Nitrogen, % DM
End of Tillering
5.6
4.1
2.0
3.0
4.0
5.0
6.0
7.0

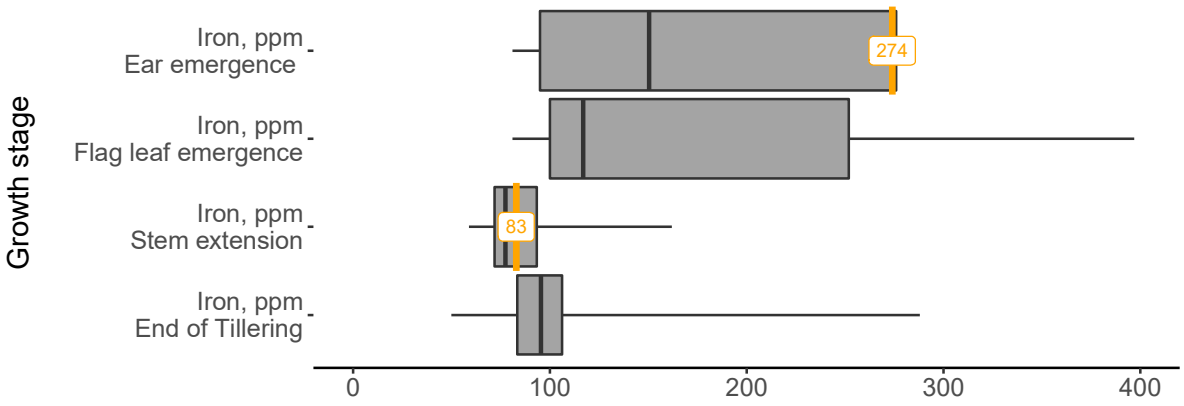

Growth stage
Phosphorus, % DM
Ear emergence
Phosphorus, % DM
Flag leaf emergence
Phosphorus, % DM
Stem extension
Phosphorus, % DM
End of Tillering
0.3
0.3
0.00
0.20
0.40
0.60

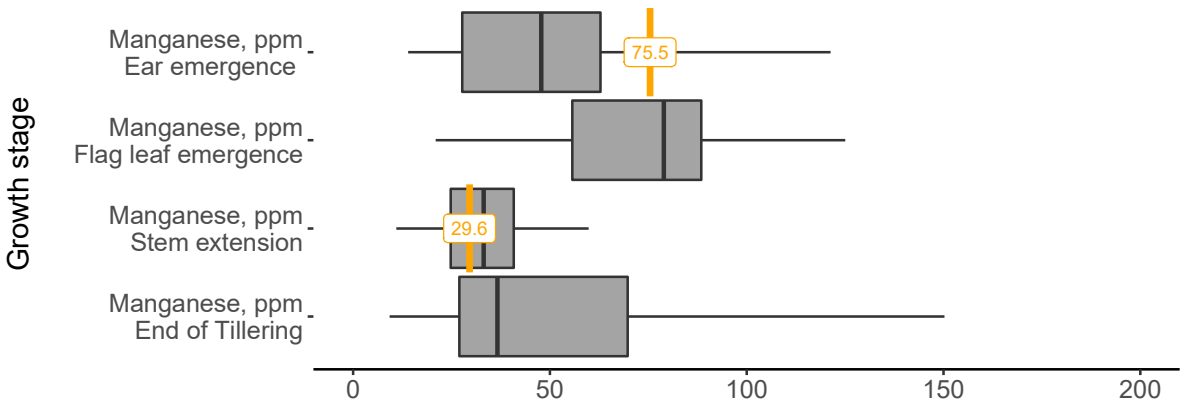

Growth stage
Potassium, % DM
Ear emergence
Potassium, % DM
Flag leaf emergence
Potassium, % DM
Stem extension
Potassium, % DM
End of Tillering
3.3
2.8
0.0
1.0
2.0
3.0
4.0
5.0

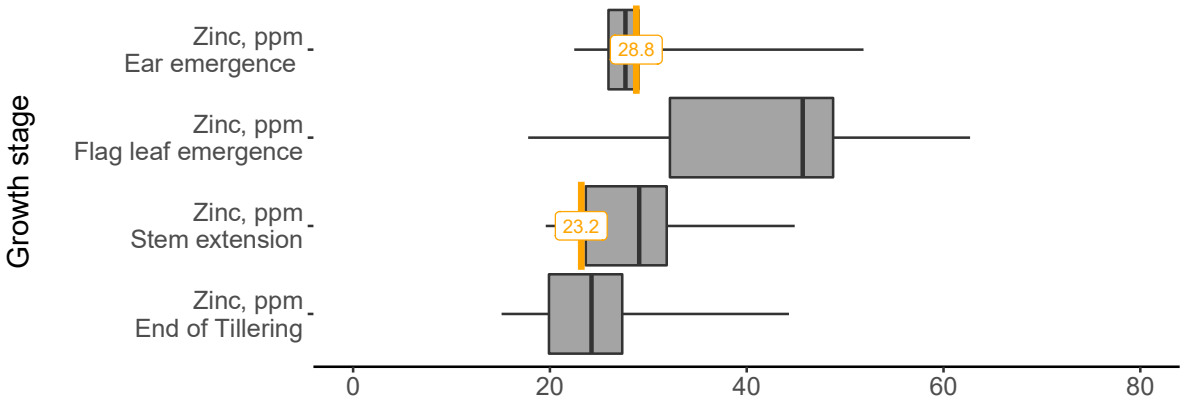

Growth stage
Magnesium, % DM
Ear emergence
Magnesium, % DM
Flag leaf emergence
Magnesium, % DM
Stem extension
Magnesium, % DM
End of Tillering
0.1
0.2
0.00
0.10
0.20
0.30
0.40
0.50

