Entrant's Report

Harvest 2024

YEN Field ID: Example

Entrant name: Example

Main contact email: Example

Sponsor/supporter: Example

Sponsor/Supporter email: Example

Field/Site name: Example

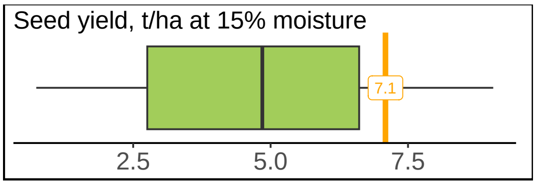
Incident energy: 35 TJ/ha

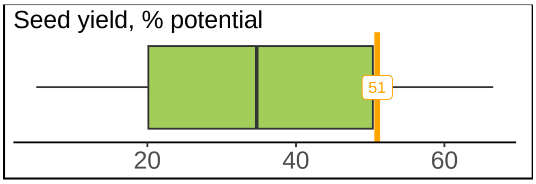
Available water: 422 mm

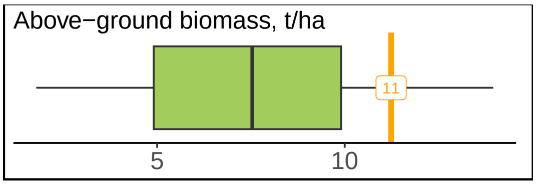
Crop: Winter bean

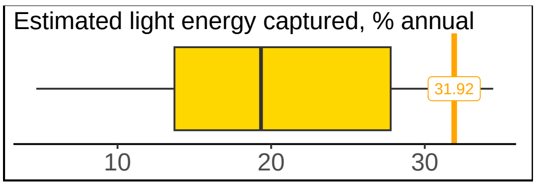
Variety: Example

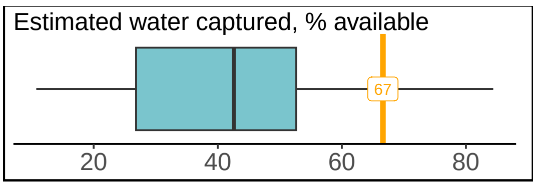
SUMMARY: YEN entries with yield were completed from 10 winter and 15 spring crops out of 36 original entries. This year we are classing crops by their sowing season rather than variety type. Headline results for your entry are shown in benchmark diagrams below. Your yield of 7.1 t/ha represents 51% of its estimated yield potential of 13.9 t/ha.

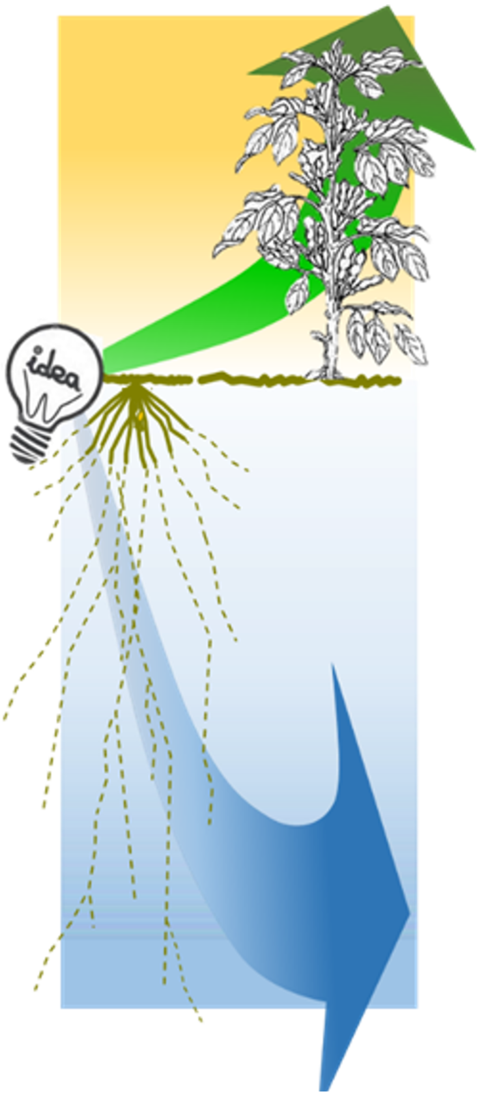












CONTENTS

Our detailed analysis of your yield result is provided in the following pages, including comparisons with other YEN entries, and with benchmarks derived from previous YEN data where possible. We hope that this helps you to identify aspects of your husbandry and growing conditions that offer possible routes to further yield enhancement.

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

The benchmarking diagrams in this report only include the data set submitted by the YEN data submission deadline. Reports produced using data submitted after this deadline show an entrants value in comparison to this previously reference data set.

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

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

(i) **70% capture of light energy** through this season (including some in September), and its conversion to 1.2 tonnes of biomass per terajoule, or

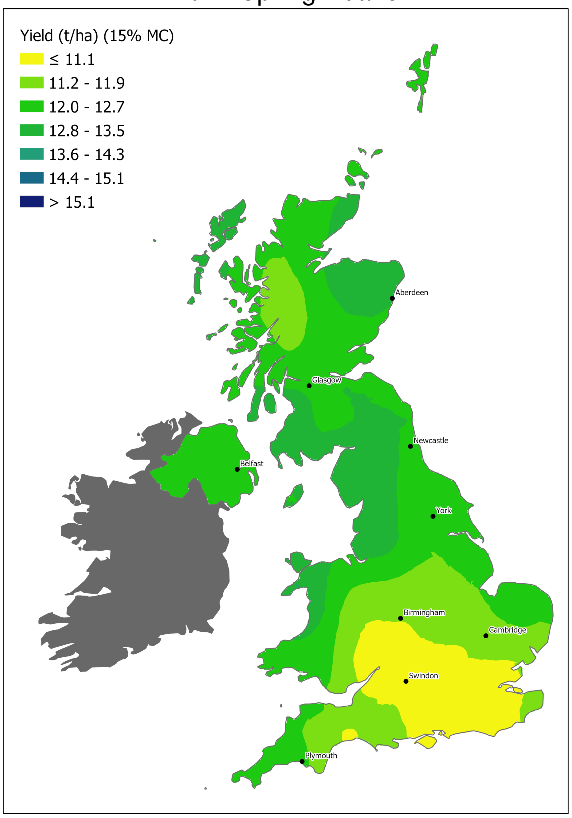
(ii) **Capture of all the available water** held in the soil to 1 m depth (or to rock if shallower than 1 m) plus all rainfall from April to July, and conversion of each 25 mm into a tonne of biomass per hectare. Our model of potential yield estimates potential growth on a daily basis; this identifies impacts of water limitation more precisely than the cruder monthly estimates we made in previous YEN reports.

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

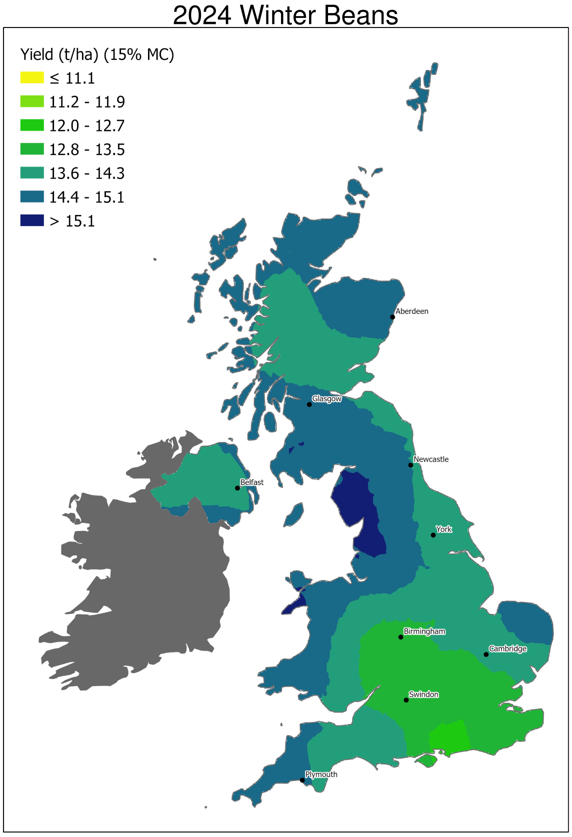
The maps below show the potential seed yields for autumn sown cereals on retentive and light soils this year. For this we assume deep soils with no irrigation.

2024 Potential yields

2024 Spring Beans



2024 Winter Beans



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

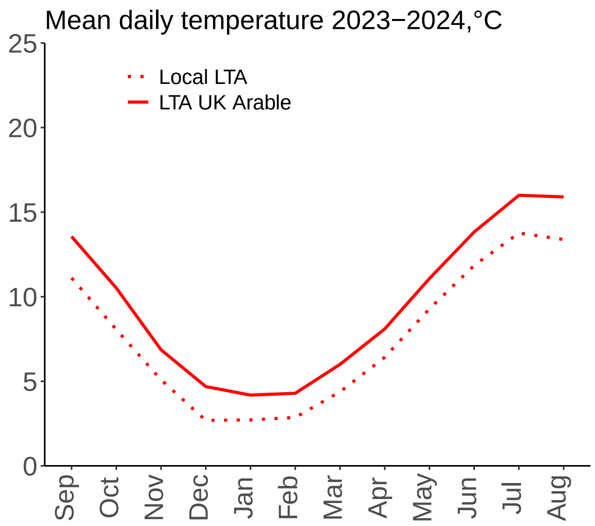
The adjacent graphs show the monthly temperatures, rainfall and total solar radiation for your area through this growing season compared to your regional long-term average (LTA) and the average for all UK arable areas (1981-2010, from the Met Office).

