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Nutrient release from cover crops Task 4: The practicality of a potential cover crop DST for farmers and other end users and the likely benefits compared to current practice

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1. Introduction

As part of the cover crop decision support tool (DST) feasibility desk study, a short online survey targeted at farmers and agronomists was carried out. The objective of the survey was to assess how nutrient release from cover crops is currently accounted for by farmers, and how agronomists advise farmers to make decisions surrounding the management of cover crops and subsequent cash crops.

The online survey was titled "Nutrient Management Planning Tool following cover crops" and was open for around 1-month during March 2025. The survey consisted of 20 multiple choice questions which addressed 5 topics:

1. (How) do farmers and agronomists currently account for nutrient release from cover crops?
2. How do farmers and agronomists interpret the recommendations given by The Nutrient Management Guide (RB209)?
3. (How) do farmers make adjustments to nutrient management plans based on agronomist recommendations?
4. Do farmers/agronomist want a tool to help guide nutrient management following cover cropping? If yes:
5. What features would be beneficial to include in a DST?

As a follow-up to the survey, survey participants were invited to join an online workshop (on 29 April 2025). Here project findings were presented and break out groups were used to discuss the project findings and get feedback on the project outcomes.

2. Materials and methods

2.1. Survey questions

The survey questions are outlined below. Orange text indicates re-routing and whether the question is compulsory; whilst blue text indicates how many options respondents are able to select. Respondents were routed to questions depending on the answers they gave, therefore the number of responses to questions varies through the survey.

1. Do you grow or advise on cover crops? *Allow selection of one option only.*

- Yes, I am a farmer
- Yes, I am an agronomist
- Yes, I am both a farmer and agronomist who currently grows and advises on cover crops
- No, re-route to end of survey at this point
- No, I am planning to in the future

2. Which country do you mainly farm/ advise in? *Allow selection of one option only.*
    - England
    - Wales
    - Scotland
    - Northern Ireland
    - Other (please specify)

    If answer is 'England' move to Q3, If answer is 'Wales' move to Q4. If answer is 'Scotland' move to Q5. If answer is 'Northern Ireland' or 'Other' move to Q6

3. [If answer to Q2 = England] In which region(s) do you mainly farm/ advise? *Select all that are relevant Question is not compulsory*
    - East Midlands
    - West Midlands
    - South East
    - South West
    - East of England
    - Yorkshire
    - North East
    - North West
    - London

4. [If answer to Q2 = Wales] In which region(s) do you mainly farm/ advise? *Select all that are relevant Question is not compulsory*
    - North Wales
    - Mid and West Wales
    - South Wales West
    - South Wales East
    - South Wales Central

5. [If answer to Q2 = Scotland] In which region(s) do you mainly farm/ advise? *Select all that are relevant Question is not compulsory*
    - Aberdeen and North East
    - Highlands and Islands
    - Edinburgh and Lothians
    - Glasgow and Strathclyde
    - Scotland South

6. How are cover crops included in your rotation or the rotations you advise on? *Allow selection of one option only.*
    - Summer cover crop/ catch crop
    - Over-winter, ahead of spring cropping
    - Both Summer cover crop/ catch crop & Over-winter, ahead of spring cropping

7. What is your main reason for growing cover crops? *Select all that apply*
    - To protect the soil surface & help prevent soil erosion
    - To reduce nutrient losses
    - To help build soil fertility and reduce the need for manufactured fertilisers
    - To provide forage for livestock grazing
    - To disrupt weed and pest cycles
    - To provide habitat for wildlife
    - Because I get paid to grow cover crops

- Other (please specify)

8. What (if any) do you perceive to be the main benefit(s) for your farm from growing cover crops? *Select all that apply*
   - An increase in following crop yield
   - Provides nutrients to the following crop and reduces the need for manufactured fertilisers
   - Helps to build soil organic matter
   - Alleviation in soil compaction and improved soil structural condition
   - Increased biodiversity on farm
   - Payment from SFI or water companies etc.
   - Improved gross margins
   - None of the above, I don't normally observe any benefit from growing cover crops
   - Reduced runoff
   - Other (please specify)

9. When producing a nutrient management plan, do you take into account nutrient availability from cover crops when calculating the fertiliser requirements of the following crop? *Allow selection of one option only.*
   - Yes
   - No

   Branching if answered no to question 9

10. Why do you not account for potential nutrient availability from cover crops? *Select the main reason that applies to you. Allow selection of one option only.*
    - Nutrient availability too difficult to quantify
    - Unsure of the type of nutrient(s), and reliability in amount and timing of availability
    - I require more support/ information to make an informed decision on this
    - Not of interest
    - Other (please explain)

    Branching if answered yes to question 9

11. How do you account for nutrient availability from cover crops? *Select the main option that applies to you*
    - Adjust following guidance in RB209
    - Adjust following recommendations from my agronomist/ developed by companies' own guidance
    - Based on own expert judgement
    - Carry out own measurements/ estimates
    - Other (please specify)