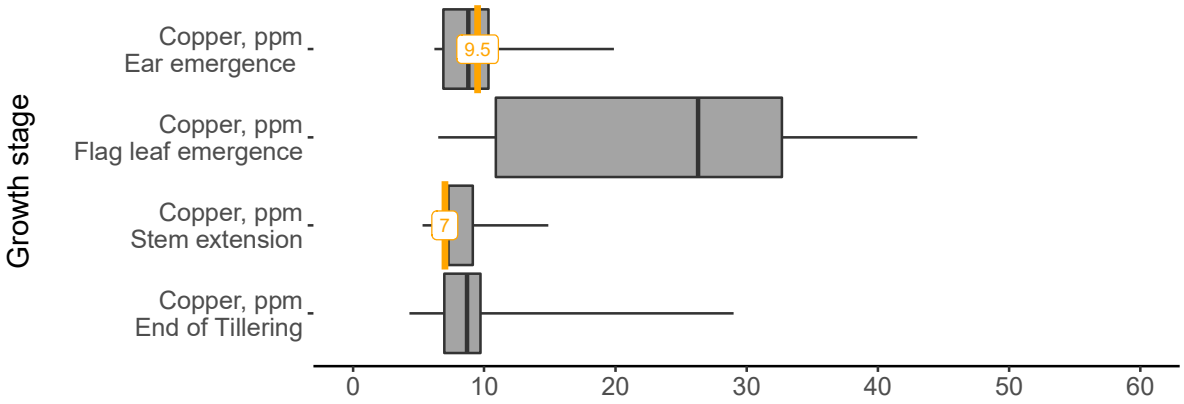

Growth stage
Sulphur, % DM
Ear emergence
Sulphur, % DM
Flag leaf emergence
Sulphur, % DM
Stem extension
Sulphur, % DM
End of Tillering
0.5
0.4
0.00
0.25
0.50
0.75

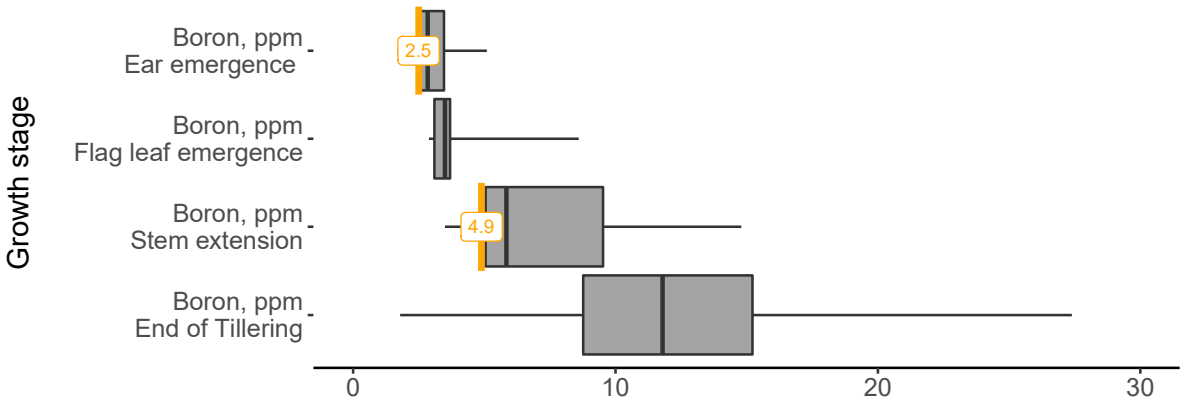

Growth stage
Calcium, % DM
Ear emergence
Calcium, % DM
Flag leaf emergence
Calcium, % DM
Stem extension
Calcium, % DM
End of Tillering
0.9
0.6
0.00
0.50
1.00
1.50
2.00
2.50
3.00


Growth stage
Iron, ppm
Ear emergence
Iron, ppm
Flag leaf emergence
Iron, ppm
Stem extension
Iron, ppm
End of Tillering
274
83
0
100
200
300
400


Growth stage
Manganese, ppm
Ear emergence
Manganese, ppm
Flag leaf emergence
Manganese, ppm
Stem extension
Manganese, ppm
End of Tillering
75.5
29.6
0
50
100
150
200


Growth stage
Zinc, ppm
Ear emergence
Zinc, ppm
Flag leaf emergence
Zinc, ppm
Stem extension
Zinc, ppm
End of Tillering
28.8
23.2
0
20
40
60
80


Growth stage
Copper, ppm
Ear emergence
Copper, ppm
Flag leaf emergence
Copper, ppm
Stem extension
Copper, ppm
End of Tillering
9.5
7
0
10
20
30
40
50
60


Growth stage
Boron, ppm
Ear emergence
Boron, ppm
Flag leaf emergence
Boron, ppm
Stem extension
Boron, ppm
End of Tillering
2.5
4.9
0
10
20
30