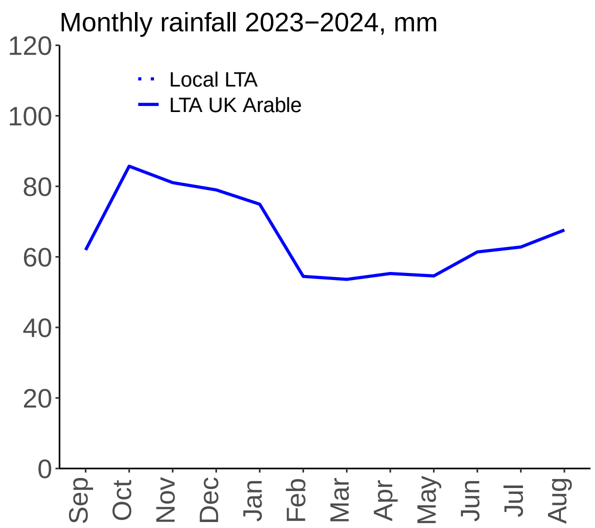
Autumn 2023 and the subsequent winter saw rainfall 125% above normal, with some regions being even higher, causing issues getting the crop drilled into good conditions. The temperatures were mild, causing few concerns about frost damage. Spring bean drilling may have been delayed as the weather conditions continued to be wet and some were drilled into less-than-ideal conditions.

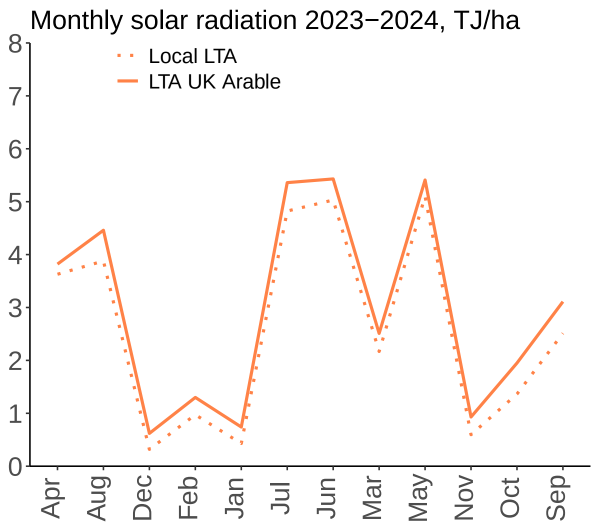
Spring 2024 saw warm spring days followed by cool humid nights allowing bean rust infection to take hold and potentially difficult to control in some regions. Chocolate spot was also present.

Summer 2024 had mild temperatures, which limited the potential for flower abortion and poor pod set. Higher levels of seed set were seen in the average YEN crop compared to last year. There were some localised reports of bean aphid infestations.

Despite the wet start and challenging drilling conditions for both winter and spring beans, yields were average, if not above average.

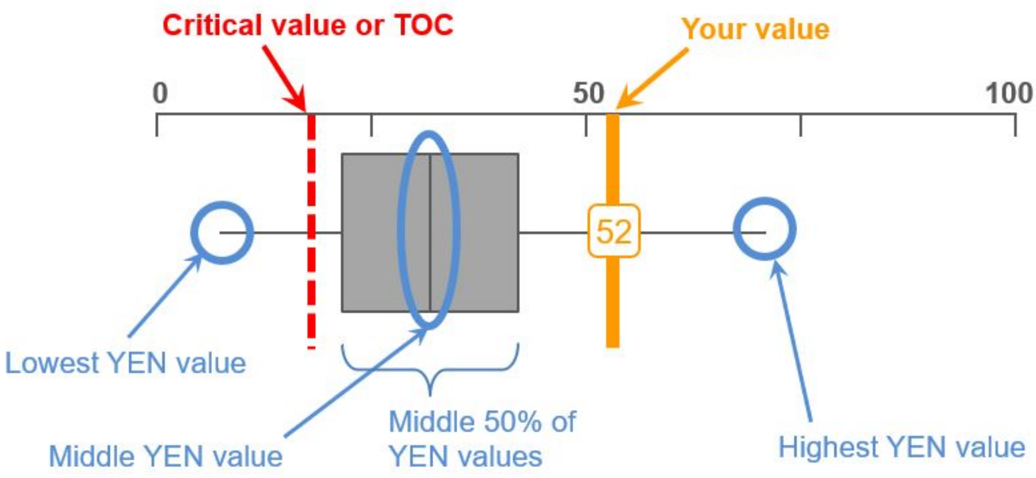






YEN Benchmarking charts – What do they mean?

YEN 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 this year 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 2024 whilst the grey box shows the middle half of 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.
Note that 'Dynamic Benchmarking' is available to all YEN members via the YEN website. This means you can compare your own yield or seed nutrient data with subsets of all other YEN crops selected by crop type, soil type, location or year back to 2013.

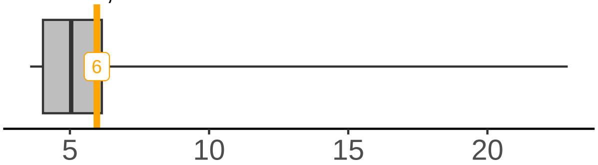
Soil description and nutrition analysis

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').

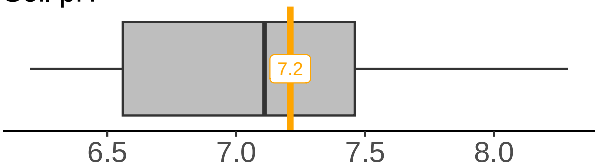
Topsoil analyses provided by NRM also tell us about soil status for pH, P, K and Mg, as reported on the next page. A few sites show low values for soil pH, P, K or Mg. If these are unexpected, they may need further checks, either by repeating soil analysis and by checking both leaf and seed analyses later in this report. Previous YEN leaf and seed 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 seed analysis, the YENs now help to diagnose whether nutrient shortfalls are arising from poor supply, or poor capture by the root system.

Soil OM, %



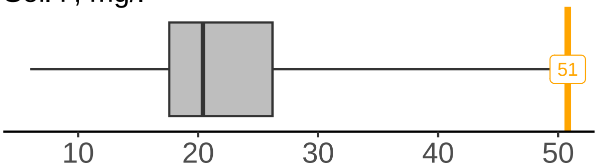
SOM supports crop performance through better nutrient availability, soil aggregation, and water holding capacity. NRM determines SOM by ‘loss on ignition’. Note: other methods can give lower values.

Soil pH



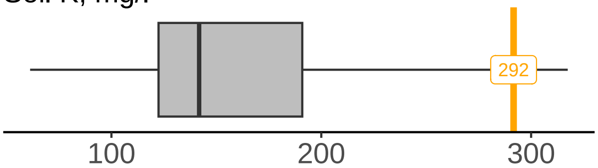
Soil pH <6 is acid. High pH soils may require that special attention is paid to phosphorus (P) and micro-nutrient levels in the leaf and seed (see later).

Soil P, mg/l



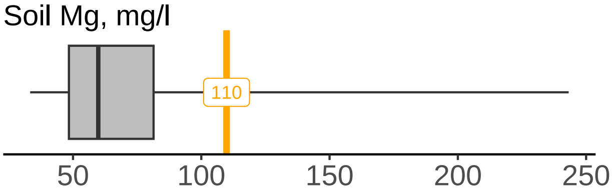
Only a small difference separates P Index 0 (<=9) and 2 (>=16). High yields are possible at P index 1 but fresh P is also usually required. Use seed P (see page 20) to double-check if P was sufficient.

Soil K, mg/l



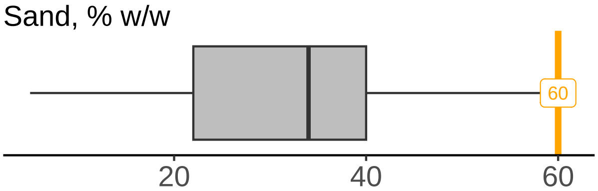
Soil potassium (K) analysis checks on whether K supplies are likely to have been deficient for average crops. However, high yielding crops require very large amounts of K.

Soil Mg, mg/l



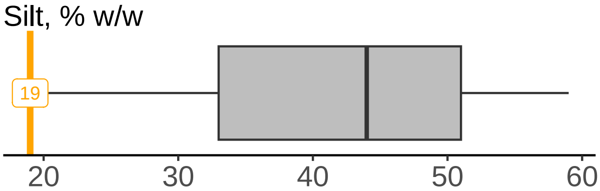
Magnesium (Mg) is a key component of chlorophyll so deficient plants show striking inter-veinal yellowing. Temporary deficiencies often occur in spring if topsoils are dry.

