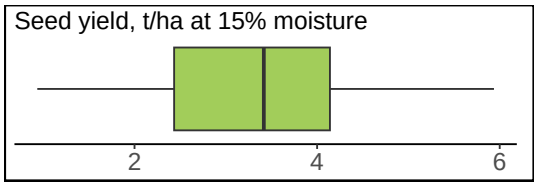
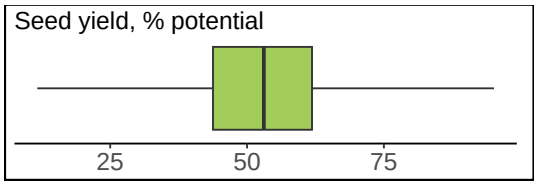
# Entrant's Report

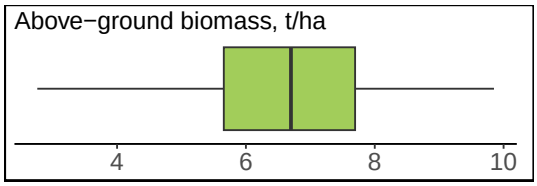
# Harvest 2022

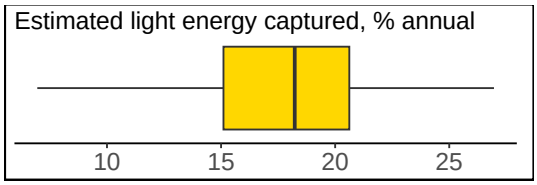
| | |
|---|---|
| YEN Field ID: PF22EXAMPLE | Field/Site name: EXAMPLE |
| Entrant name: EXAMPLE | Incident energy: NA TJ/ha |
| Main contact email: EXAMPLE | Available water: NA mm |
| Sponsor/supporter: EXAMPLE | Crop: Peas |
| Sponsor/Supporter email: EXAMPLE | Variety type: Large Blue‘ |
| | Variety: EXAMPLE |

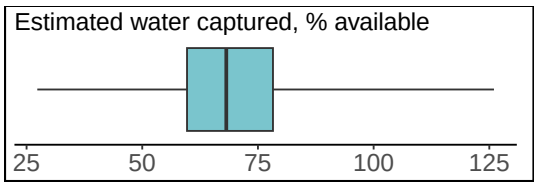
**SUMMARY:** YEN entries were completed from 18 out of 25 registered pea crops this year. Headline results for your entry are shown below. Your yield of NA t/ha represents NA% of its estimated yield potential of NA t/ha.

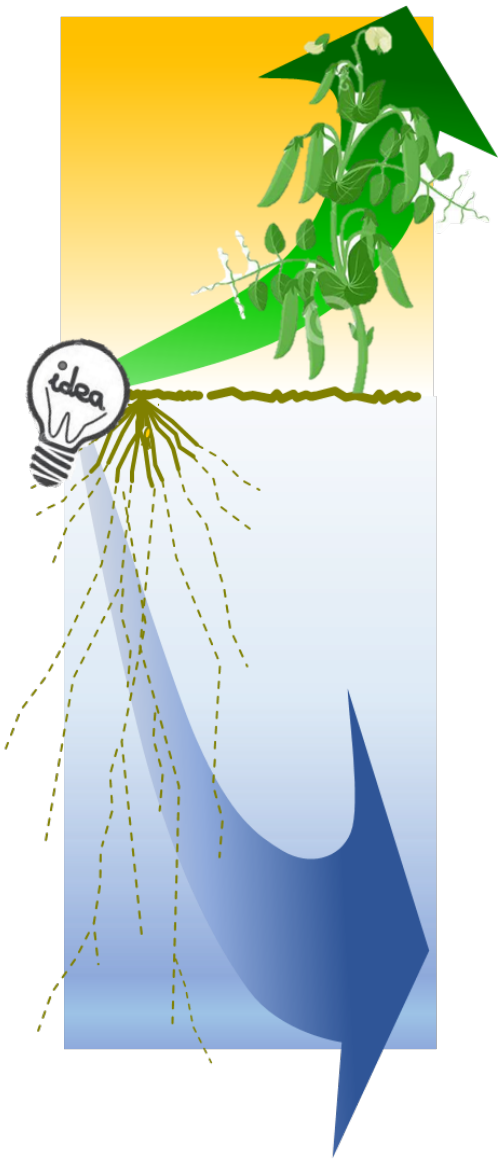


# CONTENTS

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 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 grain analysis to provide a post-mortem on your crop's limiting components and nutrition.

# POTENTIAL SEED YIELDS

## *"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) **50% capture of light energy** through this season (including some in September), and its conversion to 1.2 tonnes of biomass per terajoule, or

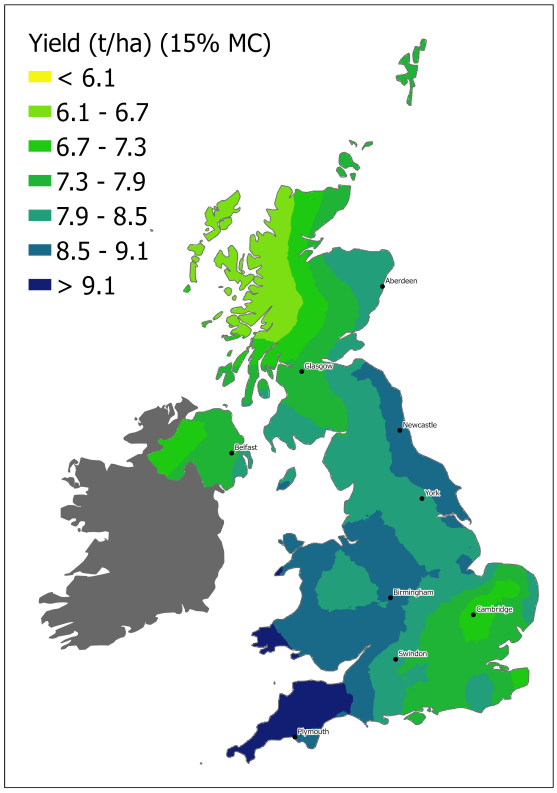
(ii) **Capture of all the available water** held in the soil to 1 m depth (or to rock if shallower than 1 m) plus all rainfall from April to July, and conversion of each 25 mm into a tonne of biomass per hectare. Our model of potential yield estimates potential growth on a daily basis; this identifies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

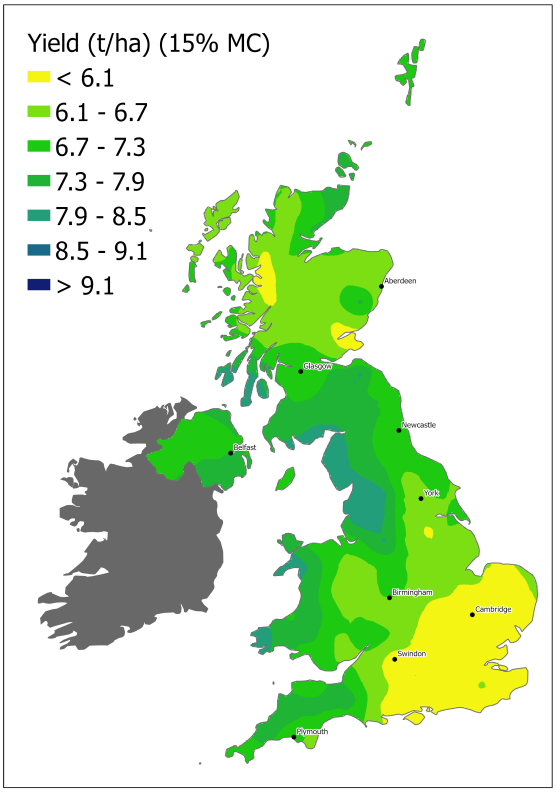
The maps below show the potential seed yields for autumn sown cereals on retentive and light soils this year. For this we assume deep soils with no irrigation. Potential yields in arable areas ranged from 10 t/ha upwards so, on most soils, high yields were theoretically possible almost everywhere.

### 2022 Potential yields

Peas non retentive soil




Peas retentive soil




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.

# SEASONAL GROWING CONDITIONS

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).

The 2022 season will be remembered for being short, mainly due to the above average temperatures and sunshine hours and below average rainfall.

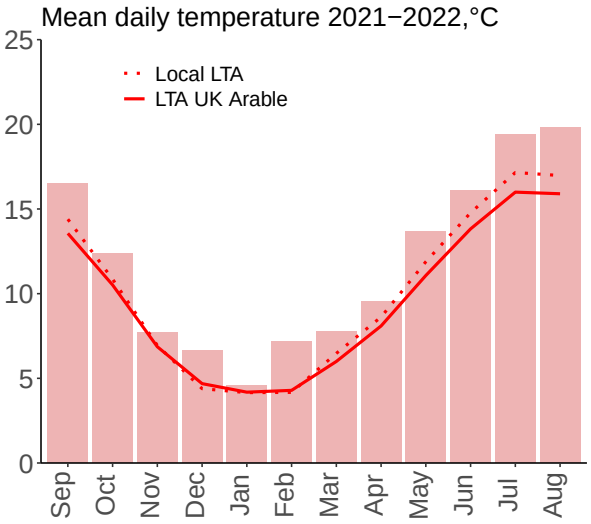
Generally, the winter was milder than average and although January was dry, February was very wet. This was followed by a warmer, drier and brighter March than average as well as a dry April.