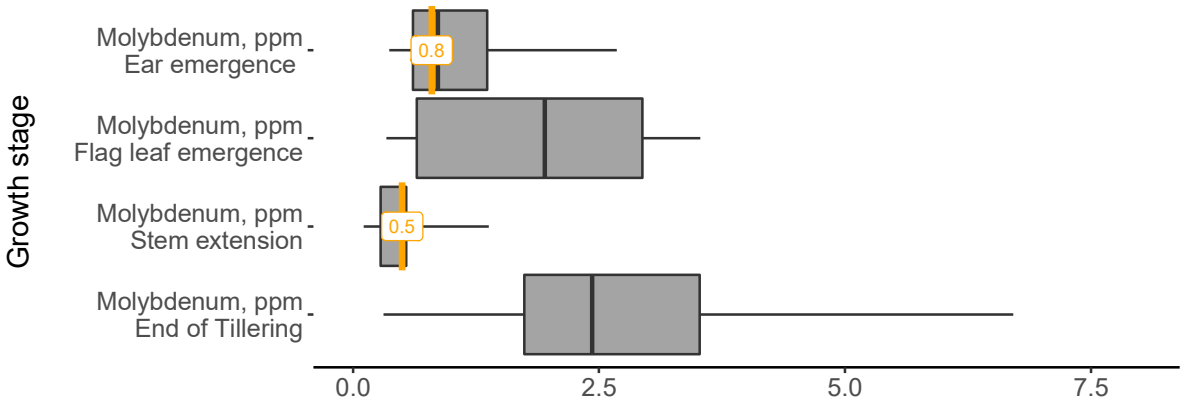
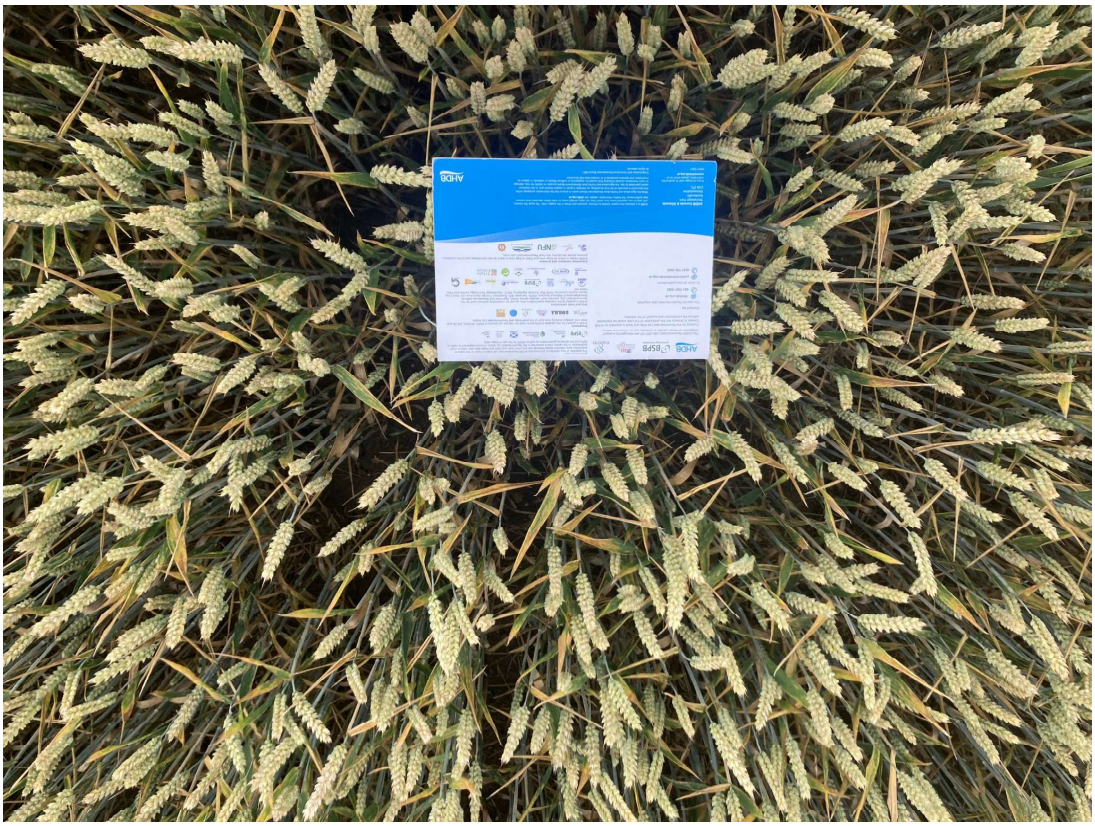
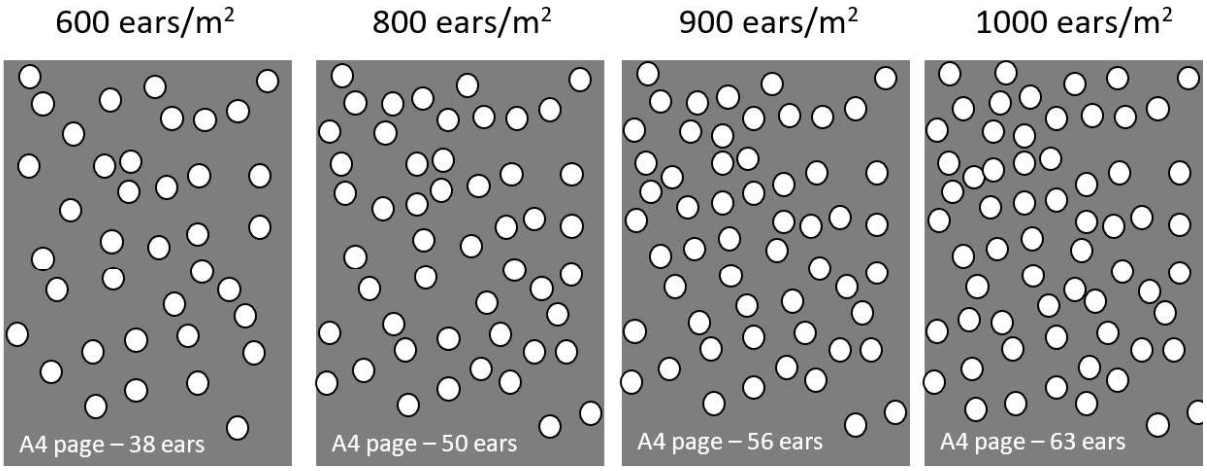

Growth stage
Molybdenum, ppm
Ear emergence
Molybdenum, ppm
Flag leaf emergence
Molybdenum, ppm
Stem extension
Molybdenum, ppm
End of Tillering
0.8
0.5
0.0
2.5
5.0
7.5

Image of this entry

Images are a very efficient way of collecting lots of information. An overhead photo taken during grain filling gives an impression of canopy size, nutrition and health, as well as providing an independent assessment of ears per m^2 (see diagram below). An overhead photo taken at the start of stem extension is similarly useful.