Sand, % w/w



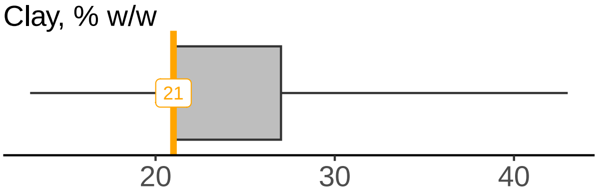
Soils with high sand content hold the least water and soils with high silt content tend to hold the most water.

Silt, % w/w



Soils with much silt and sand, hence less clay, tend to be relatively weak, and so are more difficult to maintain with a stable structure.

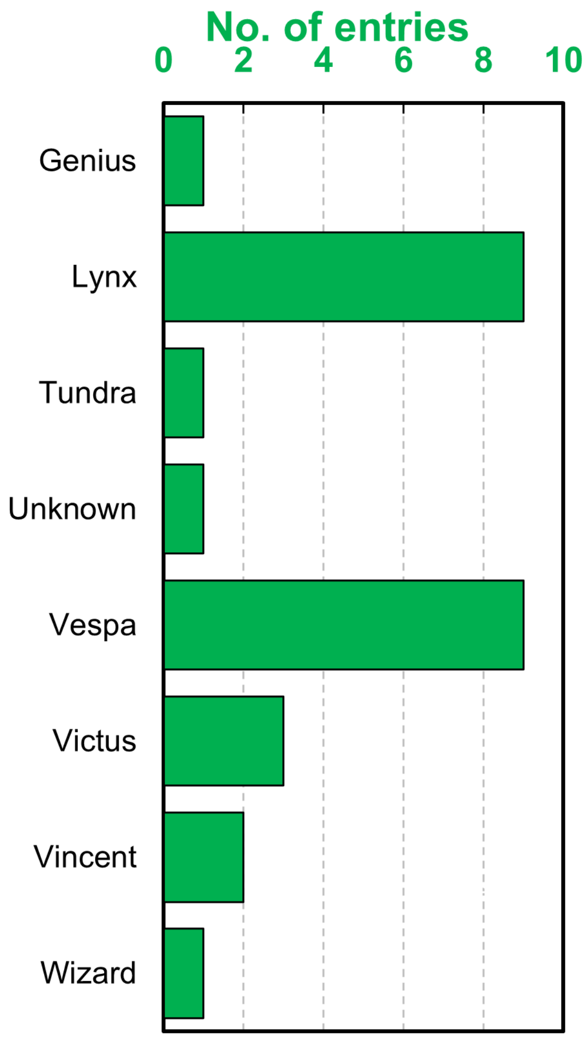
Clay, % w/w



Soils with high clay content hold much water but part of this is held too tightly for crop use. Nutrients within this unavailable water tend to be less available than nutrients in lighter soils.

This section considers how your variety and husbandry decisions related to others entering the YEN this year. The most chosen varieties are compared in the figure below.

- Your variety was Example.

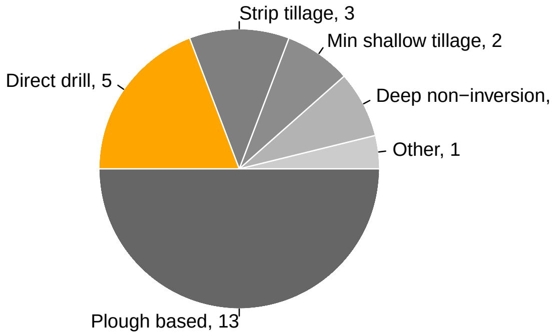


Husbandry factors

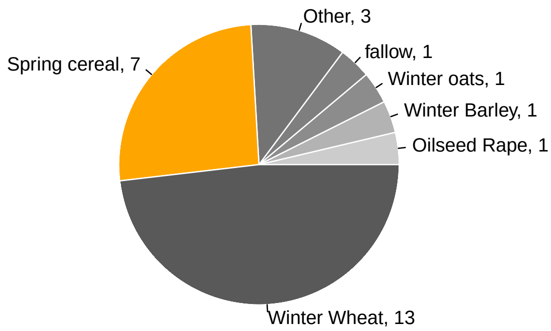
The following diagrams use orange segments or orange bars to indicate the agronomy of your crop, if known, so you can see how this relates to all other YEN entries. Analysis of all Bean YEN entries from 2019-2021 shows the following associations with seed yield (note that these do not necessarily imply causes – it may just be that farms with high yields also happen to have these traits):

Soil type	Better yields on soils with lower clay content. As winters in the Bean YEN have generally been wet, this may suggest potential difficulties of establishment in some heavy soils and improvements to soil structure could be beneficial to yields
Soil analysis	Better yields with more soil P
K inputs and seed K	Better yields with more K
Fungicide use	Higher yields associated with good disease control
Harvest losses	Higher harvest losses associated with lower yields