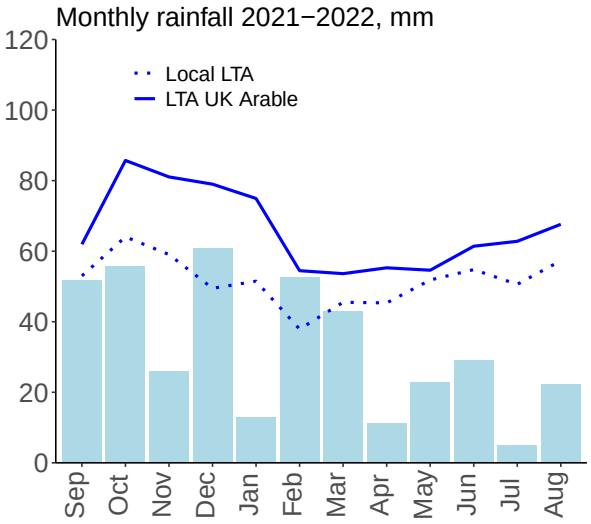
Overall pea establishment was good, with many crops drilled from mid- end of March, with seed being sown into ideal seedbeds, placed at depth (more than 6cm) into moisture to ensure germination.

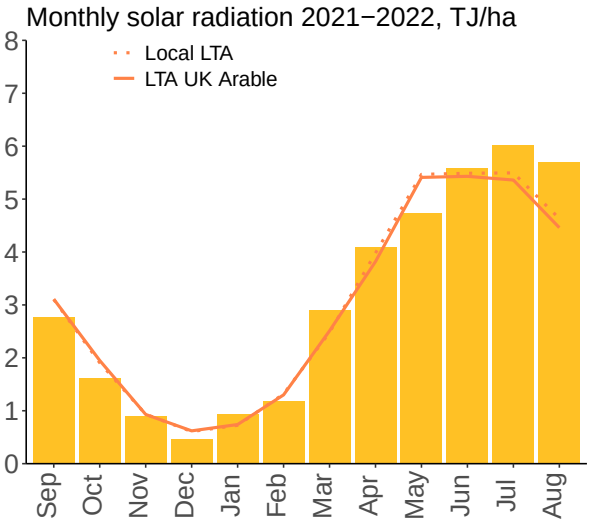
In mid-late April crops were generally well established, despite the low rainfall. Many pea plants were between second and fourth node (GS32 – GS34) with good root systems. Appearance of the crops at this time was good, with no symptoms of seedling diseases and pea and bean weevil notching was low with no presence detected of pea aphid.

By mid-May the crop potential looked to be above average, and plant counts were good, but the exceptionally dry, warm, sunny weather with little rainfall curtailed this potential. The summer was sunnier but also much warmer than average and maximum temperatures were far above the usual for most of England. There was little rain for most of July and early August, although localized thunderstorms contributed to rainfall in some areas. Crops accelerated through their growth stages, pod fill was reduced during a short flowering period. Harvest for many crops was 10 – 14 days earlier and yields were variable, with the majority lower than expected.

Overall weed, pest and disease control was good, but there were a few crops where viruses and bird damage also impacted on the crops potential. Most crops remained standing for harvest, which was ideal for combining and minimised header losses. The quality of harvest was good with overall low levels of waste, stain and bleached peas.

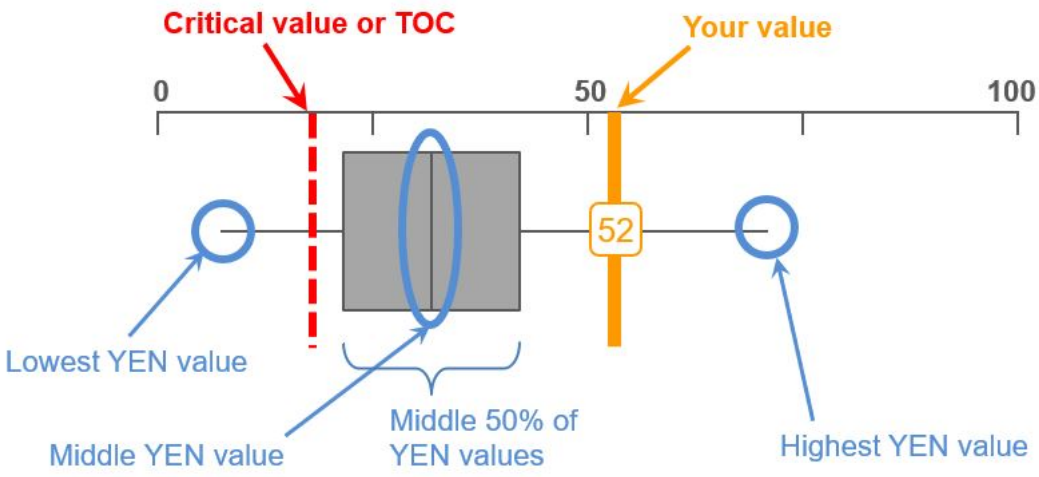


## YEN Benchmarking charts – What do they mean?

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 2022 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. In the Pea YEN 2022 thresholds have been estimated for seed using historic YEN data.
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.

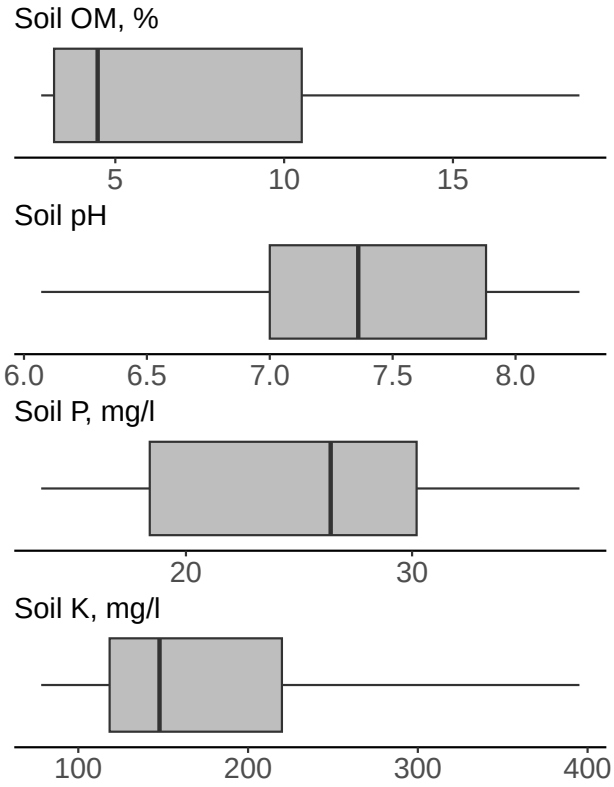
## Soil description and nutrition analysis


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 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. Levels of foot rot in the soil were assessed by PGRO. This year, the organisms responsible for foot rot were assessed separately, however an overall foot rot risk level was given to each entry.

## Soil analysis



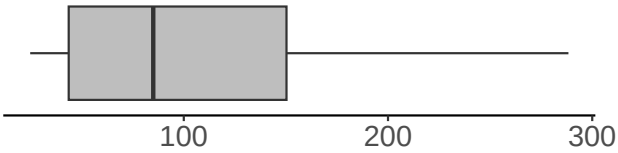

SOM supports crop performance through better nutrient availability, soil aggregation, and water holding capacity. NRM determines SOM by 'loss on ignition'. Note: other methods can give lower values.

Soil pH <6 is acid. 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 (page 20) to double-check if P was sufficient.

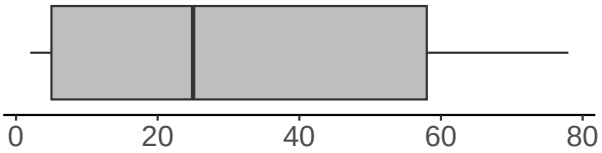
Soil potassium (K) analysis checks on whether K supplies are likely to have been deficient for average crops. However, high yielding crops require very large amounts of K.

Soil Mg, mg/l



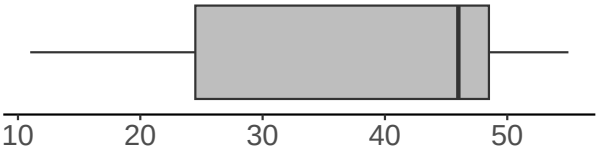

Magnesium (Mg) is a key component of chlorophyll so deficient plants show striking inter-veinal yellowing. Temporary deficiencies often occur in spring if topsoils are dry.

Sand, % w/w



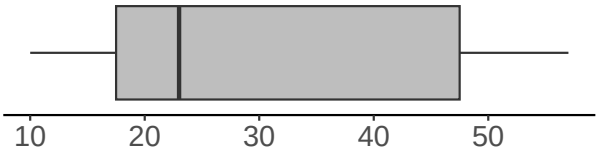

Soils with high sand content hold least water and soils with high silt content tend to hold most water.

Silt, % w/w



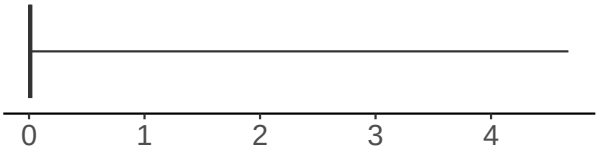

Soils with much silt and sand, hence less clay, tend to be relatively weak, and so are more difficult to maintain with a stable structure.

