# The Bean YEN - What have we learnt so far?

## Intro

The bean YEN now has five years worth of in depth crop data. The NCS project, led by PGRO, aims to unlock the greenhouse gas emission reduction potential of pulses for UK agriculture. This is through supporting the production and feeding of pulses to livestock, and has allowed us to take a deeper look into the Bean YEN data. Building upon the 2019-2021 analysis[1.] and following a similar format to the recent Pea YEN data analysis, to do several things:

1) Investigate the data we have collected as a network of farmers, industry and scientists over the last 5 years to understand how the variation of the different crop metrics we have measured associates with yield. This will help us prioritise targets within our own on farm testing or as larger research projects.

2) Highlight where the Bean YEN has helped our understanding of UK faba bean crop growth and development so we can better manage our crops.

3) Compare and contrast information about bean crops from other climates and countries to sense check whether the learnings from international research are relevant to UK crops.

## Notes on the analysis

The analysis used to investigate associations within the data set was a REML approach. This type of statistical analysis lets us partially account for some factors that might co-influence yield in the data set. We tried to account for cropping year, whether crops came from the same farm over several years as well as variety or varietal type where possible.

It's important to note that this analysis cannot determine true cause and effect and that some of these associations should not be extrapolated too far (for example the positive association between taller crops with yield will eventually tail off as lodging comes into play). To confidently state cause and effect we would need to set up controlled experimental treatment comparisons (see the section on the NCS project below).

The analysis is carried out on the variation within the network, so if the farms within the Bean YEN are generally not very varied for a particular factor (e.g if all farms are within the realms of best practice) this means the factor may not be highlighted as *statistically* significantly associated with yield. Therefore it's still important to follow the best practice in the PGRO agronomy guides even if that factor is not highlighted as statistically significant here. The association analysis is best at highlighting cropping factors that may be currently overlooked and so highlights avenues for future on-farm testing and research. It should also be noted that the ability of the analysis to resolve differences is often related to the size of the data set and so the number of bean crops is given for each metric. As a rule of thumb we are more confident in analysis results where we have more data.

Where data is numerical (e.g rate of fertiliser applied) the direction of any *statistically* significant association is highlighted in the tables below with arrows (↑ ↓) arrows not highlighted represent an almost significant association. We've added in columns to show the average parameter value of the top and bottom 25% of yields. These averages don't try and account for year, variety, variety type or repeated farms in the same way the association analysis does. However, they may give an idea of the level of variation and could form the basis of benchmarks in the future.

Where data is categorical (e.g manure type used) the predicted mean yield for each category is given and if this is *statistically* significant in the yield analysis the row is shown in bold.

Analysis is across varieties and so associations may be related to both genotype, environmental and agronomic conditions. This means we may describe certain "ideotype" crops which are mixtures of characteristics caused by genotype, management and environmental conditions.

## Site & season

Whilst it isn't possible to swap a site's characteristics or the weather we experience within a given season, reviewing these influences on crop growth can help us consider mitigation methods to better deal with imperfect situations. Weather conditions over the last several years of the Bean YEN have been extreme and sometimes contrasting from year to year.

The results of the analysis of monthly rainfall (mm), solar radiation (MJ/m$^2$) and temperature (°C) of 145 crops from 2019 to 2023 is below. Generally, the analysis points to warmer winters and cooler late spring and summer months and wetter Junes being associated with higher bean yields.

**Table 1. Weather factors.**

| Month | Rainfall | Solar radiation | Temperature |
|---|---|---|---|
| September | | | ↓ |
| October | | | |
| November | | | |
| December | | | ↑ |
| January | | ↓ | |
| February | | | |
| March | | | |
| April | | | ↓ (P=0.055) |
| May | | ↓ | ↓ |
| June | ↑ | ↓ | ↓ |
| July | | ↓ | ↓ |
| August | | | ↓ |

Solar radiation in May and July was negatively associated with yield, this may be co-associated with higher temperatures impacting negatively on yield more than sunnier conditions having a positive effect.

Increased rainfall in June was positively associated with bean yields and in the analysis, those growers who reported their crops experiencing drought achieved lower yields (1.25 t/ha less on average) than those growers who did not report drought symptoms in their crops.