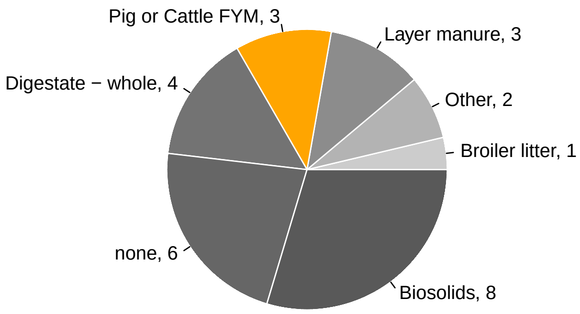
Main cultivation strategy



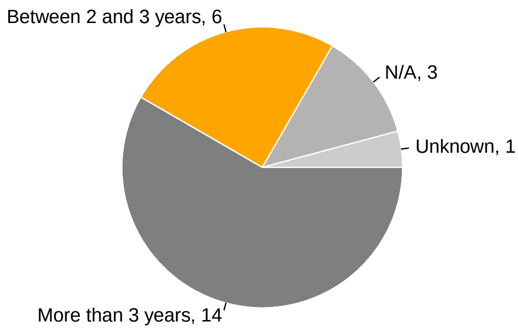
Previous Crop Type



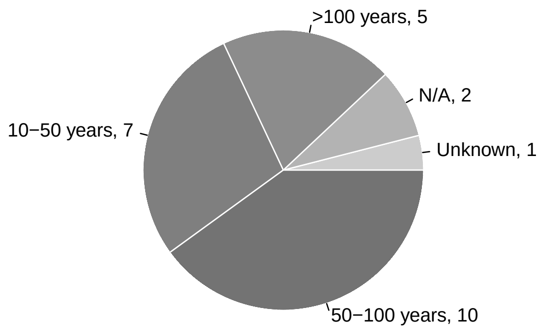
Predominant organic materials applied



Time of wildflowers mixes present

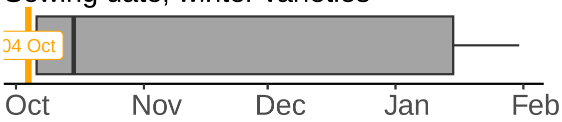


Establishment of nearby woodland/hedgerow habitats

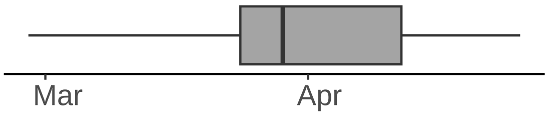


Husbandry factors continued

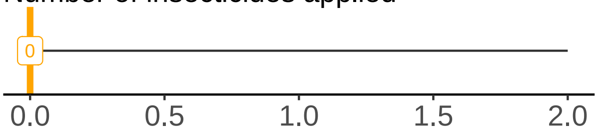
Sowing date, winter varieties



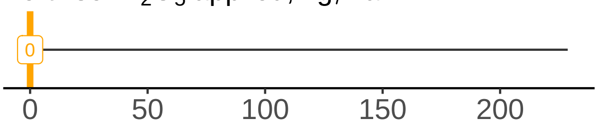
Sowing date, spring varieties



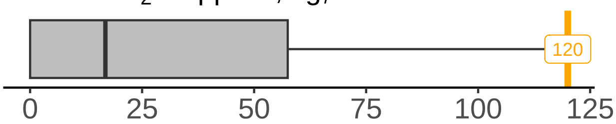
Number of insecticides applied



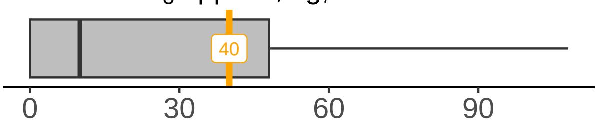
Fertiliser P_2O_5 applied, kg/ha



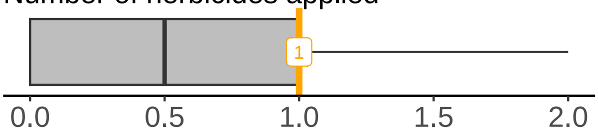
Fertiliser K_2O applied, kg/ha



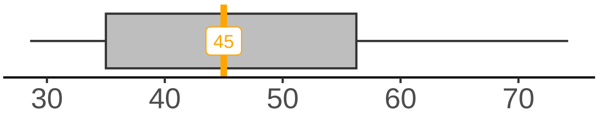
Fertiliser SO_3 applied, kg/ha



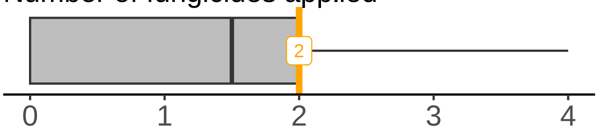
Number of herbicides applied



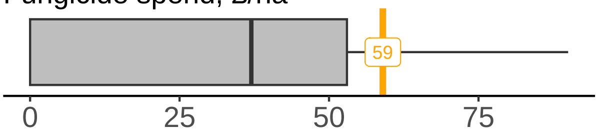
Seeds sown per m^2



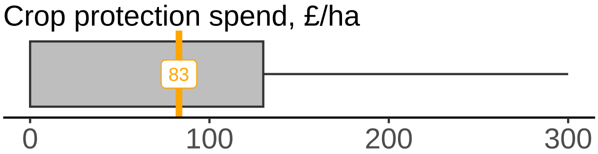
Number of fungicides applied



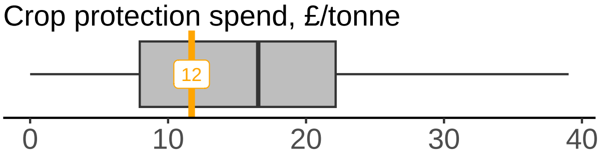
Fungicide spend, £/ha



Crop protection spend, £/ha



Crop protection spend, £/tonne



The following charts show how your entry developed through the 2021-22 season, compared to all other Bean YEN entries and Benchmarks. The cardinal stages of emergence (GS10), flowering (GS61) and full senescence (GS89) determine the length of each phase for growth:

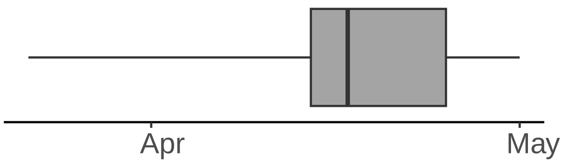
- Foundation, GS10-GS31 – when development of leaves and side shoots occurs;
- Construction, GS31-GS61 – when stem elongation occurs, and flowers are formed;
- Production, GS65-GS89 – when pods are formed, and seeds are filled.

We have separated out the dates of development for spring and winter sown crops over the next two pages.

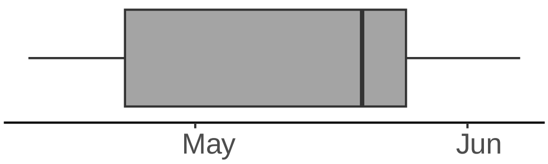
Spring

Crops are sorted into winter and spring by sowing date rather than variety type.

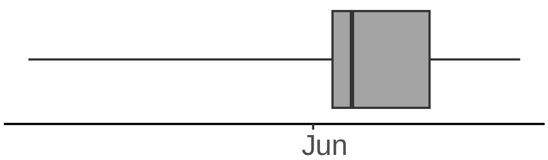
Emergence date, spring



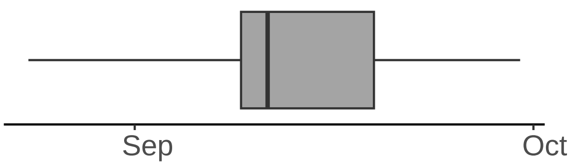
Nodulation (GS34)



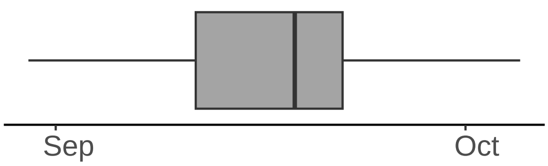
Flowering (GS61)



Canopy senescence (GS87)

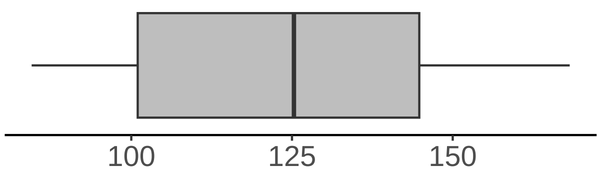


Harvest date

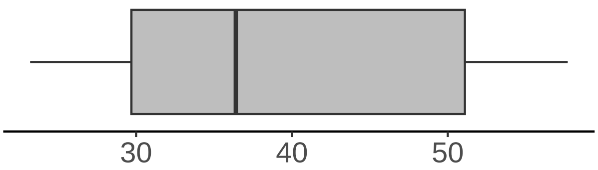


Crop height, cm

These are the average heights from 10 shoots in each grab sample.



Height of the lowest pod, cm

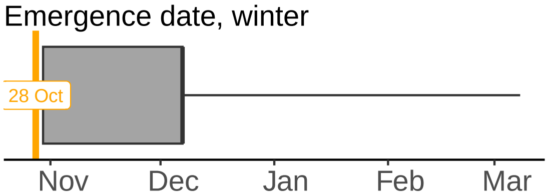


These are the average heights from 10 shoots in each grab sample.

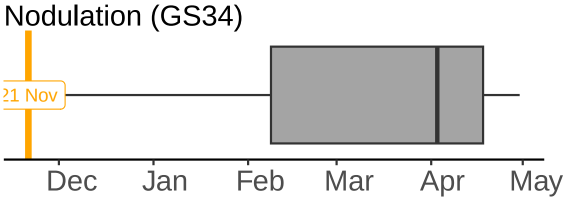
Winter

Crops are sorted into winter and spring by sowing date rather than variety type.

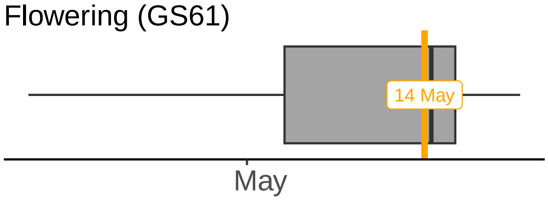
Emergence date, winter



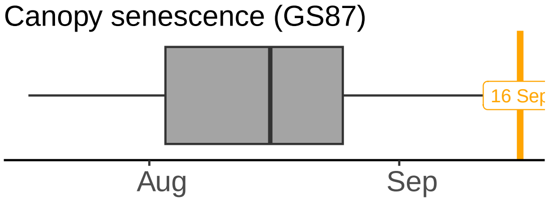
Nodulation (GS34)



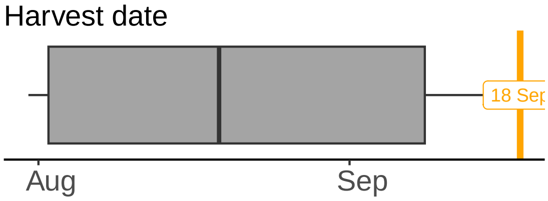
Flowering (GS61)



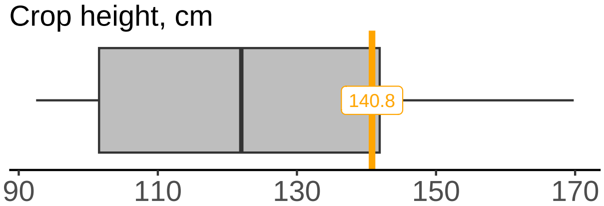
Canopy senescence (GS87)



Harvest date

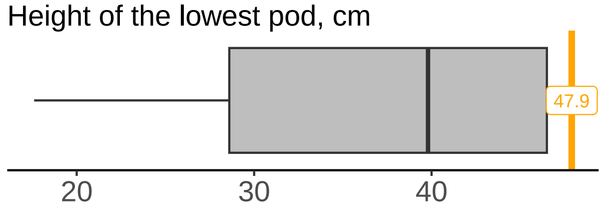


Crop height, cm



These are the average heights from 10 shoots in each grab sample.

Height of the lowest pod, cm

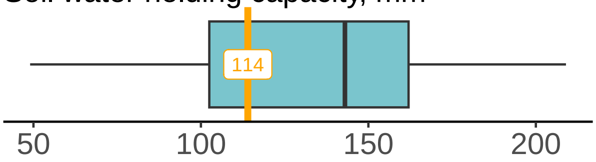


These are the average heights from 10 shoots in each grab sample.

Water availability and capture

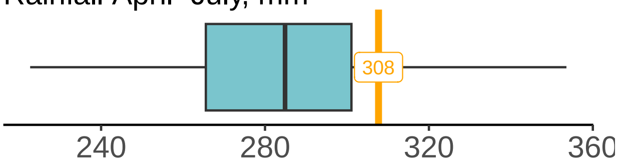
This page shows how weather this year affected the water available for your crop and other crops entered in the YEN. Water is supplied through the main growing period from concurrent rainfall and also from water stored in the soil. UK soils almost always refill with water over-winter. Water potentially available to each crop through the summer includes this soil water plus the summer rainfall (April to July).