Clay, % w/w

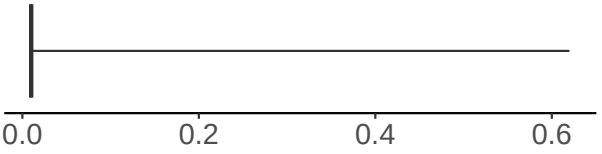



Soils with high clay content hold much water but part of this is held too tightly for crop use. Nutrients within this unavailable water tend to be less available than nutrients in lighter soils.

Aphanomyces Index, %

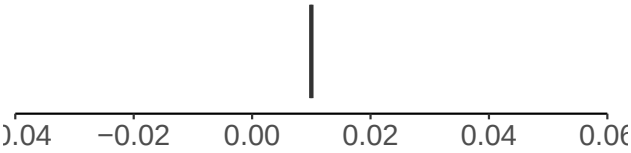



Fusarium Index, %




Overall, your foot rot risk was categorised as NA‘

Didymella Index, %

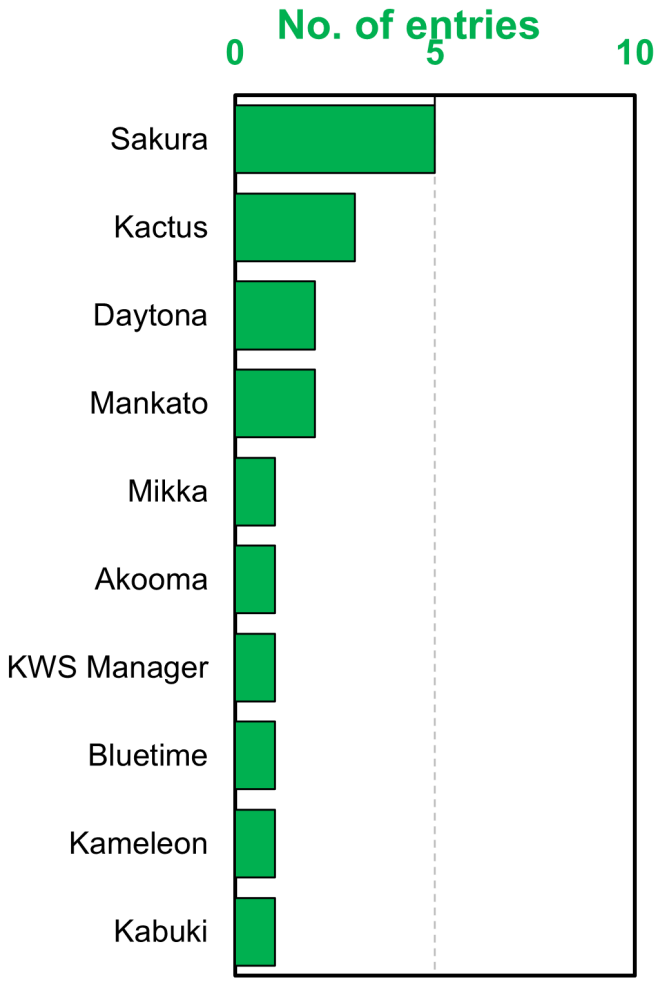


# AGRONOMY

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 for their maturity and seed protein levels, as reported in the PGRO's Descriptive list.

- Your variety was EXAMPLE.

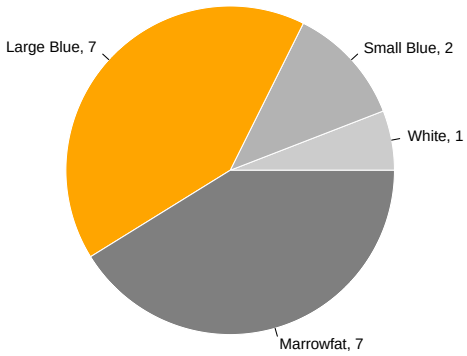


## Husbandry factors

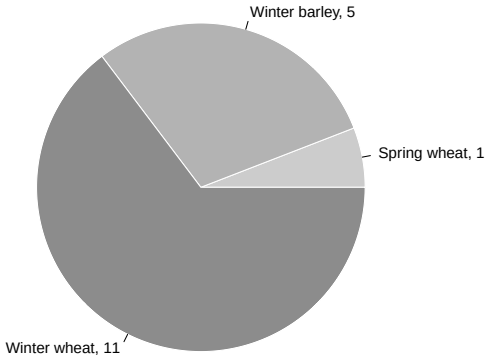
The following diagrams use orange segments or orange bars to indicate the agronomy of your crop, if known, so you can see how this relates to all other YEN entries. Analysis of all Pea YEN entries from 2016-2021 shows the following associations with seed yield (note that these do not necessarily imply causes – it may just be that farms with high yields also happen to have these traits):

| | |
|---|---|
| **Soil analysis** | **better yields with more soil P** |
| **Seed rate** | **positive association with seed rate in non-marrowfat types** |
| **Herbicide use** | **Suggests that good weed control is important for attaining high yields** |