Factors linked to the site are found in Table 2. There was no association of yield with location within the Bean YEN data set. Soil texture was associated with yield, however, with sandier soils yielding less than silty soils, suggesting that water availability may be a limiting factor between sites. Additionally, lower yields were associated with a higher estimated subsoil stone content.

**Table 2. Site factors. Lower group = mean of the lower yielding 25% of crops. Higher group = mean of the higher yielding 25% of crops.**

| Crop parameter | Number of bean crops analysed | Direction of association with yield | Lower group | Higher group |
|---|---|---|---|---|
| Latitude (northerly) | 131 | | 53.0 | 52.9 |
| Longitude (westerly) | 131 | | -1.4 | -1.7 |
| Soil clay content (%) | 94 | | 21.3 | 24.3 |
| Soil sand content | 94 | ↓ | 34.1 | 22.5 |
| Soil silt content | 94 | ↑ | 44.6 | 53.2 |
| Estimated topsoil stone content (%) | 111 | | 14.3 | 5.7 |
| Estimated subsoil stone content (%) | 135 | ↓ | 16.6 | 7.9 |
| SOM LOI | 101 | | 6.5 | 7.7 |
| Soil depth to rock | 117 | | 1.0 | 1.0 |

## Pollinators

As part of the bean YEN entrants have been asked questions on factors which could affect pollination. With between 36 and 72 responses depending on the question, which range from proximity to hives to the age and proximity of flower strips and woodland. The current dataset analysis has not shown any significant associations with yield, however, this dataset merits further, more in depth and bespoke investigation.

## Relevance to..

*Farmers*

Whilst there is not much you can do about site, factors are highlighted that could be offset by long term management. For example maintenance of good soil structure may help with soil conditions and thus soil drainage and water retention. There could be other short term practices to aid conserving/ maximizing water uptake in crops such as:

- Encouraging deep rooting by....
- Early cultivations and timely drilling
- Following good establishment guidelines - sowing into moisture, good seed to soil contact and good soil structure.

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Reinforces the likely water limitation of beans in UK conditions and highlights that climate change impacts of hot late spring and summer conditions could lead to reduced yields. Therefore research and breeding efforts could focus on increased rooting for water access to mitigate drought effects and varieties which can tolerate increasingly warmer seasons. There is an interest in the impact of pollinators on bean yields and the wider environment and the dataset within the network could be useful, with further investigation, to supporting work in this area.

## Establishment decisions

The vast majority of bean crops followed wheat or barley. Generally, most bean crops in the network followed the advice of at least a 5 year break between pulse crops, meaning it is difficult to investigate the impact of shortening this. 13% of growers had a rotation of less than 5 years between pulse crops and although there was a wider spread of data for longer rotational breaks, there seemed to be no obvious benefit to increasing this above 5 years (Table 3).

**Table 3. Length of rotational break between pulses.**

| **Years since last pulse crop** | **Less than 5** | **5 or 6** | **between 7 and 10** | **between 10 and 20** | **More than 20** | **Never** | **unknown** |
|---|---|---|---|---|---|---|---|
| Number of crops analysed | 16 | 44 | 19 | 21 | 4 | 9 | 10 |
| Predicted mean yield | 4.96 | 4.84 | 4.17 | 4.55 | 4.97 | 4.76 | 4.51 |

The majority (66%) of the bean YEN dataset is spring beans, but there was no significant difference between the two types in the analysis (Table 4.).

**Table 4. Type.**

| **Variety type** | **Winter** | **Spring** | **Unknown** |
|---|---|---|---|
| Number of crops analysed | 41 | 98 | 6 |
| **Predicted Mean yield** | **4.77** | **4.68** | **4.35** |

Sowing rate expressed as seeds/m$^2$ was not associated with final yield in the dataset. Spring beans were drilled at an average of 50 seeds/m$^2$ and winter beans at an average of 34 seeds/m$^2$. PGRO has done much work on optimum plant populations however and so good guidance is available in the PGRO agronomy guide. No association was seen between final yield and drill row width (Table 5).