Soil water holding capacity, mm



Deep soils hold water to a great depth; we assume roots can access all easily held water (to 2 bar suction) to a depth of 1 m (or to rock, if shallower). If enough roots didn't reach to this depth, capture of soil-available water will have been accordingly less.

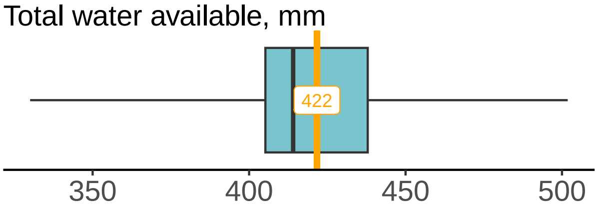
Rainfall April−July, mm



After winter drainage stops, spring and summer rainfall is held in the topsoil until it is evaporated or transpired by the crop's canopy.

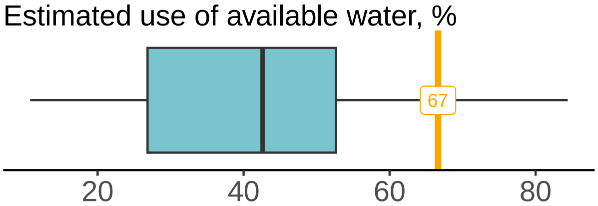
Whilst we cannot yet measure water captured by YEN crops individually, by assuming your crop's conversion of water to total biomass was 'normal' (25 mm water for each t/ha biomass formed), we have made crude estimates below of the likely success of your crop's root system in capturing water.

Total water available, mm



Total water is the sum of your soil's water-holding capacity and your summer rainfall (both shown above).

Estimated use of available water, %



Small 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.

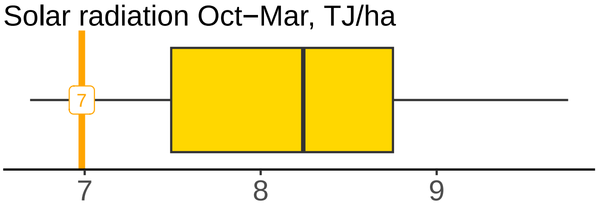
If your estimated use of available water exceeds the total water available, this may be good news! It either suggests that your crop's roots were more efficient than normal, or that your soil description was overly pessimistic: i.e. your soil apparently managed to provide more water than we estimated was possible from your soil's texture, stone content and depth.

A high yielding crop, growing say 9.4 t/ha of biomass (so yielding 5 t/ha seed at 45% harvest index and 15% moisture), would need to capture ~240 mm water from soil reserves plus summer rain.

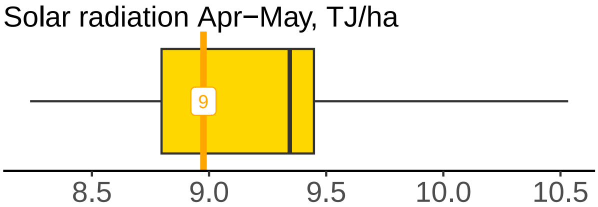
Energy capture

The benchmarking charts below show how weather this year 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:

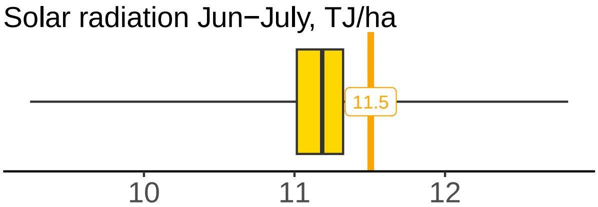
- Foundation – when development of leaves and branches occurs (Winter beans October to March; Spring beans March to May (fewer side shoots formed))



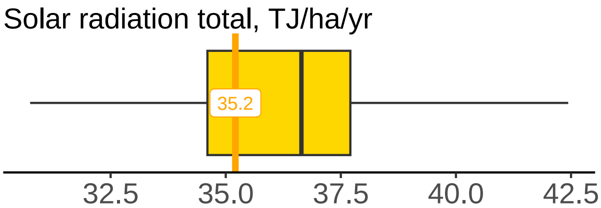
- Construction – when stem elongation occurs, and flowers are formed (Winter beans March to May; Spring beans April to June)



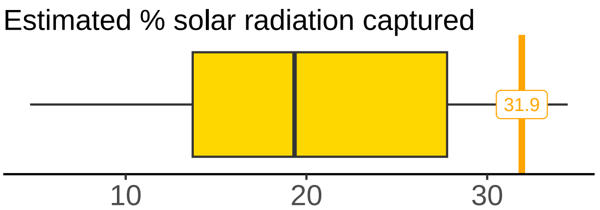
- Production – when pods are formed, and seeds are filled (Winter beans May to September; Spring beans June to October)



Whilst we cannot yet measure light capture by YEN crops individually, by assuming your crop's conversion of light-energy was 'normal' (1 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.



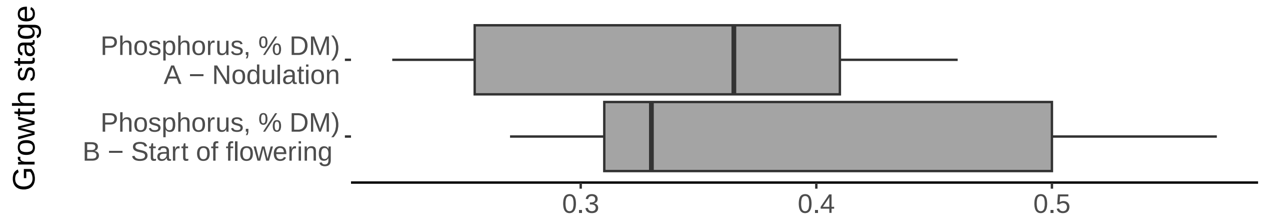
Total solar radiation across YEN entries is generally less in the north and more in the south.

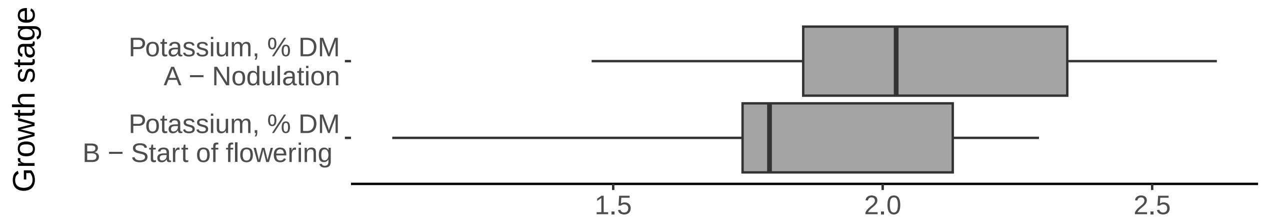


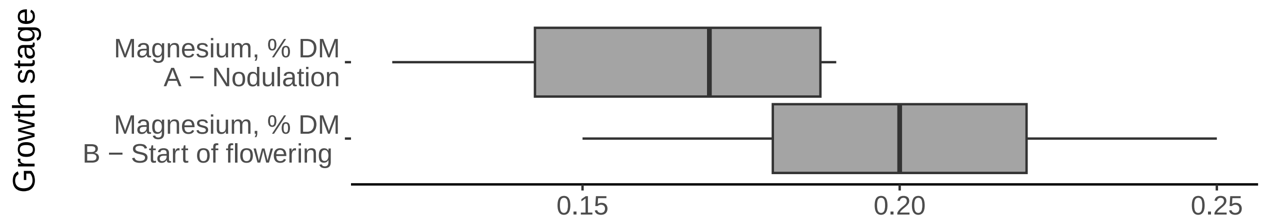
Average light capture tends to be poor if a crop's lifespan is short. The biophysical limit for beans is possibly two thirds.

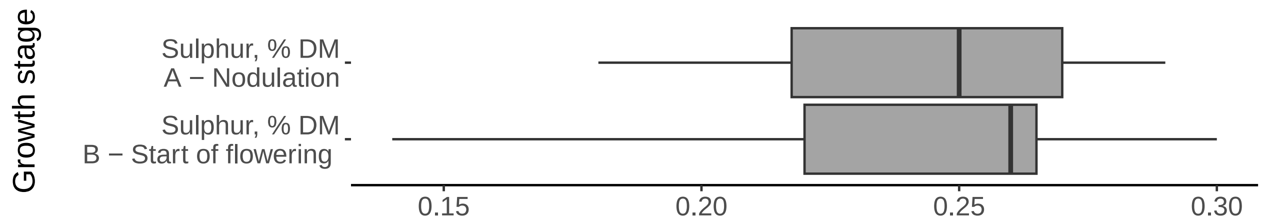
Nutrient capture

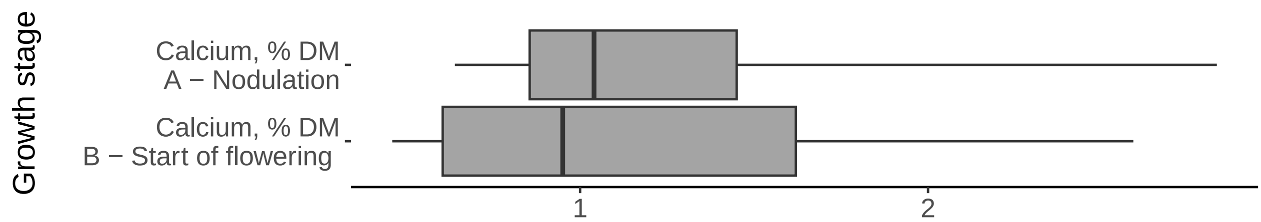
Whether nutrient capture was sufficient to support full conversion of light and water is best deduced from nutrient concentrations in crop tissues – both leaves (next three pages) and seeds (later section). No critical thresholds or benchmarks are shown for leaf analyses because these change through 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 this year, analysed at the same time. Lancrop Laboratories provide leaf analyses for YEN. Samples are of the newest fully expanded leaf. If a nutrient result does not appear on the charts, it could be that it exceeds the maximum or minimum limit of detection. Consult your Lancrop report for more info.