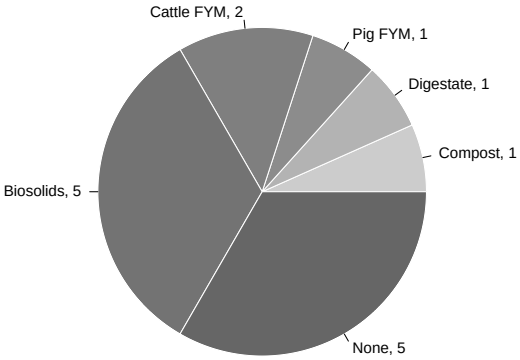
**Pea type**



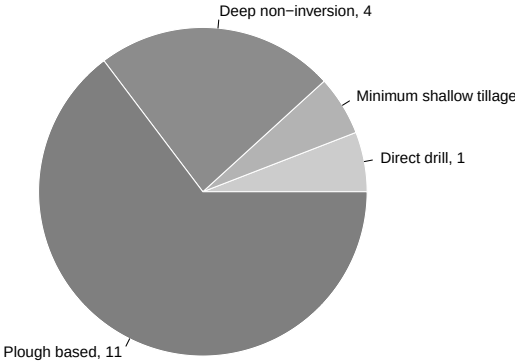

**Previous Crop Type**



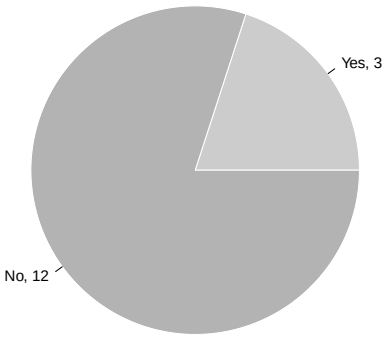

**Predominant organic materials applied**



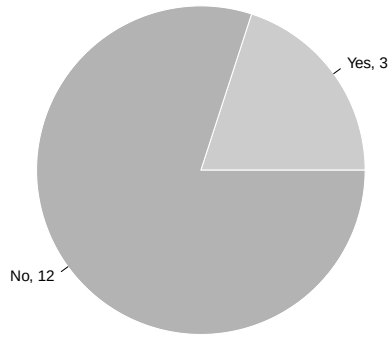

**Main cultivation strategy**




**Dessicant used at harvest**



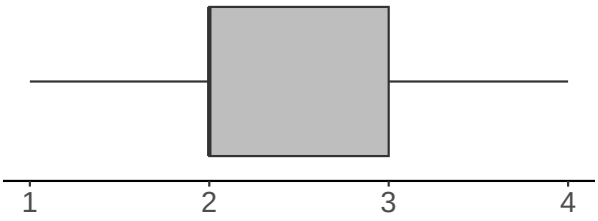

**Pod sealant used**



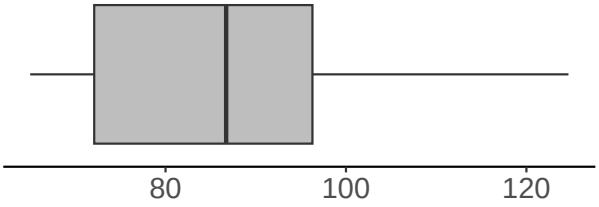
## Husbandry factors continued

Sowing date

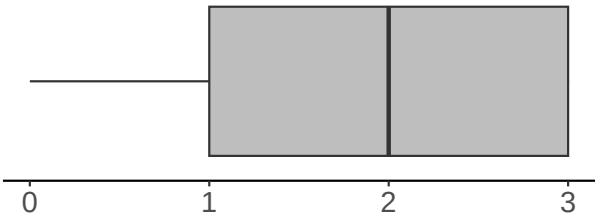

Number of herbicides applied



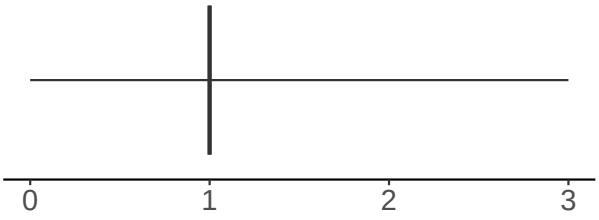

Seeds sown per $m^2$



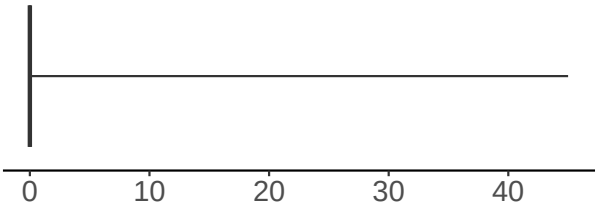

Number of insecticides applied



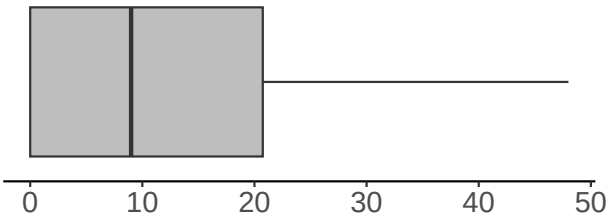

Number of fungicides applied



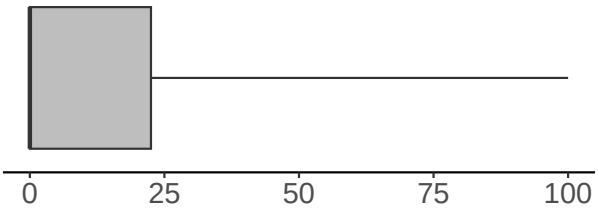

Fertiliser $P_2O_5$ applied, kg/ha



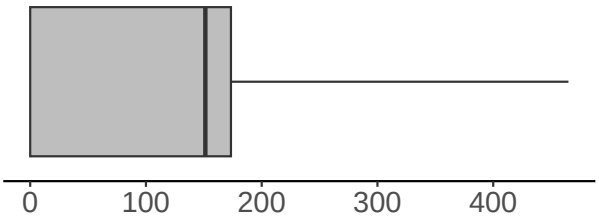

Fungicide spend, £/ha



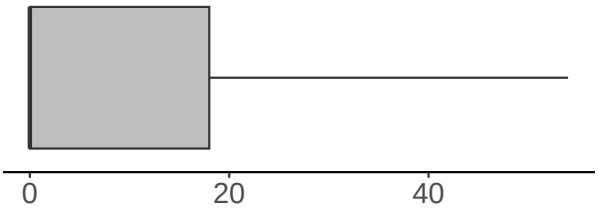

Fertiliser $K_2O$ applied, kg/ha



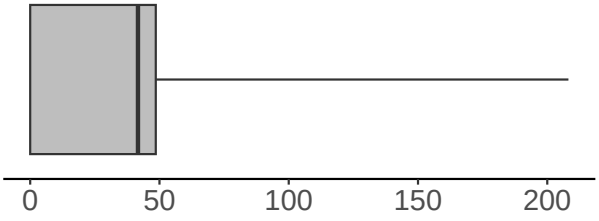

Crop protection spend, £/ha




Fertiliser $SO_3$ applied, kg/ha




Crop protection spend, £/tonne



# CROP DEVELOPMENT

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

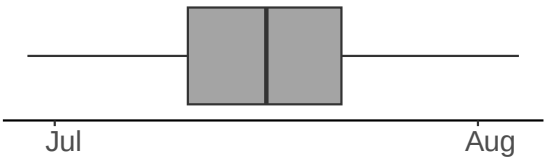
- Foundation, GS10-GS31 – when development of leaves and side shoots occurs;
- Construction, GS31-GS61 – when stem elongation occurs, and flowers are formed;
- Production, GS65-GS89 – when pods are formed, and seeds are filled.

Emergence, spring

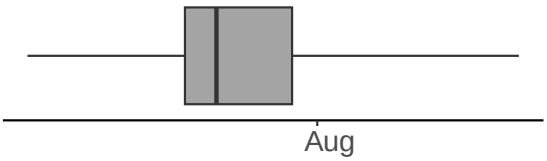

Stem extension (GS31)


Flowering (GS61)

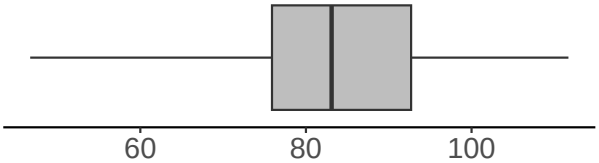

Canopy senescence (GS87)




Harvest date




Crop height, cm

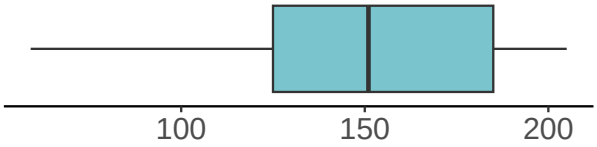



These are the average heights from 10 shoots in each grab sample.

## Water availability and capture

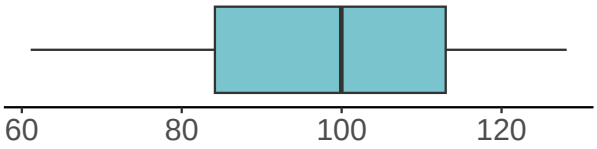
This page shows how weather this year affected the water available for your crop and other crops entered in the YEN. Water is supplied through the main growing period from concurrent rainfall and also from water stored in the soil. UK soils almost always refill with water over-winter. Water potentially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

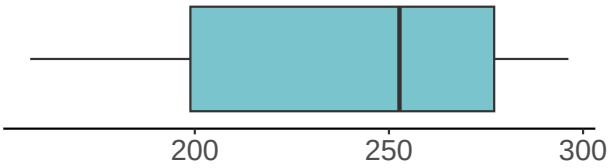
Rainfall April−July, mm




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

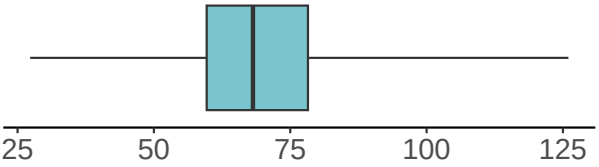
Whilst we cannot yet measure water captured by YEN crops individually, by assuming your crop's conversion of water to total biomass was 'normal' (25 mm water for each t/ha biomass formed), we have made crude estimates below of the likely success of your crop's root system in capturing water.

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.

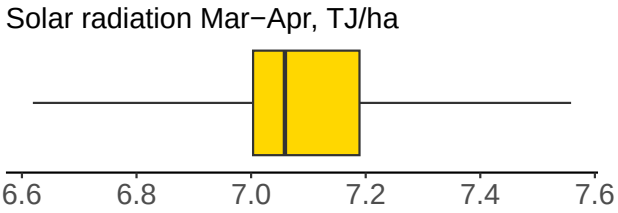
If your estimated use of available water exceeds the total water available, this may be good news! It either suggests that your crop's roots were more efficient than normal, or that your soil description was overly pessimistic: i.e. your soil apparently managed to provide more water than we estimated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

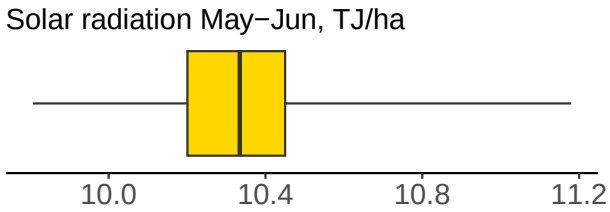
## Energy capture

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:

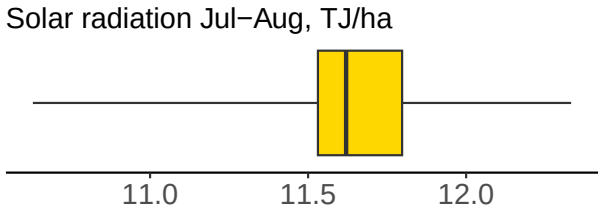
- Foundation – when development of leaves and branches occurs (March to April)



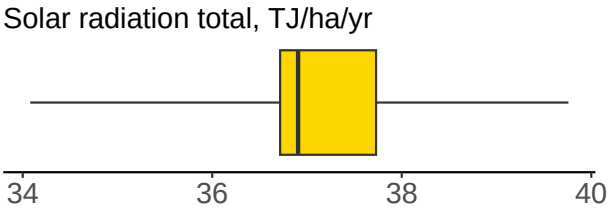

- Construction – when stem elongation occurs, and flowers are formed (May to June)



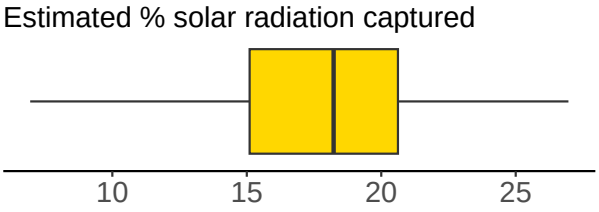

- Production – when pods are formed, and seeds are filled (July - August)




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.