**Table 5. Seed rate and drill row width. Lower group = mean of the lower yielding 25% of crops. Higher group = mean of the higher yielding 25% of crops.**

| **Factor or parameter** | **Direction of association with yield** | **Lower group** | **Higher group** |
|---|---|---|---|
| Sowing rate (m2) | | 41 | 46 |
| Drill row width (cm) | | 21 | 19 |

The majority (34%) of bean crops within the network were established using plough based cultivation methods, 25% were established using deep non-inversion cultivation methods. There was no association between cultivation strategy and yield in the dataset (Table 5).

**Table 5. Cultivation category.**

| Cultivation strategy | Deep non inversion (>6 cm depth) | Direct Drill | Min shallow tillage (<6 cm) | Strip tillage | Plough based | other |
|---|---|---|---|---|---|---|
| Number of crops analysed | 13 (4) | 33 | 4 (5) | 16 | 45 | 14 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Predicted mean yield | **4.89 (5.18)** | **4.59** | **4.63 (4.36)** | **4.73** | **4.52** | **4.38** |

Manure frequency was significantly associated with higher yields, however it is difficult to draw conclusions, with crops that received manure regularly in the rotation yielding the most (every year and 1 in 2 years) as well as the unknown crops. Crops receiving manures infrequently (<1 in 5 years) yielded the least, however those reported to have received no manures recently yielded higher than those with claiming infrequent use. So, the results are not clear cut (Table 6). Manure use as a yes or no answer did not affect the positive association of the more detailed answers. Indicating that this association is more complicated than we have been able to draw out in this analysis.

There was no significant association of removing or incorporating previous crop residues in the data set. There was a significant association if cover crops have been used since the last cash crop, with the use of cover crops yielding more than no use of cover crops, however the unknown category was the highest yielding!

**Table 6. Manure frequency.**

| Manuring frequency | Manured every year | Frequent (1 in 2 years) | Regular (1 in 3 to 5 years) | Infrequent (<1 in 5 years) | No recent use of manures | Unkown |
|---|---|---|---|---|---|---|
| Number of crops analysed | 5 | 10 | 24 | 21 | 46 | 39 |
| **Predicted mean yield** | **5.56** | **4.98** | **4.75** | **3.77** | **4.65** | **5.09** |

**Table 7. Other establishment choices.**

| **Establishment decision** | | **Yes** | **no** | **unknown** |
|---|---|---|---|---|
| Was previous crop residue removed? | Number of crops analysed | 63 | 48 | 34 |
| | Predicted mean yield | 4.72 | 4.51 | 4.94 |
| Cover crops used since last cash crop? | Number of crops analysed | 26 | 102 | 17 |
| | Predicted mean yield | 4.94 | 4.55 | 5.85 |
| Manure use in rotation | Number of crops analysed | 69 | 60 | 16 |
| | Predicted mean yield | 4.62 | 4.71 | 4.94 |

## Relevance to..

*Farmers*

Most farmers within the network followed similar plough based or deep non-inversion cultivation strategies following a winter cereal crop with a good rotational break. More data needs to be collected on the impact of the use of cover crops and the details of the impacts of manure use in the rotation. The PGRO agronomy guide is the best source of information for establishment choices and seed rates etc.

*And the broader scientific understanding & industry*

Understanding what drives the indication of an association between organic material use in the rotation (e.g nutrient availability, soil structure and water retention) and bean crop yield is of interest, as would be understanding the impact of different cover crops and cultivation strategies over time on yield.

## Crop development

One of the most beneficial aspects of the Bean YEN data collection is the data on crop development from many different fields and farms in different years. This helps to paint a picture of the average crop. Generally , we see negative associations of crop yield with sowing date, date of emergence and the start of nodulation. In other words, crops that are sown and reach these growth stages earlier in the season tend to be associated with higher yields (Table 8 and Figure 1.).