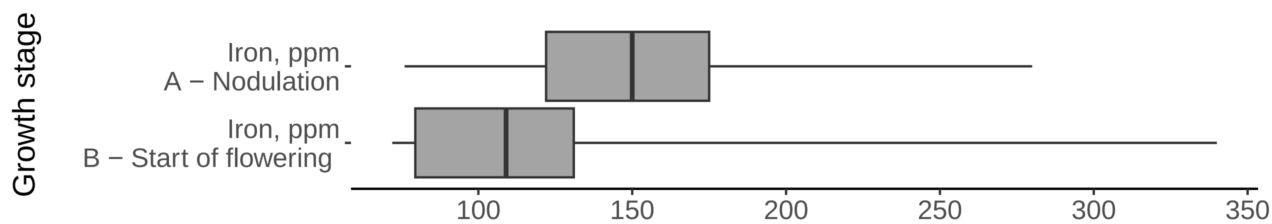


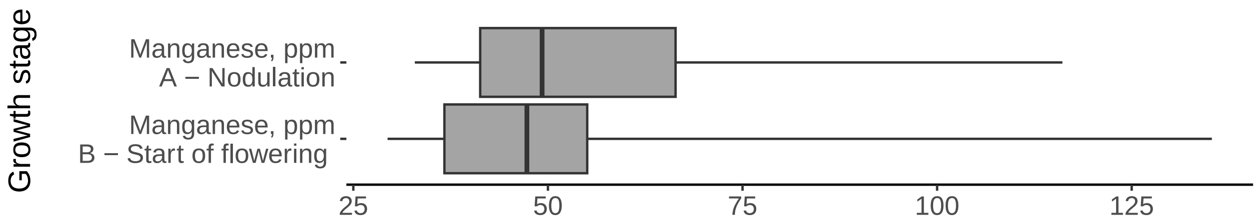


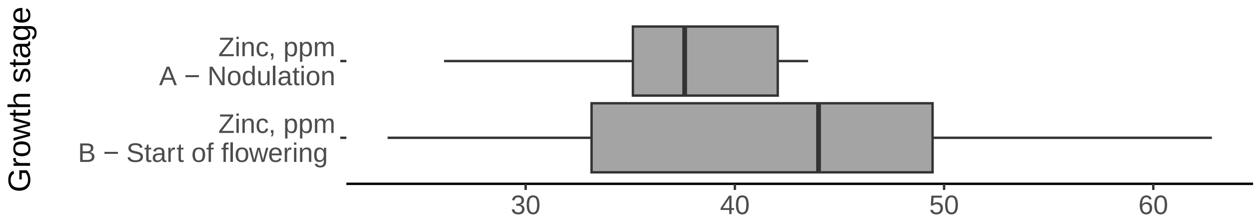


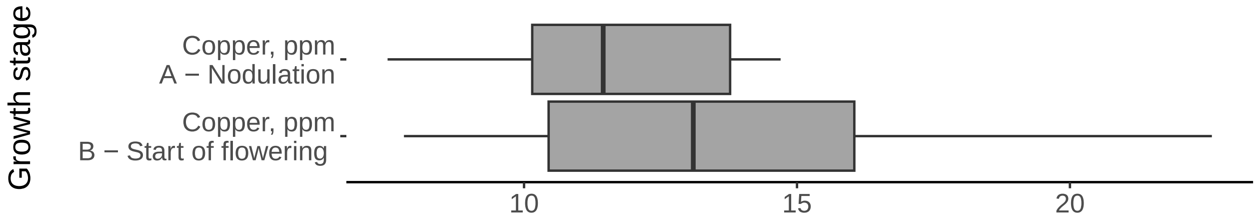


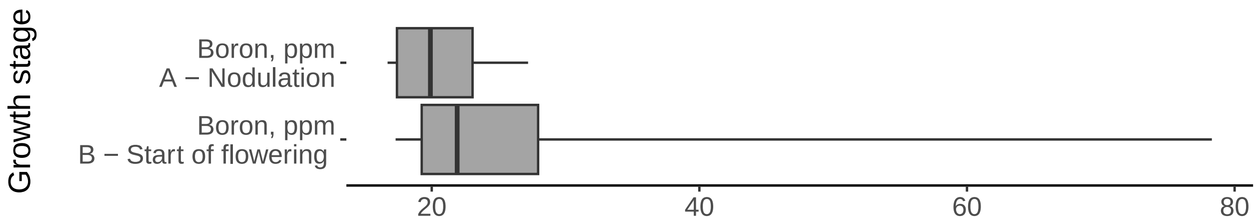


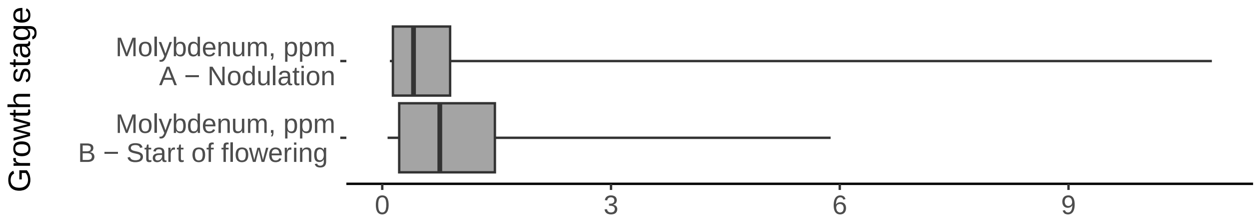



Growth stage
Manganese, ppm
A − Nodulation
Manganese, ppm
B − Start of flowering
25
50
75
100
125


Growth stage
Zinc, ppm
A − Nodulation
Zinc, ppm
B − Start of flowering
30
40
50
60


Growth stage
Copper, ppm
A − Nodulation
Copper, ppm
B − Start of flowering
10
15
20


Growth stage
Boron, ppm
A − Nodulation
Boron, ppm
B − Start of flowering
20
40
60
80

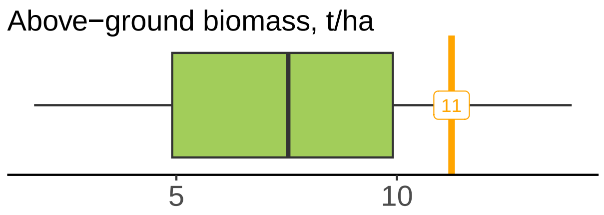

Growth stage
Molybdenum, ppm
A − Nodulation
Molybdenum, ppm
B − Start of flowering
0
3
6
9

Yield formation

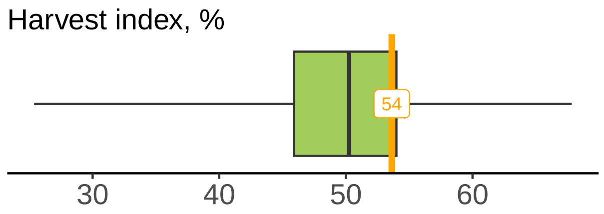
The whole-crop samples that YEN entrants provide all have their components counted and weighed and results are shown in the following charts, assuming that each sample was representative of the whole area from which seed yield was determined. [Area-related values such as seeds/m^2 are derived from the validated yield are derived from the validated seed yield.]

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 seed. Since seed growth happens last, harvest index also indicates how late growth related to early growth.

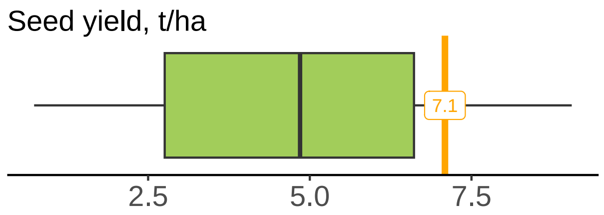
Your seed yield (expressed as t/ha and % of potential) is shown below along with biomass and harvest index, in relation to all other YEN entries.



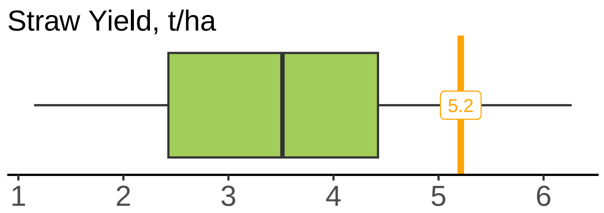
The average winter bean crop biomass in 2024 was 7. t/ha. The average spring bean crop biomass in 2024 was 7.6 t/ha. Experience with other crops shows that high biomass relates to high yields.