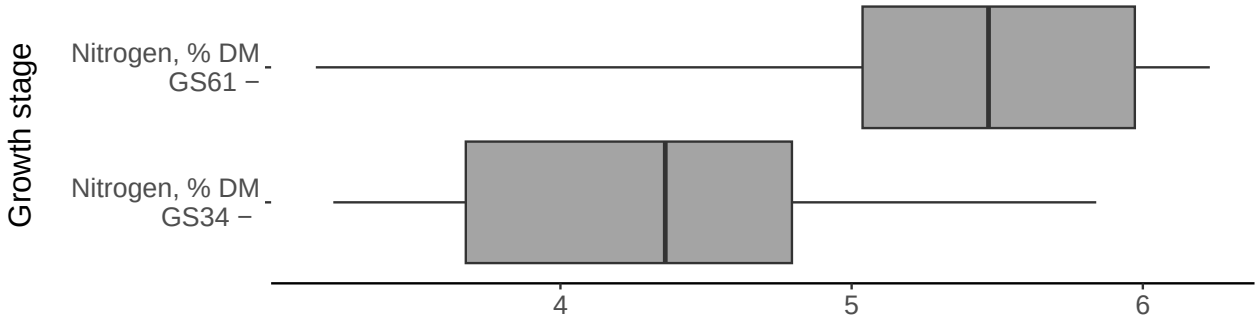


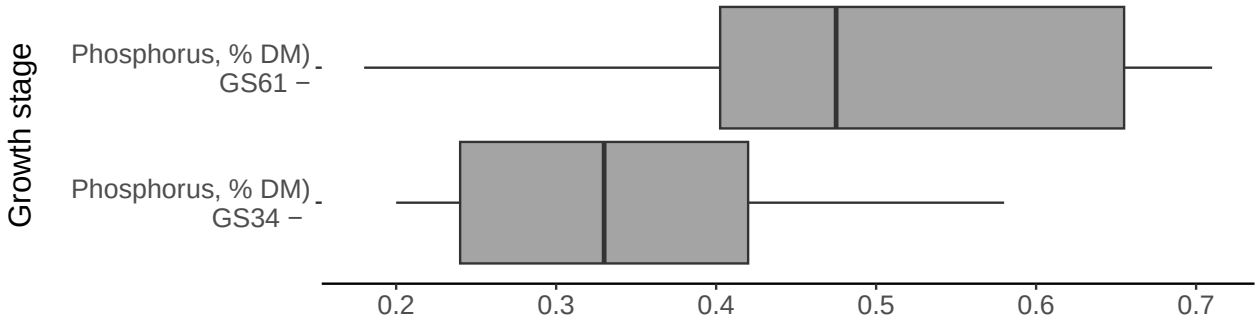

Average light capture tends to be poor if a crop's lifespan is short. Here, the estimated light captured is based on March-August.

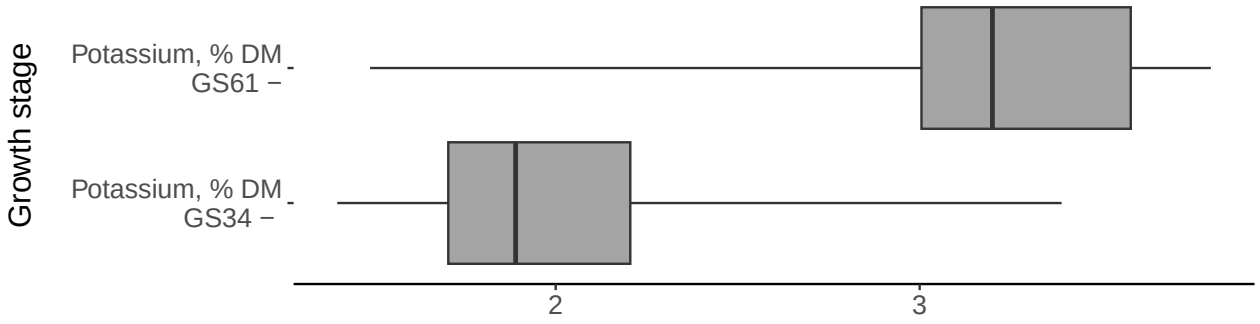
## Nutrient capture

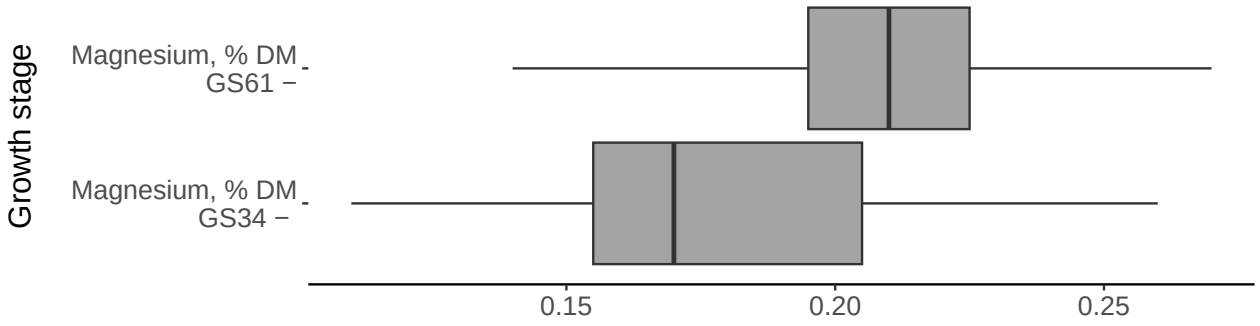
Whether nutrient capture was sufficient to support full conversion of light and water is best deduced from nutrient concentrations in crop tissues – both leaves (next 3 pages) and seeds (later section). No critical thresholds or benchmarks are shown for leaf analyses because these change through a crop's life and are still uncertain. However, the benchmarking diagrams used below should enable comparison of your crop's levels with all other YEN entries this year, analysed at the same time.

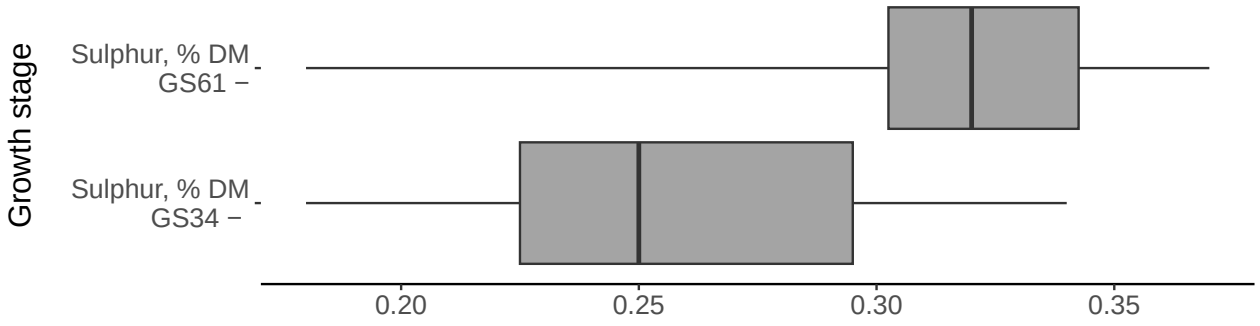
Lancrop Laboratories provide leaf analyses for YEN. Samples are of the newest fully expanded leaf.