    Branching if answered "Carry out own measurements/ estimates" to question 11

12. Please provide details of how you carry out any measurements or estimates for nutrient availability from cover crops, *select all that applied to you*
    a) Measure cover crop biomass
    b) Measure both cover crop biomass and nutrient content
    c) Measure soil mineral nitrogen and cover crop N-content
    d) Measure soil mineral nitrogen
    e) Measure additionally available N or potentially mineralizable N in the soil
    f) Crop scans, and adjustment to N-fertiliser rates in growing season
    g) Other (please specify)

    Branching if answered "Adjust following guidance in RB209" *to question 11*

13. How do you interpret the recommendations given by The AHDB Nutrient Management Guide (RB209)? *Allow selection of one option only.*

- Increase Soil Nitrogen Supply by 1 Index
- Increase Soil Nitrogen Supply by 2 Indices
- Other (please specify)

14. Which factors do you take account of when estimating the amount of nutrients supplied by cover crops? *Select all that are applicable*

- Cover crop destruction timing
- Destruction method
- Over-winter rainfall
- Soil type
- Cover crop type including mix of species
- Following crop type
- None of the above
- Other (please specify)

15. Which nutrients do you mainly account for? *Select all that are applicable*

- Nitrogen (N)
- Phosphorus (P) (or phosphate)
- Potassium (K) (or potash)
- Other (please specify)

Branching if answered Nitrogen (N) to question 15

16. When accounting for N-supply from cover crops, typically by how much do you reduce N-fertiliser rate in the following crop?

- Less than or equal to 30 kg N/ha
- 31 - 60 kg N/ha
- 61 – 80 kg N/ha
- >81 kg N/ha
- Hard to say, varies each year
- I don't reduce N rates

Branching if answered Phosphate (P) to question 15

17. When accounting for phosphate supply from cover crops, typically by how much do you reduce P_2O_5 fertiliser rate in the following crop?

- Less than or equal to 30 kg P_2O_5/ha
- 31 - 60 kg P_2O_5/ha
- 61 – 80 kg P_2O_5/ha
- >81 kg P_2O_5/ha
- Hard to say, varies each year
- I don't reduce P_2O_5 rate

Branching if answered Potash (K) to question 15

18. When accounting for potash supply from cover crops, typically by how much do you reduce K_2O fertiliser rate in the following crop?

- Less than or equal to 30 kg K_2O /ha
- 31 - 60 kg K_2O /ha
- 61 – 80 kg K_2O /ha
- >81 kg K_2O /ha
- Hard to say, varies each year
- I don't reduce K_2O rate

19. If available would you use a decision support tool (DST) that will help guide nutrient management planning following cover cropping?

- Yes, I already use a DST for this
    i. *If selected then show free text box: Please provide name and details of the tool you currently use*
- No, but I am interested in using a DST
- No, not something I'm interested in

Branching if answered 'yes' & 'No, but I am interested in using a DST' to question 19

20. What features would be *most* beneficial to include in a DST? *Please select the top 3 features that are of interest?*

- Keeps a record of cover crop biomass and nutrient uptake
- Details on type and amount of nutrient release
- Nutrient availability i.e. fertiliser replacement value of the cover crop
- Details on timing of nutrient release to the following crop
- Details on timing of nutrient release to both the following crop and subsequent crops in the rotation
- Takes into account impacts of cover crop destruction timing and method on nutrient availability to following crop(s)
- Takes into account impacts of soil type and weather conditions and impacts on nutrient availability (from cover crops) to the following crop(s)
- Other (please specify)

2.2. Data analysis

For the majority of the questions the total number of responses has been presented, or the percentage calculated, please note percentages shown are dependent on the number of respondents to each question, not the total number of respondents to the survey. Throughout this document the number of respondents answering each question has been noted within the figure title or description as this changes between questions.

The high number of responses to the survey (n =151) allowed further multivariate analysis to be undertaken using a technique known as Factor Analysis. This is a statistical technique that identifies underlying dimensions (referred to as 'factors') that explain patterns of correlations amongst observed variables. We can employ this approach to identify patterns in why respondents grow cover crops and what benefits they perceive from cover crops. Factor analysis begins by examining correlations among observed variables (e.g., reasons for growing cover crops). After extracting factors from the correlation matrix, each variable receives a loading score on every factor, representing how strongly it correlates with that underlying dimension. Variables that correlate strongly with each other tend to cluster together, suggesting an underlying dimension. As such, we can identify 'factor loadings', which are correlation coefficients between the variables and the factors, ranging from -1 to 1. A positive loading means the variable is positively correlated with that factor, and a negative loading means the variable is negatively correlated with that factor. Generally, loadings above 0.3-0.4 in absolute value are considered meaningful. The Factor analysis was undertake using Stata statistical software.