The average harvest index for winter bean crops in 2024 was 49%. The average value for spring crops in 2024 was 50%.

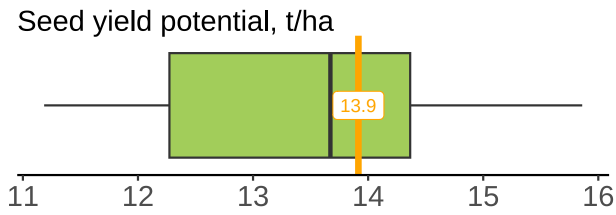


The average value for winter crops and spring crops was both 4.8 t/ha.

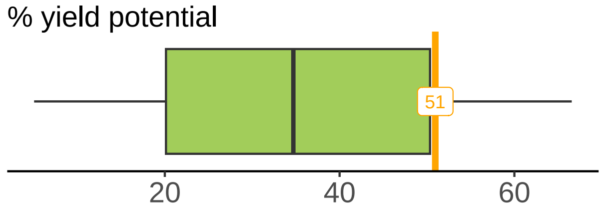


Straw Yields here include stubble and pod walls. The average value for winter and spring crops was both 3.6 and 3.5 t/ha.

Estimated from the number of seeds seen on the ground after harvest, and the average weight per seed.



YEN yield potential express the light energy and water available for your entry this year, simply converted to t/ha. The average value for winter crops was 14.1 t/ha. The average value for spring crops was 12.6 t/ha.



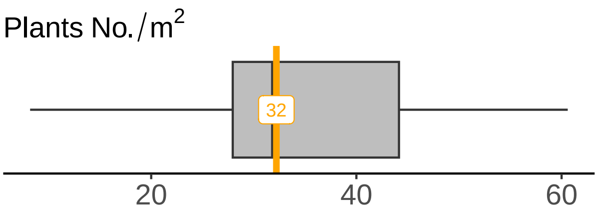
Bean YEN yields in 2024 averaged at 33% of yield potential for winter crops and 38% for spring crops.

Yield components

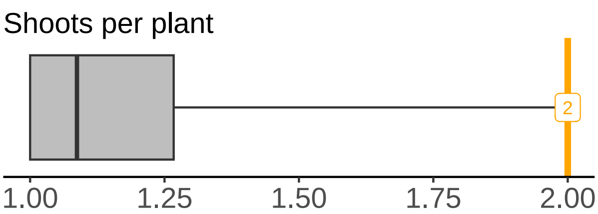
Whole crop yield analysis can also tell us about the history of your crop becuase the different crop components are determined sequentially, at least within given layers of the canopy for beans. So comparing your yield components with those of other YEN entrants should indicate the stage(s) through the season at which your crop deviated from others and from normal.

Total biomass provides the overall summary of your crops' growth; this depends on plant numbers determined first, shoot numbers determined next, pod numbers determined next, seed numbers determined next and the seed size determined last.

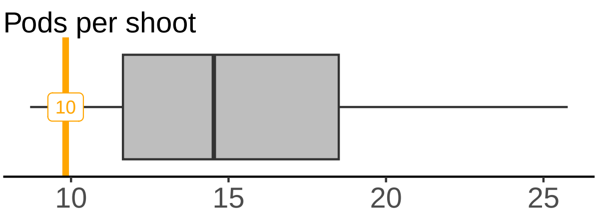
Analysis of 2019-2023 Bean YEN data suggest that high yields are associated with high pods/shoot, seeds/pods and seeds/m^2 rather than shoots per plant, however, high yields can be built in different ways.



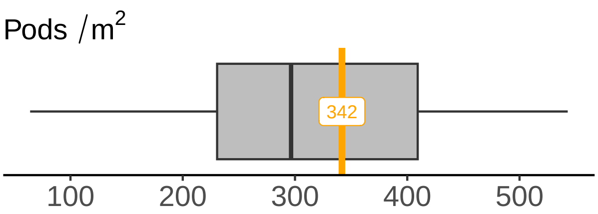
Plants per m^2 are calculated from the plant counts or overhead photos you provided. If you did not provide plant counts some calculated metrics below might be missing. The average was 30 and 41 for winter and spring crops respectively.



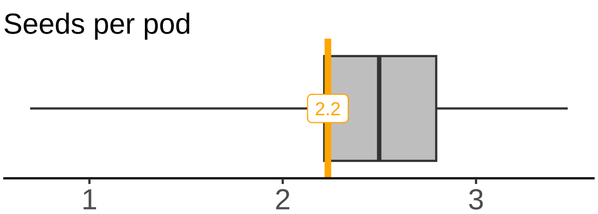
Shoots per plant were counted from your grab sample. Note that if plants were cut above ground level this could reduce the value.The average was 1.5 and 1.0 for winter and spring crops respectively.



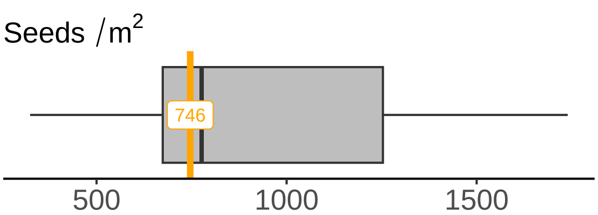
Pod numbers were counted on 10 shoots. Taller stems may have space for more pods per shoot. This count may have included infertile pods. The average was 15.1 and 15.5 for winter and spring crops respectively.



Pods per m^2 is a calculation of pods per shoot and shoots per plant. This is only calculated where both plant counts and grab samples were avaliable simultaneously. The average was 233 and 360 for winter and spring crops respectively.



The expected value is 3-5 seeds per pod. Infertile pods in the grab sample may lead to underestimation.The average was 2.7 and 2.3 for winter and spring crops respectively.



Seeds per m^2 in the crop are a reflection of seed set. Here, seeds per m^2 are estimated from you combine seed sample, TSW and crop yield. The average was 990 and 762 for winter and spring crops respectively.

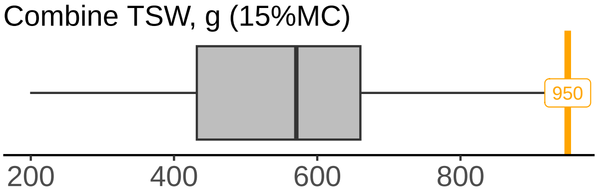
Seed formation and size

We use your combine-harvested seed sample to provide the analysis of seed size and seed filling. Seed filling depends mainly on photosynthesis after flowering, therefore it largely relies on the health and longevity of the green canopy.

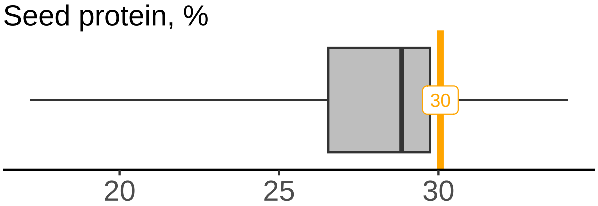
If the number of seeds per m^2 is low (see above), or if conditions during early seed-fill are limiting, final seed filling, hence yield may be constrained even if later conditions are good – this is sometimes described as ‘sink’ limitation. Sink limitation is often more important for beans than for wheat.

Bruchid beetle can affect both winter and spring bean varieties. Adults emerge from seeds leaving a circular hole, staining and larvae in the seeds. Beetles do not breed in seed stores, but damaged beans may not be accepted for quality markets. Bruchid damage can also cause abnormal seedlings and increased infection by soil-borne pathogens such as damping off, so reducing germination and maybe also the vigour of the seedlings.