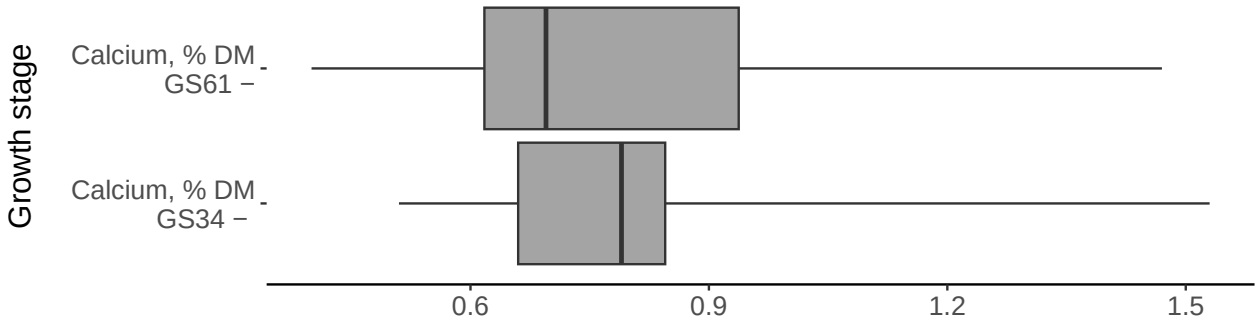


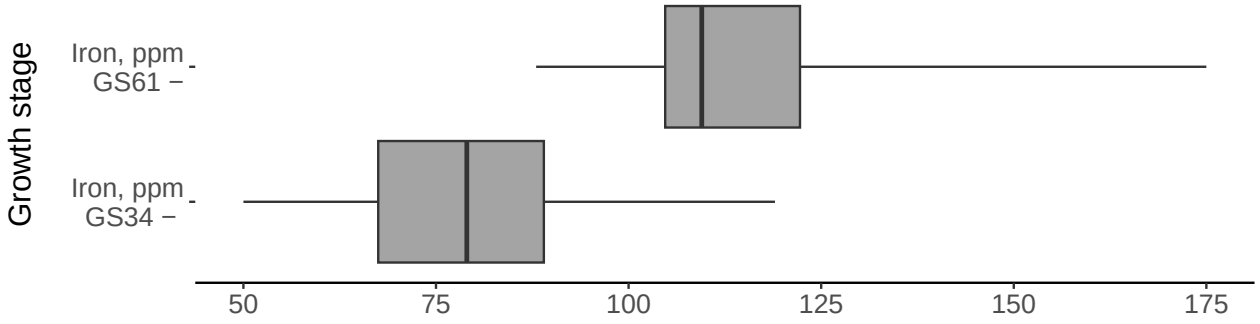



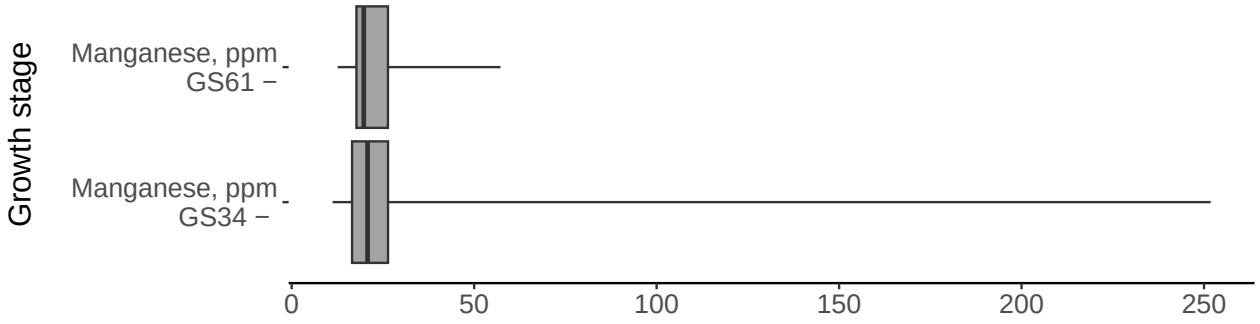



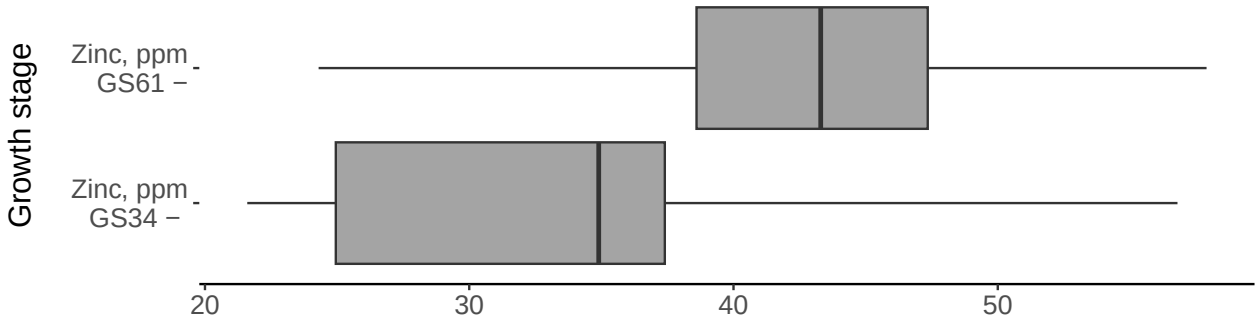



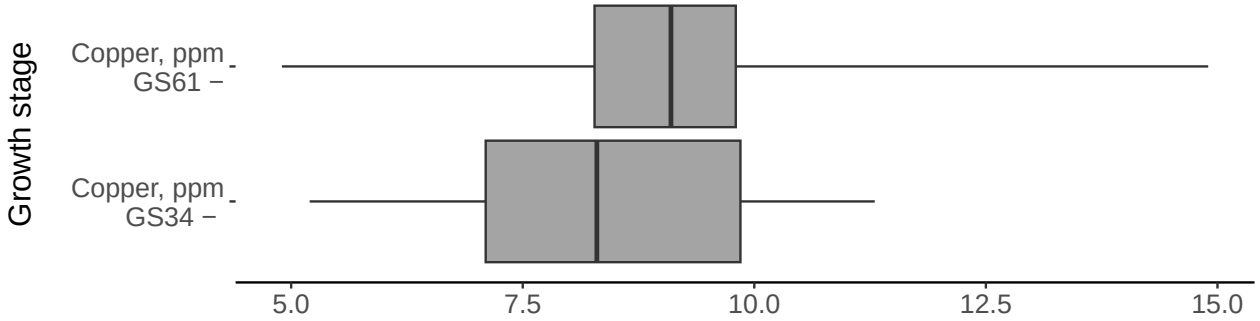

Growth stage
Sulphur, % DM
GS61
Sulphur, % DM
GS34
0.20
0.25
0.30
0.35

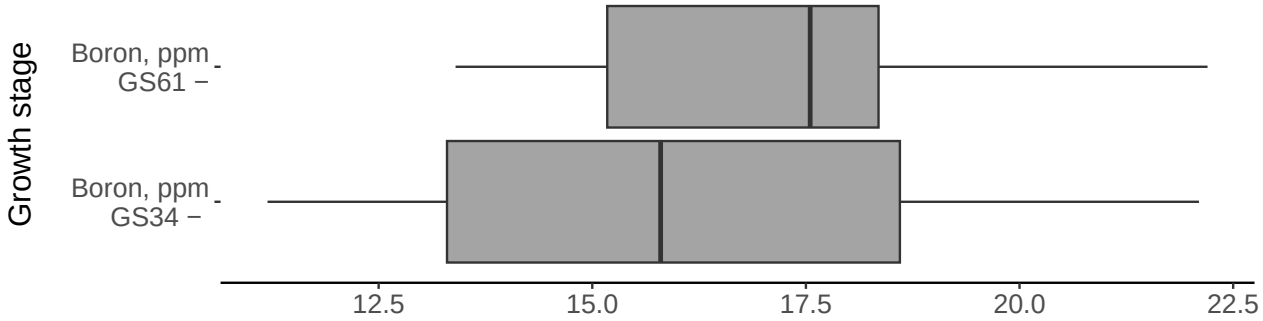

Growth stage
Calcium, % DM
GS61
Calcium, % DM
GS34
0.6
0.9
1.2
1.5

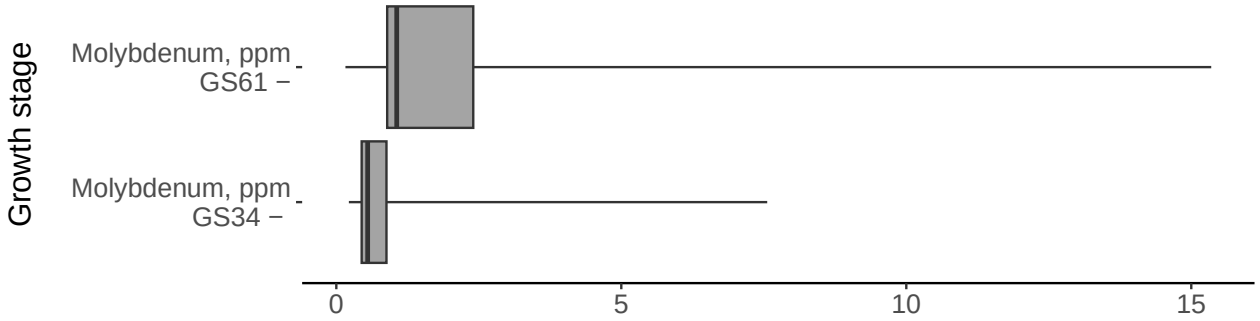

Growth stage
Iron, ppm
GS61
Iron, ppm
GS34
50
75
100
125
150
175


Growth stage
Manganese, ppm
GS61
Manganese, ppm
GS34
0
50
100
150
200
250


Growth stage
Zinc, ppm
GS61 –
Zinc, ppm
GS34 –
20
30
40
50


Growth stage
Copper, ppm
GS61 –
Copper, ppm
GS34 –
5.0
7.5
10.0
12.5
15.0


Growth stage
Boron, ppm
GS61 –
Boron, ppm
GS34 –
12.5
15.0
17.5
20.0
22.5


Growth stage
Molybdenum, ppm
GS61 –
Molybdenum, ppm
GS34 –
0
5
10
15

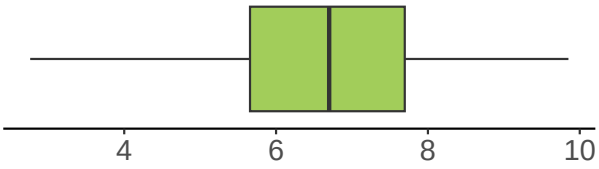
## Yield formation

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 yield.]