An A4 sheet of paper in your image can help to assess ear numbers per m^2, as shown here:

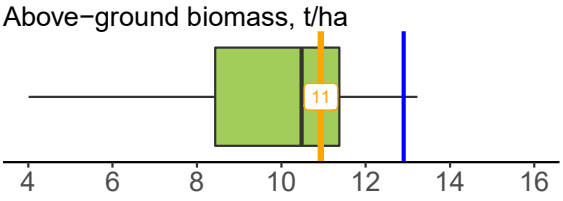


Yield formation

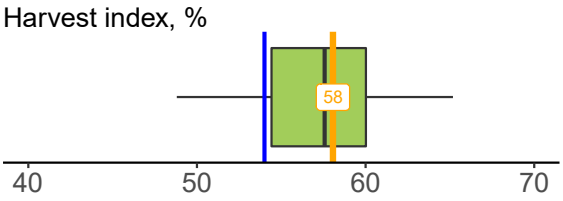
The whole-crop samples that YEN entrants provide all have their components counted and weighed and results are shown in the following charts, assuming that each sample was representative of the whole area from which grain yield was determined.

Total biomass production indicates the success with which a crop captured its key resources, light energy and water, and the harvest index (the proportion of total biomass that was harvestable) indicates how this biomass was apportioned to grain. Since grain growth happens last, harvest index also indicates how late growth related to early growth.

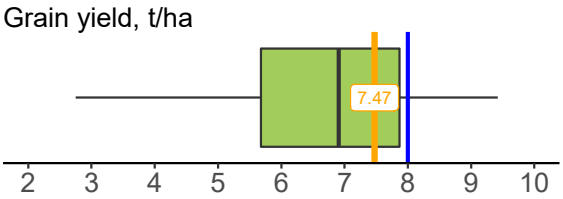
Your grain yield (expressed as t/ha and % of potential) is shown below along with biomass and harvest index, in relation to all other YEN entries.



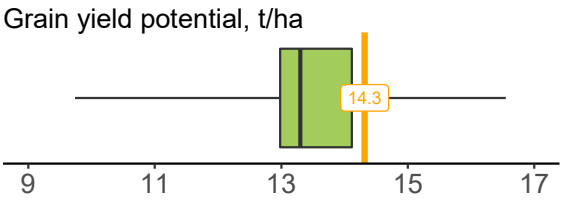
YEN 2021 biomass figures were lower than average compared to previous years, likely as a result of the dry spring restricting tillering and delaying N uptake. The benchmark biomass is 12.9 t/ha*.



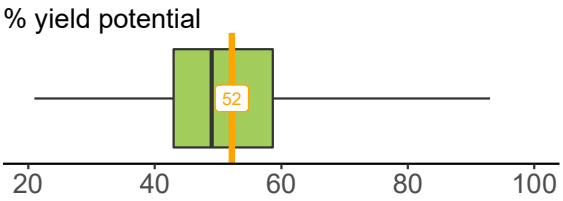
Harvest index is the percentage of total biomass that was harvestable as grain; values were high in 2021. Years with few fertile shoots tend to have high harvest indexes. The benchmark harvest index is 54%*.



YEN yields averaged 6.6 t/ha in 2021; this compares to 7.1 t/ha in the previous season, 2020. The benchmark yield is 8.3 t/ha*.



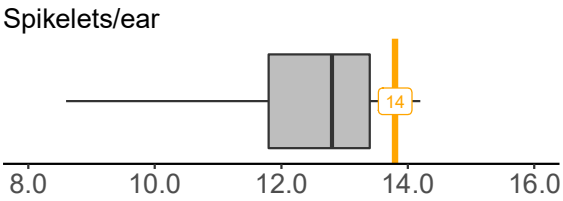
YEN yield potential is estimated from the light energy and water available at the site of your entry this year, simply converted to t/ha. We used a new model (which makes water limitation more common) to estimate yield potentials in 2021.



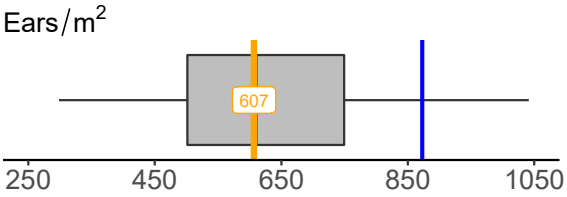
Yields achieved by YEN entries in 2021 averaged 51% of their estimated potential, which is very similar to that achieved by crops in 2020

Yield components

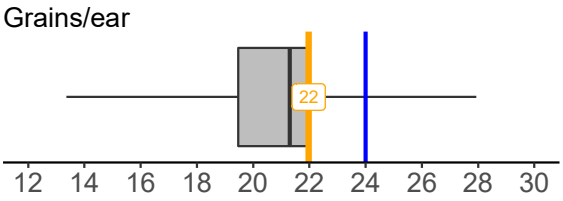
Whole crop yield analysis can also tell us about the history of your crop because the different components are determined sequentially. So comparing components of yield for your crop in the following charts with those of other YEN entrants should help to indicate the stage(s) through the season at which your crop deviated from others in 2021 and from normal (represented by the AHDB or Teagasc Benchmarks, blue lines).