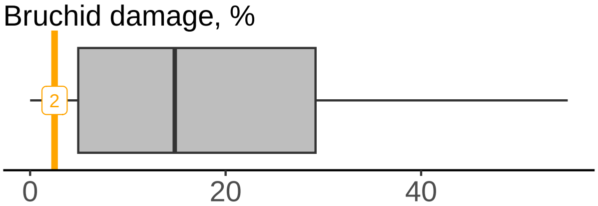
Combine TSW, g (15%MC)



Seed protein, %



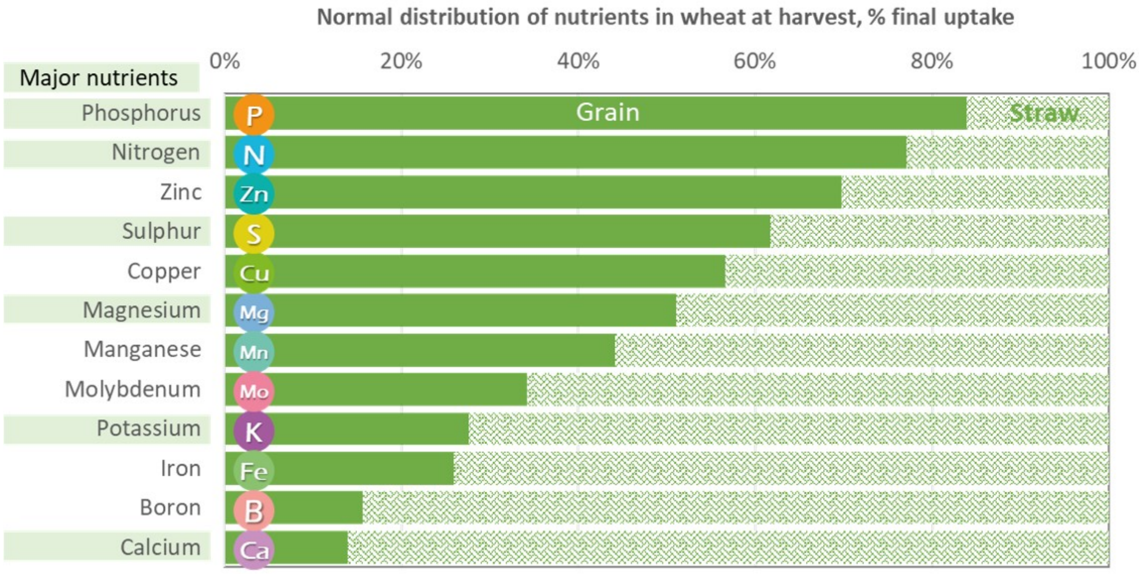
Bruchid damage, %



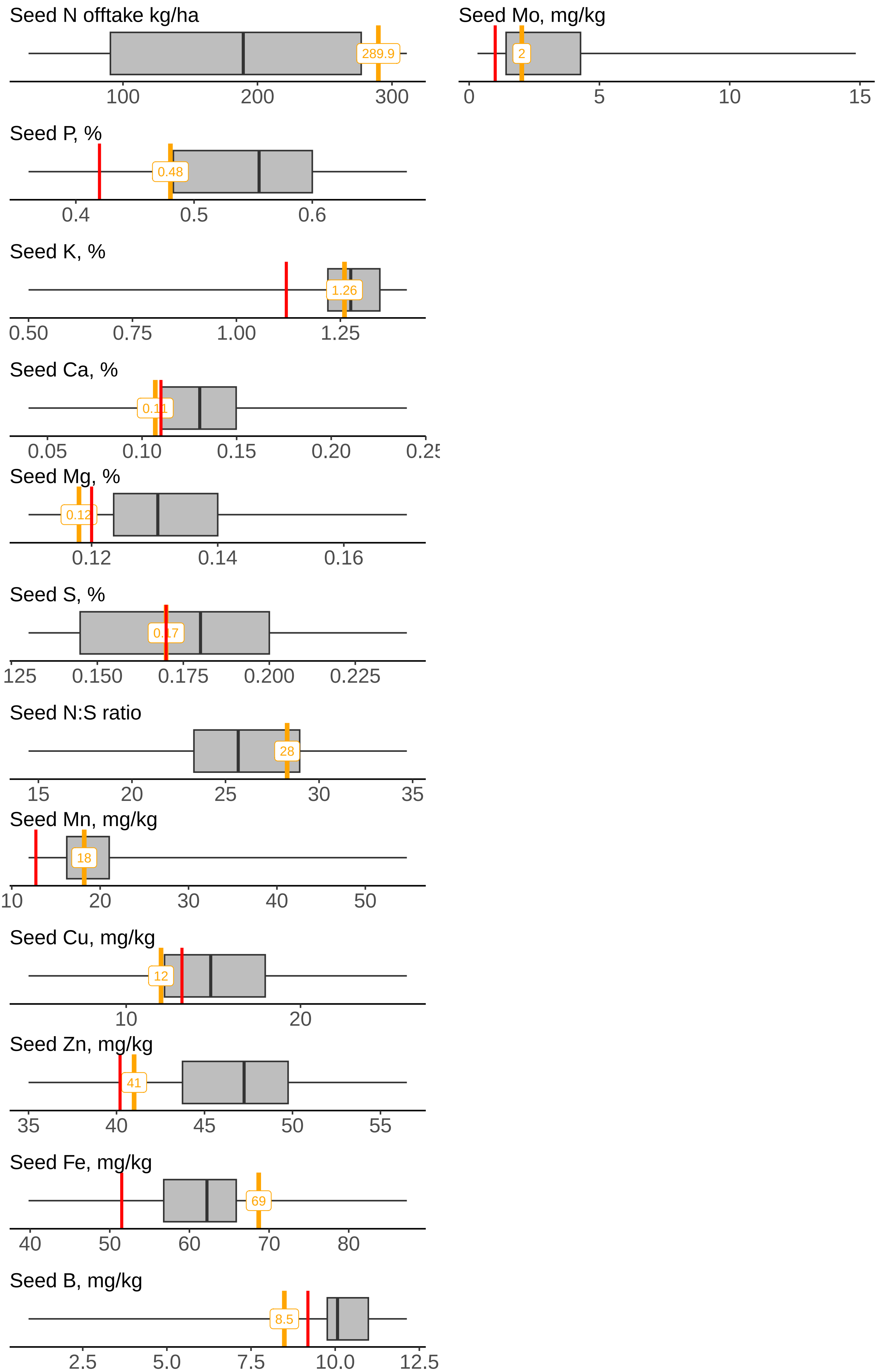
Bruchid damage affects acceptance for quality markets, and maybe also germination and seeding vigour.

The YEN has trail-blazed use of seed analysis to provide overall post-mortems on a crop's nutrition.

- Results from >900 YEN cereal samples analysed up to last year suggest that nutrient deficiencies are very common (using the 8 critical values that we know so far); >80% of crops showed deficiencies, and >50% showed two or more deficiencies! Phosphorus deficiency has been most common.
- YEN Nutrition was therefore launched in 2021 to help to remedy these deficiencies – 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 & P in the seed but most of their K in the straw (as estimated from analyses of feed materials).



- We now use YEN-low values (i.e. lower quartiles from all past YEN data – the boundary between the bottom quarter and top three-quarters of all YEN values since 2013) as comparators (red lines) for all nutrients in all crops. We find YEN-low values to be very similar to known 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.


Seed N offtake kg/ha
289.9
100
200
300
Seed Mo, mg/kg
2
0
5
10
15
Seed P, %
0.48
0.4
0.5
0.6
Seed K, %
1.26
0.50
0.75
1.00
1.25
Seed Ca, %
0.05
0.10
0.15
0.20
Seed Mg, %
0.12
0.14
0.16
Seed S, %
125
0.150
0.175
0.200
0.225
Seed N:S ratio
28
15
20
25
30
35
Seed Mn, mg/kg
18
10
20
30
40
50
Seed Cu, mg/kg
12
10
20
Seed Zn, mg/kg
41
35
40
45
50
55
Seed Fe, mg/kg
69
40
50
60
70
80
Seed B, mg/kg
8.5
2.5
5.0
7.5
10.0
12.5

SUMMARY

The 2024 Bean YEN:

- Thank you for providing the samples and information necessary to complete this report; the collective efforts of all YEN contributors maximise the value of the results that can be reported and the deductions that can be made.
- The highest seed yield in 2024 was a winter bean crop yielding 9.1 t/ha (in Kent), a tremendous acheivement and the highest yield in the Bean YEN so far. The highest percentage of biophysical potential was from a spring bean crop (in Sussex) yielding 7.7 t/ha at 67%.

YIELD ENHANCEMENT NETWORK RELATED INITIATIVES

YEN Zero connects growers and stakeholders in sharing data and testing ideas to reduce greenhouse gas (GHG) emissions from crop production. To join the network, and benchmark GHG emissions from your fields, fill out the webform on the YEN Zero webpage and we will contact you.

YEN Nutrition provides multi-field, multi-crop grain nutrient analysis and benchmarking to guide crop nutrition and input strategy across the farm. To order your YEN Nutrition pack for 2024 seed/grain samples please visit – https://yen.adas.co.uk/yen-nutrition-signup and we will contact you.

YEN Dynamic Benchmarking is a free tool to help any current or past YEN entrant compare their YEN results across farms, fields, crops, and years, so they can improve their future decision-making. Data from 2024 will be available from March '25.

Imagine a library where you can also meet the authors and experts in their respective fields – this is what we want to facilitate in FarmPEP.FarmPEP aims to provide easier access to the latest research and best practices as well as to experts who can benefit you. Access the site FarmPEP.

IPM NET is a free farm research network to improve and promote IPM, through updates, events & IPMNET Hubs. Use the QR code to join. Click to register for upcoming free IPMNET Conference 2025, 13 February 2025 (here) and IPMNET BYDV Hub Webinar on 29 January 2025 (here).

The NCS project aims to unlock the benefits of pulses in UK agriculture. Farmers can baseline their farms through the Farm Carbon Toolkit and, as Pulse Pioneers, can be paid to run pulse field trials, monitored through YEN.

legumES

The LegumES project seeks to increase legume cropping and consumption by showing the wider benefits of legumes. Participatory Farmers are being recruited with financial support to test benefits in farm trials. Anyone interested should email Thomas.Wilkinson@adas.co.uk.

CONTACTS

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Charlotte White	Charlotte.White@adas.co.uk	07503570264

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!

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