**Table 8. Spring bean Crop development. Lower group = mean of the lower yielding 25% of crops. Higher group = mean of the higher yielding 25% of crops.**

| Parameter | Number of crops analysed | Association with yield | Lower group | Higher group |
|---|---|---|---|---|
| Sowing date | 88 | ↓ | 18 March | 26 Feb |
| Date of emergence | 57 | ↓ | 17 April | 01 April |
| Date of nodulation | 51 | ↓ | 20 May | 05 May |
| Date of start of flowering | 19 | | 01 June | 30 May |
| Date of senescence | 66 | | 04 June | 01 June |
| Date of harvest | 37 | | 01 July | 05 July |
| Length of foundation | 50 | | 61 | 66 |
| Length of construction | 31 | | 41 | 56 |
| Length of production | 18 | | 32 | 43 |
| Length of growing season | 37 | ↑ | 106 | 129 |

The size of the data sets for length of growing periods is smaller than for each individual growth stage as not every crop had every growth stage recorded. Extending the length of the growing season, via early sowing and earliness of growth stages before flowering have a strong association with increased yield. All crops appear to flower around the same time and reach subsequent growth stages on similar dates, this is may be due to day length driving flowering date . However, it should be noted that the time to flowering is driven by both day length and temperature in June. It should be noted however, that the number of data points for flowering is limited at 18.

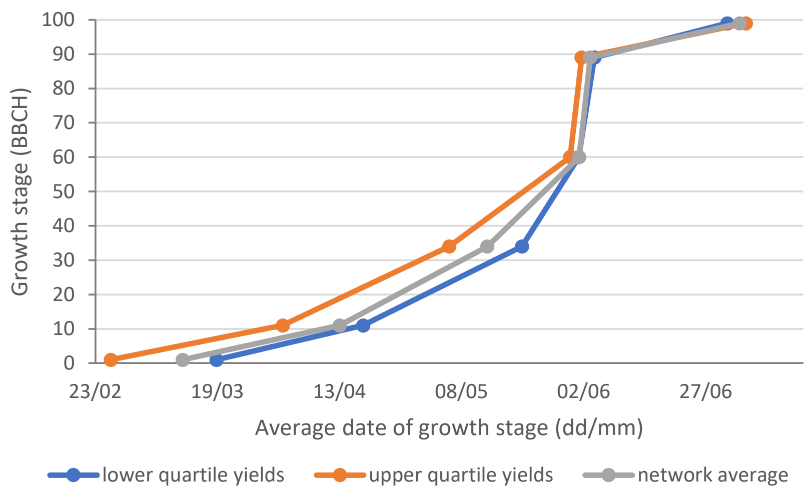


**Figure 1. Average date of key growth stages of spring bean YEN crops. Lower and upper quartile yields = the average dates of key growth stages for the lower and higher yielding 25% of crops respectively.**

There are too few winter bean crop entries to analyse these separately with REML analysis.

## Relevance to..

*Farmers*

This information may help more experienced bean growing farmers understand whether crop development is being impacted by conditions of the current year. It may also help farmers new to growing beans to estimate timing for field walks to monitor crops and key application timings.

Higher yields seem to be associated with earlier drilled crops, perhaps due to the avoidance of stressful conditions at key growth stages. Whilst actual drilling windows are often dependent on the weather, practices that may lend themselves to widening this window such as resilient and well drained soils to aid travelling could help.

*And the broader scientific understanding & industry*

The dates of these key growth stages are useful for sense checking growth models and considering the impact and mitigation of disruptive sowing conditions on bean productivity. Also, monitoring growth stages over time can aid in understanding the impact of a changing climate on development and can inform needed changes in genetics and best practices on farm.

## Crop nutrition

Generally, there was variation in soil nutrient concentrations for P and K within the bean YEN network. There was less variation in soil Mg concentration and soil pH was a little above 7 (Table 9.) There were no associations of soil nutrient concentrations with yield. There was a positive association between yield and the amount of $K_2O$ and $SO_3$ applied, but not with the other inorganic fertilisers which were applied, however, it could be possible that some crops are having fertiliser applied at other stages of the rotation rather than before the bean crop.