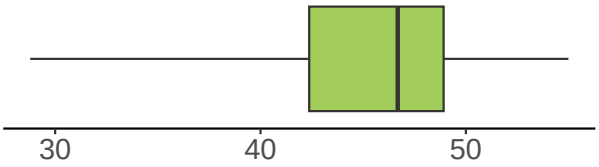
Total biomass production indicates the success with which a crop captured its key resources, light-energy and water, and the harvest index (the proportion of total biomass that was harvestable) indicates how this biomass was apportioned to seed. Since seed growth happens last, harvest index also indicates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

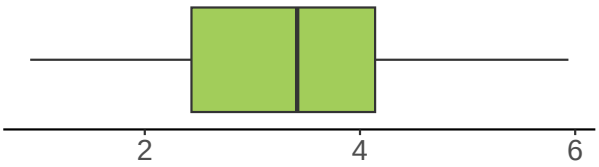
Above−ground biomass, t/ha



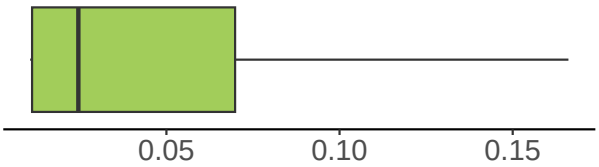

Harvest index, %




Seed yield, t/ha

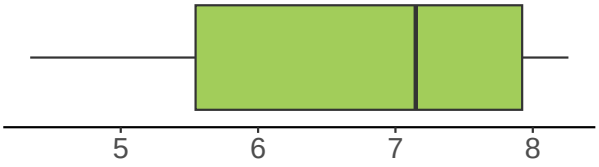



Estimated harvest loss, t/ha



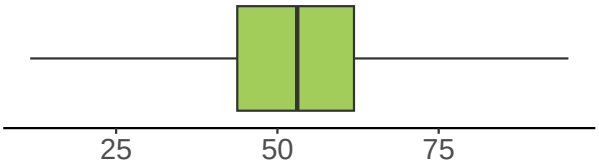

Estimated from the number of seeds seen on the ground after harvest, and the average weight per seed.

Seed yield potential, t/ha




YEN yield potential express the light energy and water available for your entry this year, simply converted to t/ha.

% yield potential

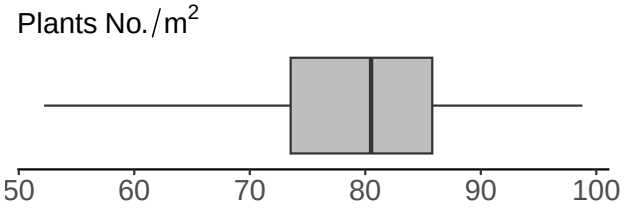


## Yield components

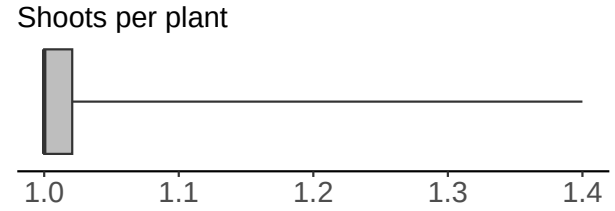
Whole crop yield analysis can also tell us about the history of your crop because the different crop components are determined sequentially, at least within given layers of the canopy for peas. So comparing components of yield for your crop in the following charts with those of other YEN entrants should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

Total biomass provides the overall summary of your crop's 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.

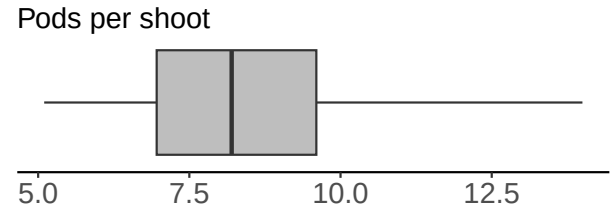
Pea yields within the YEN appear to be 'sink limited', meaning that the ability to set seed numbers is likely to be a factor limiting yields. Analysis of 2016-2021 Pea YEN data suggests that high yields are associated with set seeds/$m^2$, whilst the pods/shoot and HI remain stable, across Pea YEN crops, this may be linked to targeting optimum plant populations rather than achieving larger, more well podded individual plants. However, high yields can be built in different ways.



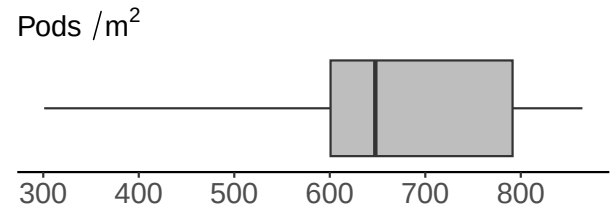

Plants per $m^2$ are calculated from the plant counts or overhead photos you provided. If you did not provide plant counts some calculated metrics below might be missing.



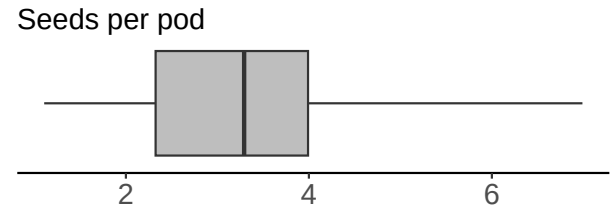

Shoots per plant were counted from your grab sample. Note that if plants were cut above ground level this could reduce the value calculated.



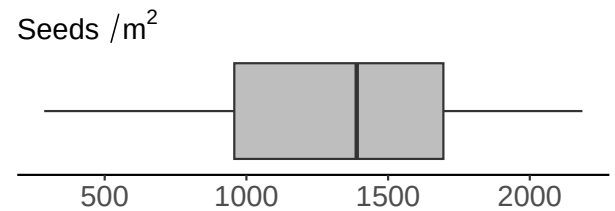

Pod numbers were counted on 10 shoots. Taller stems may have space for more pods per shoot. This count may have included infertile pods. This is a varietal characteristic and also influenced by growing conditions. Typically, two pods will set per fertile node and between 6 and 14 pods per plant.




Pods per $m^2$ is a calculation of pods per shoot and shoots per plant.




The expected value is 3-6 seeds per pod. Infertile pods in the grab sample may lead to underestimation.



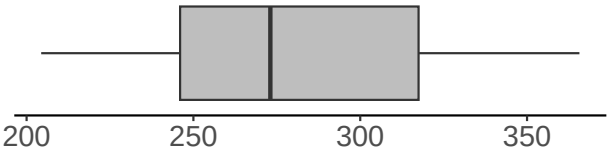

Seeds per $m^2$ in the crop are a reflection of seed set. Here, seeds per $m^2$ are estimated from you combine seed sample TSW and crop yield.

## Seed formation and quality

We use your combine-harvested seed sample to provide the analysis of seed size and seed filling. Seed protein was measured by Lancrop laboratories and other seed quality assessment scores below are provided by Askew & Barrett Pulses Ltd.

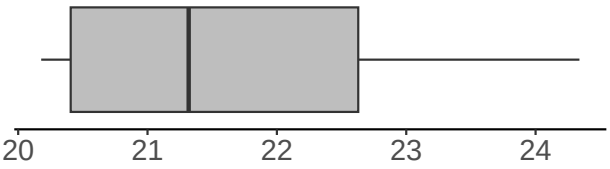
Using the quality comments provided by Askew & Barret Ltd for your sample, we have estimated the value of the crop based on it's potential end use and yield on a per/ha basis, using estimated sell prices provided by PGRO. We hope that this will help compare the success of different variety types within the Pea YEN more easily.

Combine TGW, g (15%MC)

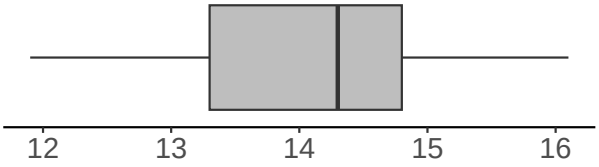



This is a varietal characteristic and influenced by growing conditions, if photosynthesis is limited during seed filling values may be lower than expected e.g compared to PGRO's descriptive list. Typically, white peas: 150-250, small blues 150-225, large blues >225, Maples >150, Marrowfats >275.

Seed protein, %

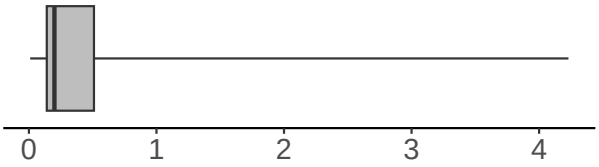



A & B Moisture, %



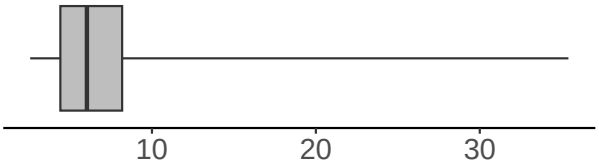

Typically merchants would look to take peas at 15% moisture content.

Admixture, %



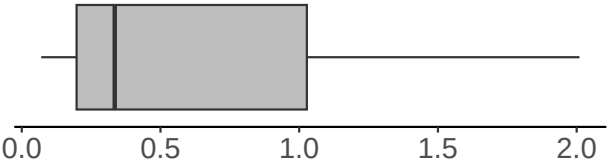

This would include soil, pods, weeds, stones and other species. Levels less than 2% should be the target. Higher levels may be accepted.

Waste, %

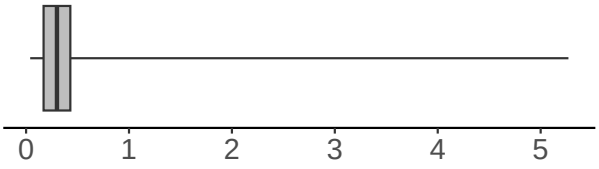



Waste, insect damage and stain % are often combined, with levels of <10% being the target. Higher levels may be accepted. Some contracts may specify levels for insect damage E.g. 2%.