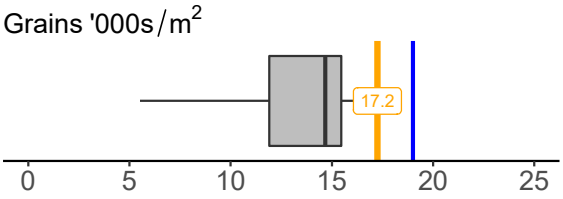
Spikelets are determined between GS30 (ear at 1cm) and GS31 (1st node). Numbers are important because current spring barley varieties are all 2-row and only produce one grain per spikelet.



Maximising the number of fertile shoots (i.e. ear numbers) is critical for barley yields due to yield being sink limited. The benchmark is 873 ears/m^2* and average ear numbers were low for spring barley this year.



Grains per ear are set in the 2-3 weeks before flowering. Barley is less able to compensate for low ear numbers by increasing grain number. Spring barley crops normally produce 19-24 grains/ear and grains per ear were average this year.



Spring barley yields are highly dependent on grains/m^2. The benchmark for grains/m^2 is 18,597*. The number of grains/m^2 was low in 2021, driven by mainly by lower ear populations.

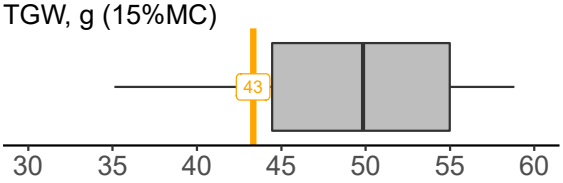
Grain formation and size

We use your combine-harvested grain sample to provide the analysis of grain size and grain filling on the next page. Grain filling depends mainly on photosynthesis after flowering, therefore it largely relies on the health and longevity of the green canopy, but sugars stored in the stem can also provide 20-50% of assimilates for grain growth and most of the protein from senescing leaves is also redistributed to form grain protein.

We have not measured stem sugars in YEN so far, but it is possible to assess them using a refractometer. It is likely that stem storage was less than the benchmark of 1.5 t/ha in 2021, because conditions during May were dull.

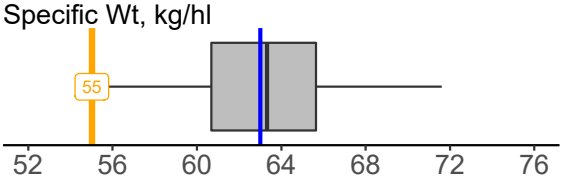
If grain number per m^2 is low (see above), or if conditions during early grain-fill are limiting, final grain filling, hence yield, may be constrained even if later conditions are good – this is sometimes described as 'sink' limitation. We try to use analysis of grain volume and grain density to deduce whether crops were limited by sink (well filled grains) or limited by availability of source during grain filling (partially filled grains). It should be recognised that spring barley crops are commonly sink limited.

TGW, g (15%MC)



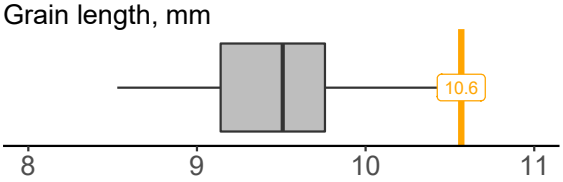
Thousand grain weights (TGW) can be small either because of low storage capacity (set in the 2 weeks after flowering) or poor conditions for filling, later. This year, average TGW was slightly lower than normal, probably because July was not bright but warm and August was dull.

Specific Wt, kg/hl



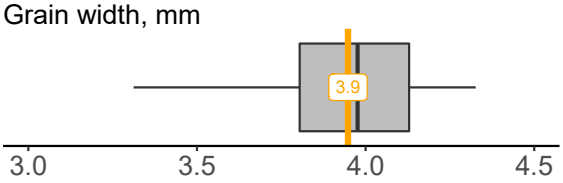
Specific weight is a measure of individual grain density and how the grains pack together. Large, well filled grains have a high malt extract potential. The benchmark for specific weight is 63 kg/hl*.

Grain length, mm



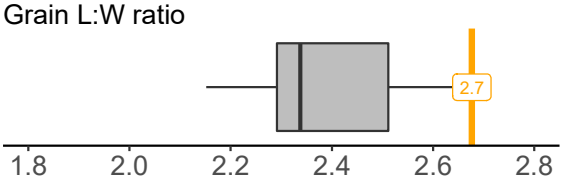
Grain length is set before grain width, and tends to indicate potential grain storage capacity.

Grain width, mm



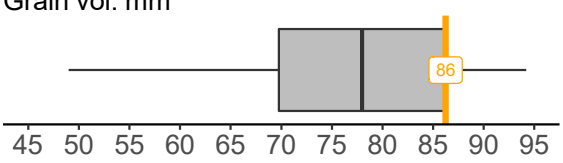
Grain width reflects the success with which grain storage capacity is filled.

Grain L:W ratio



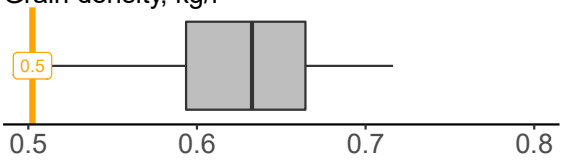
A high ratio indicates that the grain may not have achieved its potential for filling set soon after flowering.