**Table 9. Soil and inorganic nutrient applications. Lower group = mean of the lower yielding 25% of crops. Higher group = mean of the higher yielding 25% of crops.**

| Parameter | Number of crops analysed | Association with yield | Lower group | Higher group |
|---|---|---|---|---|
| $K_2O$ application kg/ha | 109 | ↑ | 19 | 30 |
| $P_2O_5$ application kg/ha | 107 | | 18 | 22 |
| $SO_3$ application kg/ha | 106 | ↑ | 5 | 8 |
| Soil K concentration mg/l | 68 | | 256 | 218 |
| Soil P concentration mg/l | 68 | | 32 | 27 |
| Soil Mg concentration mg/l | 68 | | 166 | 146 |
| Soil pH | 102 | | 7.2 | 7.1 |

The full results of the association of yield with seed nutrient concentration and offtake are not covered here as this is best considered alongside the information from all crops available through YEN Nutrition database.

Yields were associated with both seed nitrogen concentration and with total N content (or offtake) (Table 10). Across the network lifetime, a subsection of the straw and pod walls from crop grab samples have been analysed for N content. This has allowed above ground N content and nitrogen harvest index to be calculated. Straw & pod wall nitrogen concentration was negatively associated with final yield while N offtake from both the grain and straw & pod walls were positively associated with yield. This highlights that higher yielding bean crops likely need to acquire more N throughout their development (through N fixation and/or direct N uptake). It could also indicate that higher yielding crops had a lower concentration of N in their tissues, but a higher total biomass, giving a higher N content. Therefore, higher yielding bean crops could return more N to rotational systems from incorporating above ground crop residue. The contribution of biologically fixed N to this likely depends on the ratio of N fixation to direct N uptake in the crop as well as N turnover dynamics between the bean and following crop.

**Table 10. Crop nitrogen content. Lower group = mean of the lower yielding 25% of crops. Higher group = mean of the higher yielding 25% of crops.**

| Parameter | Number of crops analysed | Association with yield | Lower group | Higher group |
|---|---|---|---|---|
| Grain N % | 132 | ↑ | 4.42 | 4.52 |
| Grain N offtake (kg N/ha) | 129 | ↑ | 111 | 237 |
| N concentration (%) in straw and chaff | 97 | ↓ | 1.21 | 1.01 |
| N content in straw and chaff (Kg/ha) | 78 | ↑ | 24.5 | 39.1 |
| Nitrogen harvest index | 78 | ↑ | 0.8 | 0.9 |

The Bean YEN has collected leaf tissue nutrition data at several growth stages. It is unclear how the start of flowering leaf tissue data is affected by remedial foliar nutrient sprays and so this is not shown here. There were no associations with leaf nutrition at GS34 (nodulation) with yield (Table 11). Although not significant there are relatively large differences between the two groups in the leaf concentrations of both Iron and Manganese.

**Table 11. Leaf nutrition at GS34. Lower group = mean of the lower yielding 25% of crops. Higher group = mean of the higher yielding 25% of crops.**

| Parameter | Number of crops analysed | Association with yield | Lower group | Higher group |
|---|---|---|---|---|
| GS34 Leaf B | 82 | | 16.8 | 18.5 |
| GS34 Leaf Ca | 82 | | 1.08 | 1.11 |
| GS34 Leaf Cu | 82 | | 13.8 | 13.0 |
| GS34 Leaf Fe | 81 | | 430 | 513 |
| GS34 Leaf K | 82 | | 2.27 | 2.51 |
| GS34 Leaf Mg | 82 | | 0.19 | 0.21 |
| GS34 Leaf Mn | 82 | | 70.85 | 100.24 |
| GS34 Leaf Mo | 82 | | 16.8 | 18.5 |
| GS34 Leaf N | 70 | | 5.0 | 5.0 |
| GS34 Leaf P | 82 | | 0.37 | 0.35 |
| GS34 Leaf Zn | 826 | | 47.7 | 54.7 |

## Relevance to..

*Farmers*

Farmers within the network are likely performing good practice for maintaining soil nutrient indices. Associations between yield and above ground N offtake suggest that healthy N fixation is important for bean crops to achieve higher yields.

*And the broader scientific understanding & industry*

Crop nutrient offtakes could contribute to refining nutrient balances for crop rotations. Understanding how bean yield and N provision to the following crop relate could help refine the use of N within crop rotations.