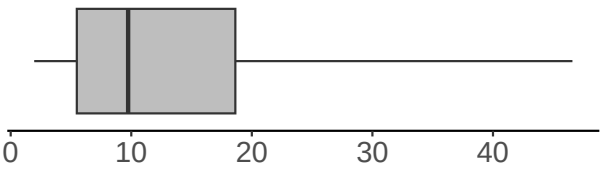
Insect damage, %



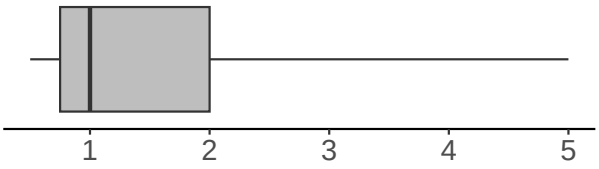
Stain, %




Bleach, %




Cook, (1−5)




Bleaching is described as “where the green colour has leached from the pea (in part or whole) due to environmental conditions. This is diagnosed as a lightening of colour of the skin to a yellow/white, away from the intended green colour”. It is in part varietal, very dependent on the timing of and weather conditions at harvest. Bleaching limits the intended markets and value of the produce.
Merchants carry out soaking and cooking tests to determine suitability for various markets. Methods and scales may differ between merchants, but here a value of 1= best and 5= worst.

We hope that this will help compare the success of different variety types within the Pea YEN more easily.

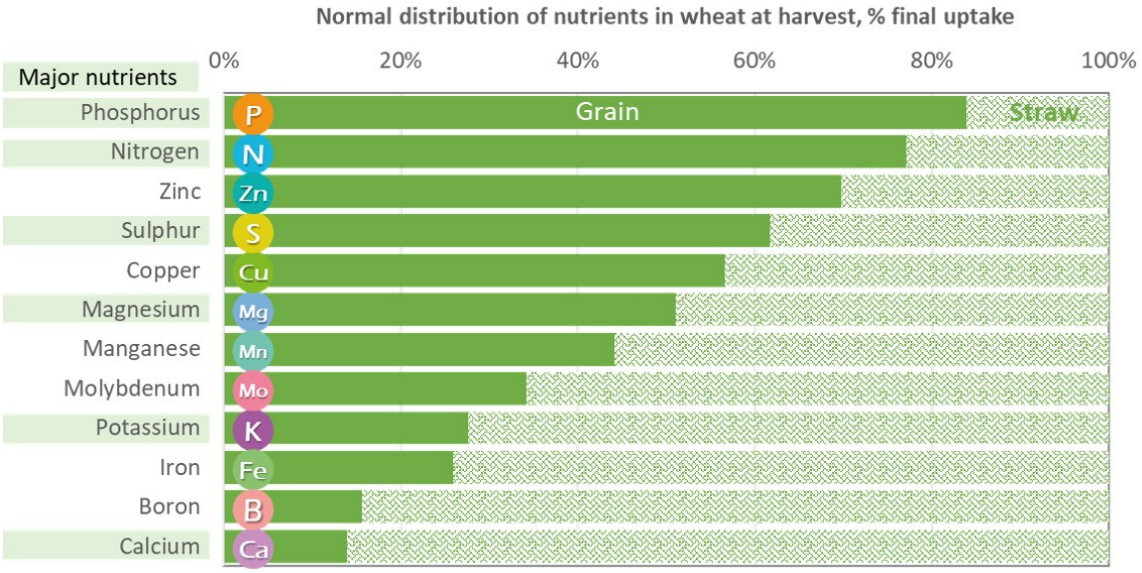
Askew and Barrett Ltd comments of the sample:

- NA
- NA

# CROP NUTRITION POST-MORTEM

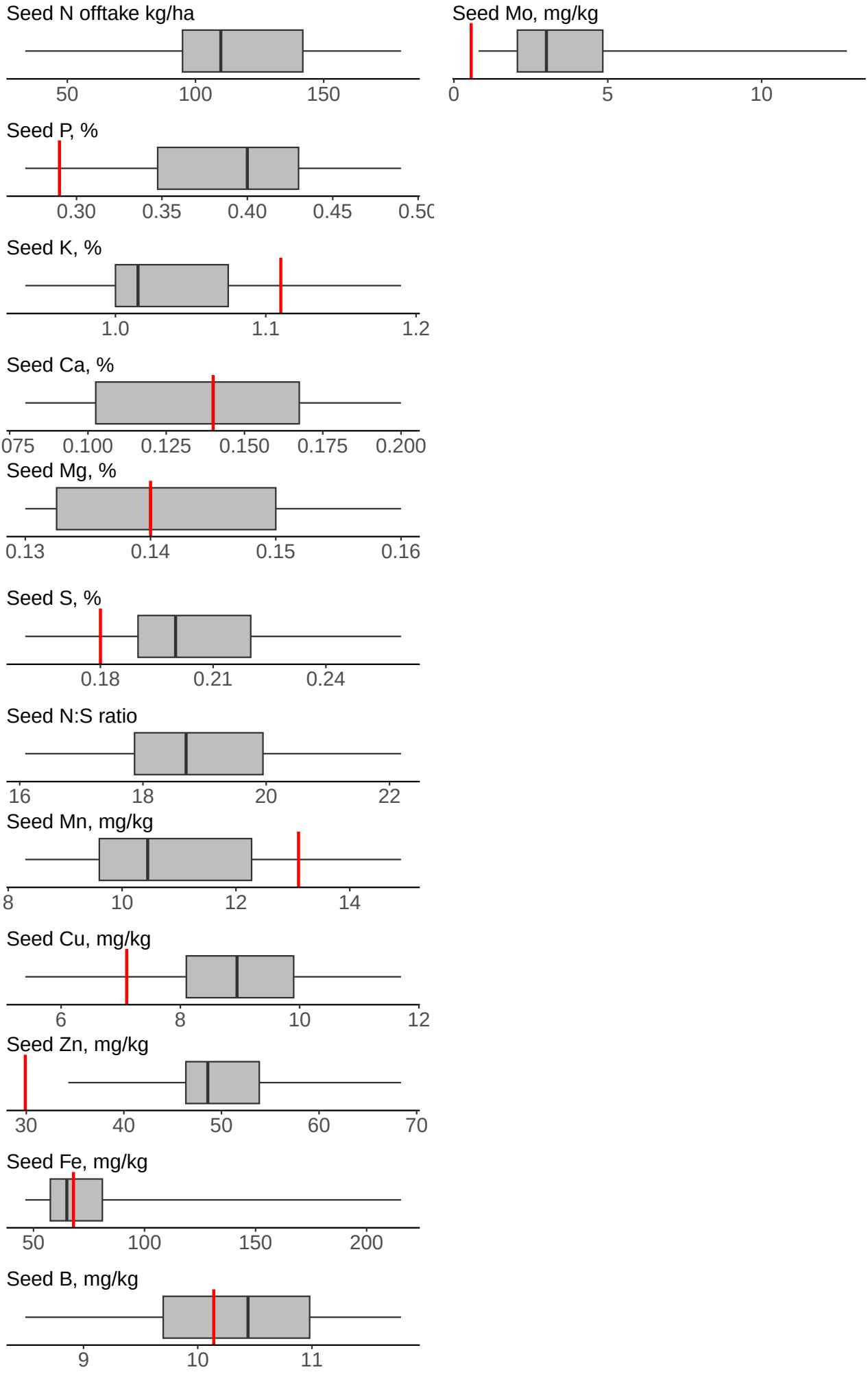
The YEN has trail-blazed use of seed analysis to provide overall post-mortems on a crop's nutrition.

- 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
50
100
150
Seed Mo, mg/kg
0
5
10
Seed P, %
0.30
0.35
0.40
0.45
Seed K, %
1.0
1.1
1.2
Seed Ca, %
.075
0.100
0.125
0.150
0.175
0.200
Seed Mg, %
0.13
0.14
0.15
0.16
Seed S, %
0.18
0.21
0.24
Seed N:S ratio
16
18
20
22
Seed Mn, mg/kg
8
10
12
14
Seed Cu, mg/kg
6
8
10
12
Seed Zn, mg/kg
30
40
50
60
70
Seed Fe, mg/kg
50
100
150
200
Seed B, mg/kg
9
10
11

## SUMMARY

### The 2022-2023 Pea YEN competition:

- 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 2022 was 5.9 t/ha (in Bedfordshire). This crop achieved a percentage of biophysical potential at 88 %.

## UPCOMING EVENTS

**'YEN is ten' Conference** If you haven't done so already, please register and join us to celebrate the YEN's tenth birthday at a cross-YEN conference at East of England Arena, Peterborough on 24th January 2023. You can Register for the YEN Conference here.

### Pea and Bean YEN 2022 discussion meeting

In addition to the cross crop YEN Conference 2022 we are pleased to invite Pea YEN and Bean YEN members and sponsors to a Pulse YEN specific meeting to discuss the season and learnings from the Pulse YEN data sets on the 16th January 2022 at PGRO, The Research Station, Great North Road, Thornhaugh, Peterborough PE8 6HJ. More details and a link to register are to follow. We hope to see you there!

## CONTACTS

Please send any comments, observations or queries to the contacts below.


| | | |
|---|---|---|
| Thomas Wilkinson | Thomas.Wilkinson@adas.co.uk | 07814043347 |
| Charlotte White | Charlotte.White@adas.co.uk | 07503570264 |

Or email yen@adas.co.uk for general enquiries. twitter: @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 2023.