Grain vol. mm^3



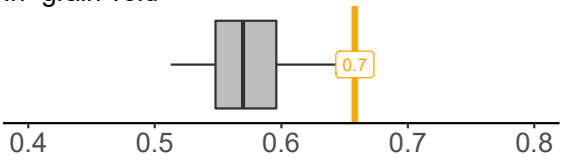
Grain volume here is the product of length and cross-sectional area, assuming grains are ovoid, so this volume includes the grain's 'crease'.

Grain density, kg/l



We think high density - >1 kg/l - may indicate that grain filling was constrained by storage capacity (volume) - often termed 'sink limitation'.

In−grain void

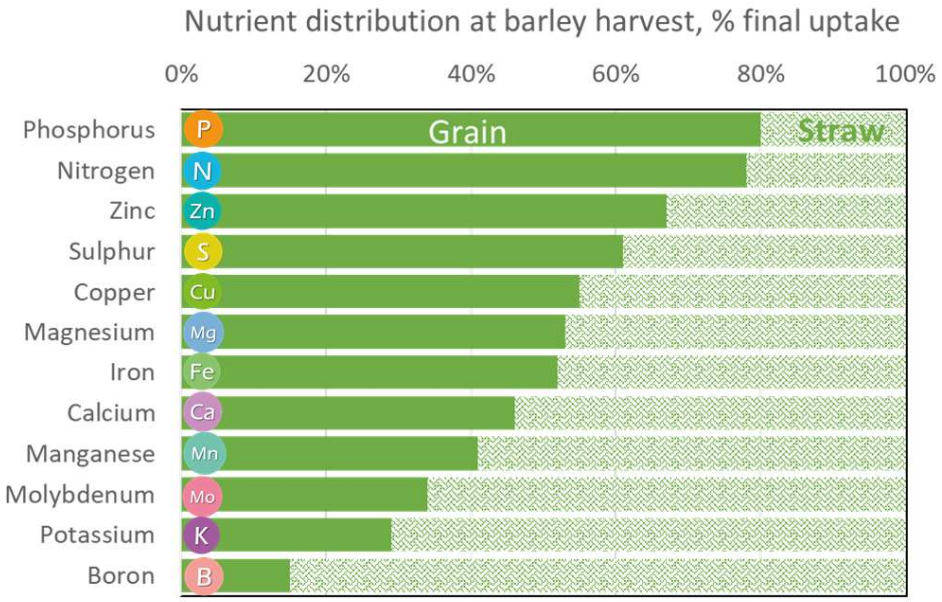


The density of starch, the main grain constituent, is 1.5, so it is possible to estimate the proportion of grains' unfilled volume - 0.56 (56%) on average here. This includes the crease.

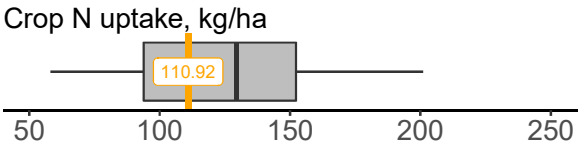
CROP NUTRITION POST-MORTEM

The YEN has trail-blazed use of grain analysis to provide an overall post-mortem on each crop's nutrition.

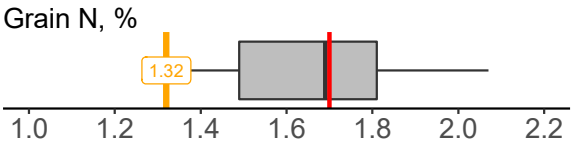
- Results from >300 YEN Spring barley samples analysed up to last year suggest that the nutrients harvested in the grain for many crops is on the low side, and many crops could be deficient.
- YEN Nutrition was therefore launched in 2020 to provide an opportunity for the sharing of grain analysis, yield and nutrient input data to further our understanding – further details and registration are available here
- Crop nutrients differ in how they are shared between grain and straw at harvest. The graph below shows how different crop species store most of their N and P in the grain but most of its K in the straw. These proportions are estimated from published tables of average feedstuff analyses.



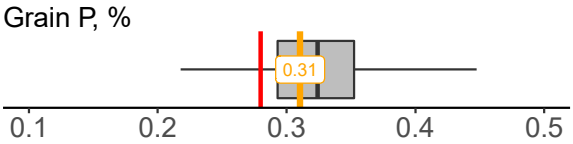
- This year we are using YEN-low values (i.e. lower quartiles from all past YEN data – the boundary between the bottom quarter and top three-quarters of values) as comparators for all nutrients in all crops. We find YEN-low values to be very similar to critical thresholds of N, P, S and Mn in wheat, as well as to less certain critical values of K, Mg, Cu & Zn, so we assume they can be applied for all nutrients in all crops.
- The following benchmarking-charts and YEN-low values provide the best means of identifying the nutrient(s) most likely to have limited your crop.
- Critical grain N levels are variety-dependent so it's best to compare your value with the value reported in the AHDB Recommended List for that variety. If the observed grain N levels are significantly less or more than the RL value, we take this to indicate that this crop was under- or over-supplied with nitrogen. However, market requirements for malting crops will obviously affect grain N% and that should be accounted for with the interpretation.



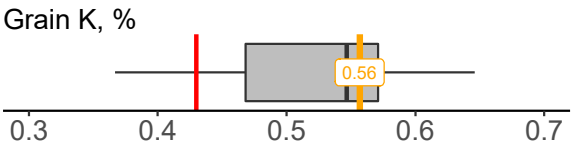
Uptake of 140kg/ha N (GAI=5) is required to build a canopy that can intercept most of the available light. However, beyond 6-7 t/ha, more N than this – around 20 kg N / tonne is required to maintain grain N concentration.