## Ag-chems and pests & diseases

When discussing ag-chem applications it's important to once again highlight that the analysis carried out is an association analysis rather than directly looking at cause and effect. It could therefore be possible that farmers within the network were willing to apply more inputs to crops with good yield potential. Higher yielding crops were associated with more fungicide applications, and generally Bean YEN entrants applied between 1 and 2 fungicides. There were no associations between higher yields and the number of insecticide or herbicide applications or the total crop protection spend.

**Table 12. Crop protection inputs & foot rot risk. Lower group = mean of the lower yielding 25% of crops. Higher group = mean of the higher yielding 25% of crops.**

| Parameter | Number of crops analysed | Association with yield | Lower group | Higher group |
|---|---|---|---|---|
| Number of fungicide applications | 111 | ↑ | 1.0 | 1.7 |
| Fungicide spend (£/ha) | 80 | ↑ | 28.7 | 50.2 |
| Number of herbicide applications | 112 | ↑ | 1.6 | 1.7 |
| Number of insecticide applications | 110 | | 0.9 | 1.1 |
| Total crop protection spend (£/ha) | 78 | | 119 | 164 |

Out of the 70 growers who responded to whether pod stick was used at harvest 4 responded yes. There was no significant difference in yield between the two groups (Table 13.), although the conditions preceding harvest for these different crops wasn't accounted for.

**Table 13 pod stick.**

| Podstick used at harvest | yes | no |
|---|---|---|
| Number of crops analysed | 4 | 66 |
| Predicted mean yield | 4.62 | 4.03 |

## Crop physiology

The number of seeds per m$^2$ is associated with final yields in beans, with the number of harvestable pods being highlighted as a major component affecting yield (Mínguez and Rubiales, 2021) Much of this work on understanding the physiology of bean crops and what aspects of crop growth and development limit yield are taken from studies carried out in different countries and climates, ranging from Europe, South America and Australia over a number of years.

Understanding which crop physiological components is important for understanding what aspects of crop growth may be limiting yields and in turn allows us to make changes to practice to try and overcome these limitations.

Yield was positively associated with seeds per m$^2$ at harvest (a measure of seed set). There was a positive association with crop height and the number of pods per shoot. There was no association with the number of shoots per plant, so it seems as though the higher number of seeds set in higher yielding crops arose from taller and higher biomass plants with more pods per shoot rather than more branching per plant. Yield was also associated with more seeds per pod. Interestingly, yield was also positively associated with TSW (a measure of seed filling), suggesting that the ability to fill the seeds set differed between crops in the network (Table 14).

**Table 14. Crop Physiology – spring and winter beans. Lower group = mean of the lower yielding 25% of crops. Higher group = mean of the higher yielding 25% of crops.**

| Factor or parameter | Number of pea crops analysed | Direction of association with yield | Lower group | Higher group |
|---|---|---|---|---|
| TSW (g) | 130 | ↑ | 550 | 688 |
| Crop height (cm) | 128 | ↑ | 93 | 120 |
| Height to lowest pod (cm) | 47 | | 35 | 43 |
| Shoots per plant | 129 | | 1.2 | 1.2 |
| Harvest index | 129 | ↑ | 55 | 59 |
| Plants per m2 | 52 | | 43 | 39 |
| Pods per shoot | 128 | ↑ | 12 | 15 |
| Seed set (seeds/m2) | 112 | ↑ | 537 | 916 |
| Seeds per pod | 128 | ↑ | 2.5 | 2.9 |
| Shoots per m2 | 48 | | 44 | 44 |
| Straw DM yield (t/ha) | 112 | ↑ | 2.1 | 3.8 |
| Total shoot biomass (g) | 29 | ↑ | 4.4 | 9.6 |

The period a little before the start of flowering and start of seed filling is defined as the critical period for faba bean (Mínguez and Rubiales, 2021). Seed number is determined between flowering and seed filling, although it should be noted that there can be considerable overlap between the stages of growth along the stem which can widen the period of time that seed number is determined for the whole plant. High temperatures during flowering and pod set can reduce autofertility and can lead to flower abortion. Flower retention and pod set can be affected by temperature, incident light and rainfall in a critical stage 4 days following anthesis (Stoddard, 1993). Even in the presence of adequate pollination, reduced light during overcast weather can reduce flower retention. Faba bean are also very sensitive to water deficits during flowering and pod set (Pilbeam, Hebblethwaite & Yusuf, 1990 and Xia, 1994). When considered alongside both the association of weather conditions and crop development timing with yield, the Bean YEN physiology data supports that summer conditions are large drivers in final yields for UK bean crops through the impact on seed set and filling.

## Relevance to..

*Farmers*

Bean yields are likely limited by the number of seeds they set. The critical period for determining this within the bean plant is around flowering, so setting the crop up to be robust, supplied with N from the nodules and deep rooted before flowering is important. Earlier developing crops may also avoid hotter temperatures at this critical period. Developing benchmarks for crop physiology and particularly seed set success as in oilseed rape could help monitor success.

*And the broader scientific understanding & industry*

The data from the Bean YEN supports evidence from other agro-climates that seed set is critical. Research into maximizing seed setting potential and mitigating stress around the flowering period is likely to be beneficial to final bean yields.

# Quality – Bruchid beetle damage

Bruchid beetle damage was negatively associated with final yield (Table 16). Bruchid beetle damage is also associated with higher temperatures throughout April to August (Table 17). There was no association between bruchid beetle damage and the number of insecticide applications.

**Table 16. Bruchid beetle damage (%)**

| Factor or parameter | Number of crops analysed | Direction of association with yield | Lower group | Higher group |
|---|---|---|---|---|
| Bruchid beetle damage % | 123 | ↓ | 24 | 12 |

Negative associations between the number of seeds set and temperatures in May and June, when most crops are flowering, support that this is a critical period for seed development (Table 17). Seed fill was also negatively affected by higher temperatures at this time, but most significantly in July.

**Table 17. Summer temperatures, quality and seed development.**

| Factor or parameter | Number of crops analysed | Association with monthly temperature | | | | |
|---|---|---|---|---|---|---|
| | | April | May | June | July | August |
| Bruchid beetle damage (%) | 114 | ↑ | ↑ | ↑ | ↑ | ↑ |
| Seeds set per m2 | 105 | | ↓ | ↓ | | ↓ |
| Seed TSW | 122 | ↓ | ↓ | ↓ | ↓ | ↓ |

Bean losses at harvest were all lower in the higher yielding 25% of the network, however these losses were significantly associated with beans shedded between swathes.

**Table 18 Bean losses at harvest**

| Factor or parameter | Number of crops analysed | Direction of association with yield | Lower group | Higher group |
|---|---|---|---|---|
| Losses shedded between swathes | 63 | ↓ | 35 | 15 |
| Losses behind combine swathes | 63 | | 44 | 30 |
| Losses weight/m$^2$ | 60 | ↓ | 38 | 20 |
| Losses at harvest (t/ha) | 60 | | 0.25 | 0.15 |

## Relevance to...

*Farmers*

Bruchid beetle damage has a significant impact on yield, but the data shows that it is not controlled by insecticide use and is related to spring and summer temperatures.

Minimizing harvest losses is important and the association with losses via shedding indicates perhaps focusing on a more timely harvest where possible.

*And the broader scientific understanding & industry*

Investigating alternative ways to prevent shedding at harvest in beans, could help to prevent yield losses at harvest. Investigating ways to interrupt the bruchid beetle life cycle including IPM actions which could help to reduce the impact of this insect on bean yield, as insecticides are proving ineffective at management.

## What's next for the Bean YEN learning journey?

Continued data collection will allow the network to become more confident in the associations we see, and also look at more complex relationships between different parameters within the data set to help us learn and develop ideas for how on farm practice might influence them. As the network continues we will also try to continue investigating metrics in addition to yield, such as $CO_2e$, quality and profitability within rotations.

Data collection in the Bean YEN is part of the participatory network approach and further confidence and translation to on farm testing will help test the cause and effects of on farm choices and develop strategies to get to the type of crops we think will be most productive. The NCS project is an opportunity for pulse growers to get involved to run their own trials on their topics of interest and be supported financially and scientifically through the Pulse Pioneer initiative. The Pulse Pioneers are supported through the British On Farm Innovation Network (BOFIN). Get in touch with info@bofin.org.uk to find out more.

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