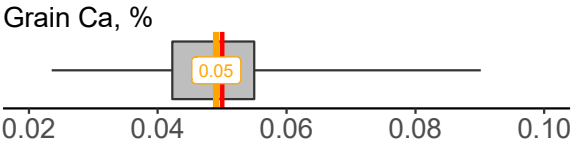
Barley market specifications for the distilling/brewing industry include: malt distilling (below 1.66%), brewing (1.60-1.86%) and grain distilling (above 1.85%)



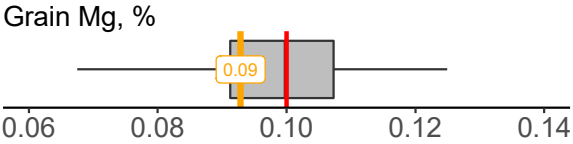
Recent work has shown grain P analysis can provide a useful check on sufficiency of phosphorus. Values less than the YEN low value of 0.28% could indicate further checks on P nutrition are required.



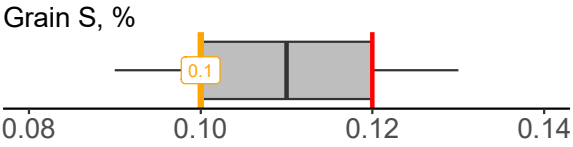
RB209 assumes a standard value of 0.56% potassium (K) in grain. Values less than the YEN low value of 0.43% could indicate further checks are needed.



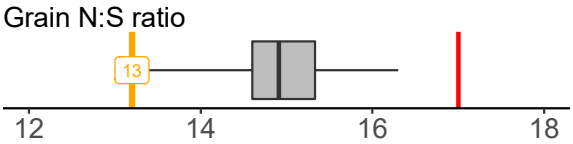
Calcium nutrition relates to the crop's use of water. However, almost all the crop's calcium remains in the straw at harvest, so we are yet to learn whether grain calcium can tell us about the crop's water status.



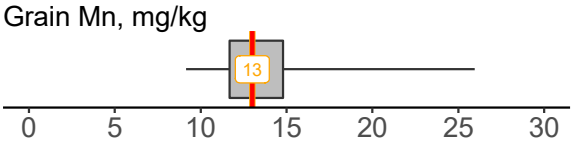
Low grain Mg levels are less than 0.1%, which may provide a useful guide for when to check on soil levels and crop symptoms.



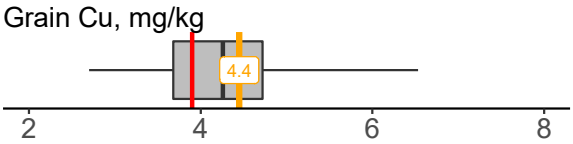
S is required in proportion to grain protein (especially glutenin) formation. Grain with <0.12% S may indicate deficiency.



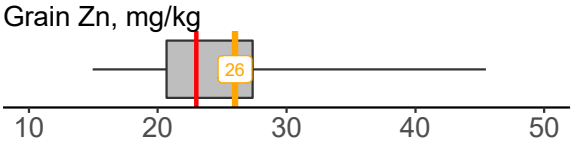
The higher the N:S ratio, greater than about 17, the more likely the crop is to have suffered from sulphur deficiency.



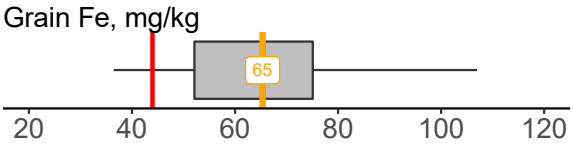
Low Manganese (Mn) values in grain are <13mg/kg for barley – and it appears that Mn deficiency is more common in barley crops than wheat.



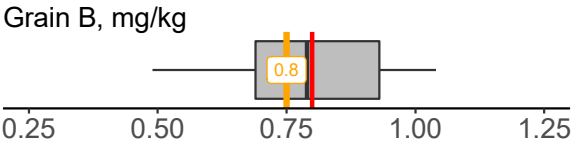
Low copper (Cu) values in grain are <3.9mg/kg for barley. Some crops showed Cu below this in 2021.



Zinc (Zn) values below 23mg/kg are classed as low, but whether these should be treated as limiting is uncertain. Some crops showed Zn below this in 2021.



Whilst grain iron (Fe) may prove useful with further experiment, we are unsure about interpretation. The YEN low value of 44mg/kg can be used as a guide.



Most Boron is kept in the straw. Previous YEN boron values have varied hugely with season, so grain analysis may not be useful for assessing boron sufficiency.

SUMMARY

The 2020-21 competition:

- Many congratulations for providing the information necessary to complete this report; the collective efforts of all YEN contributors serve to maximise the value of what can be reported and the deductions that can be made for everyone – we call this approach 'learning by sharing', and believe that the whole industry would benefit by making this approach their normal practice.
- We are pleased provide this separate Cereal YEN report for spring barley. We hope that being able to benchmark your crops against other spring barley crops is both useful and informative.
- The winning percentage of yield potential achieved in 2021 was 82%, with a grain yield of 8.0 t/ha (Aberdeenshire) also with a grain N% of 1.6.
- Clearly there is an element of luck in achieving high yields at a particular site in any particular year. However, it is striking that some farms are consistently achieving high yields, and several farms have achieved YEN Awards over several seasons. We are coming to recognise that there is an important 'farm factor' which plays a big part in governing yield levels. This gives real value to being a YEN participant – through having an opportunity to compare with and learn from others. Estimated UK farm average yields in 2021 were slightly better than the 5-year average for each of the cereals; YEN yields far exceeded farm averages, except for spring barley:

Cereal yields in 2021	Winter wheat	Winter Barley	Spring Barley	Oats
AHDB farm yield estimate, t/ha	8.1	7.0	6.6	5.7
Change from previous 5 years	+2%	+2%	+7%	+6%
Average YEN yield in 2021, t/ha	10.7	8.5	6.9	7.6
Change from previous 5 years	+1%	NA	NA	NA

- In terms of physiology, high barley yields have been shown to result from achieving many grains/m2, primarily from many ears/m2.
- The 2021 spring barley growing season was again characterised by stark contrasts in weather, which posed significant challenges to many crops across the country. Crop establishment was good in most parts but a dry and cold spring resulted in poor early N uptake. Wet conditions in May contributed to good tiller retention but generally ear numbers were on the low side.
- Warm and sunny conditions during flowering led to good numbers of grains/ear but dull conditions in the late summer restricted grain fill, causing lower than normal thousand grain weights, and a drawn out harvest due to moistures being slow to come down.

Comments on the next page are generated automatically from your data, with the aim of high-lighting features of your crop which may point out routes to yield-enhancement on your land.

SPECIFIC COMMENTS ON THIS ENTRY

Resource capture, growth and yield:

- Your entry yielded 7.5 t/ha, the benchmark spring barley yield is 8.3 t/ha

- High YEN yields have generally been associated with high biomass production. Your yield arose from a normal total biomass and a very high harvest index.

- Our target for annual light interception by annual crops (whether sown in autumn or spring) is 60% compared with 52.4% achieved by this crop.

- Maximising fertile shoots is critical for barley yields. Your crop achieved fewer ears than the benchmark 873 ears/m2.

- Your crop is estimated to have had a TGW of 43g. TGW can be small either because of low storage capacity or poor conditions for filling.

- Specific weight is a measure of individual grain density. Large, well filled grains have a high malt extract potential. Your crop achieved a lower specific weight than the benchmark of 63kg/hl.

Crop Nutrition:

- Your soil is estimated to be pH 6. Low pH soils can limit yield.

- Grain N content of this crop was low for LG Diablo, indicating a likely inadequate N supply or fertilising for a lower market requirement

- Uptake of 140 kg/ha is required to build a canopy that fully intercepts light. However, beyond yield of 6 t/ha, an additional 20 kg N/ tonne is needed to maintain grain N concentration. We estimate that uptake of 169 kg/ha of N was required for your crop, compared with the 111 kg/ha taken up.

- Your grain is estimated to have had 0.09% Mg. Less than 0.1% indicates a need for further checks on Mg nutrition.

- Your grain is estimated to have had 0.1% S. Less than 0.12% indicates a need for further checks on S nutrition.

Short review of cereal YEN 2020-21

Cereal YEN saw completed entries from 203 crops in the 2021 harvest season, including 42 spring barley and oat crops, with an average yield of 10.4t/ha. As last year, the winning field yield in 2021 was 15.6 t/ha (in Lincolnshire). Yield potentials ranged between 11.4 and 22.2 t/ha, with entries averaging 65% of potential achieved. Winter cereals established well in most incidences, with a cool and bright spring supporting high ear numbers. However, this was followed by a disappointingly dull summer which resulted in unrealised potential, and poorly filled grains. This was reflected in low harvest indices as crops with high shoot numbers failed to achieve sufficient grain fill., generally the dull summer was the biggest constraint on yields.

Update on Wheat Quality Competition

The YEN Wheat Quality Award, sponsored by UK Flour Millers, will take place again in 2022. All Group 1 wheat entries which provided a large grain sample are entered and the best will be short-listed. Following breadmaking analysis and assessment the winners will be announced during the AHDB Milling Wheat Conference on Tuesday 22nd February 2022. There will be in person or online attendance options. Look out for more information in the coming weeks on the AHDB events pages

AHDB events

Several AHDB Monitor Farms entered the YEN competition for 2021 and YEN will be included in a number of upcoming monitor farm meetings, please visit the AHDB website for more details. The AHDB Agronomist's Conference takes place on 7th December 2021 at the Peterborough Marriott Hotel. Attendance is either in-person or online.

YEN Nutrition

YEN Nutrition was initiated last year because YEN data have indicated that the majority (>80%) of crops have inadequate nutrition, one way or another. This new YEN connects anyone – farmers, advisors, suppliers and academics in the UK or abroad – seeking to improve nutrition of any grain crop – cereal, oilseed or pulse. Membership begins with grain analysis and grain nutrient benchmarking on six or more fields. Further details are available here.

YEN Technical Webinars

Please join us for a series of technical webinars and register for these events if you haven't already done so:

The 2021 YEN Awards - 24th November 2021, to be held at Croptec at East of England Showground, Peterborough, PE2 6XE.

Register here for a free ticket to Croptec

Then register here for the YEN awards

Cereal YEN Technical Webinar - 6th December 2021, 3.30pm to 6.00pm

Register here for the Cereal YEN Technical Webinar

Oilseed YEN Technical Webinar - 8th December 2021, 3.30pm to 6.00pm

Register here for the Oilseed YEN Technical Webinar

CONTACTS

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Or email yen@adas.co.uk for general enquiries. @adasYEN

YEN SPONSORS

The YEN was initiated by industry and is entirely industry funded. We are most grateful to all our sponsors. They not only provide funding but they are fundamentally involved in management of the YEN and in supporting individual farms in making their YEN entries. The YEN would not exist without them!

Visit www.yen.adas.co.uk for sponsors' details, news updates and to register for 2021.