To enhance interpretability of findings, Varimax rotation was applied. Varimax rotation is an orthogonal rotation technique commonly applied in exploratory factor analysis to enhance interpretability of factor structures. After initial extraction, variables often exhibit moderate loadings across multiple factors, making it difficult to identify distinct patterns. Varimax addresses this by redistributing loadings to maximise the variance of squared loadings within each factor, thereby producing a simpler and more interpretable solution. In practice, this means that each variable tends to load strongly on one factor and weakly on others, clarifying the conceptual meaning of each factor without altering the total variance explained. The orthogonal nature of Varimax ensures that factors remain uncorrelated, which is desirable when the aim is to identify independent dimensions of motivation or behaviour. Its use in this analysis has allowed us to uncover distinct, non-overlapping patterns in reasons for growing cover crops, enabling clearer interpretation of farmer motivations. By applying Varimax rotation, the resulting factor structure provides robust, interpretable insights that align with best practices in multivariate analysis.

3. Results

3.1. Overview of respondent role and geographical location

In total 151 people completed the survey. Of the 151 respondents *c*.58 % were farmers, *c*.29 % were agronomists and *c*.11 % were both a farmer and an agronomist who either currently grow and/or advise on cover crops (**Error! Reference source not found.**). The remaining 3% of respondents planned to either grow or advise on cover crops in the future.

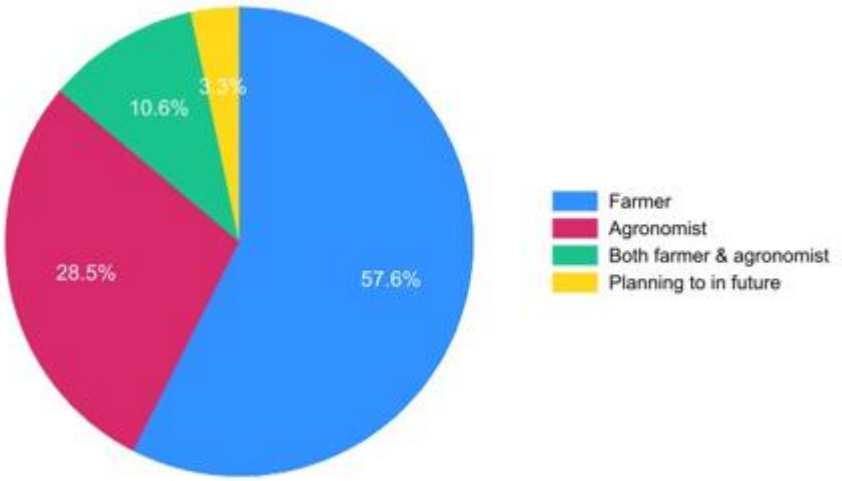

Figure 1: Role of respondents who completed the survey.

In total 95% of respondents (n= 144) farmed or advised in England; with the remaining c. 5% of respondents working in either Wales (n =3), Scotland (n =3) or Northern Ireland (n =1). Respondents were asked to indicate all the regions in which they currently farm or advise. For England, most farmed or advised in the East of England (n= 68), followed by East Midlands (n= 32) and the South East (n= 23) (Figure 2).

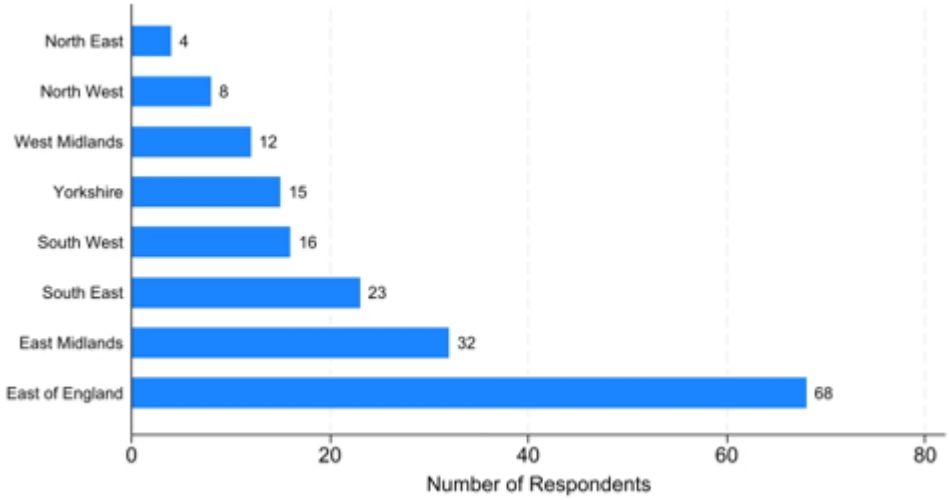

Figure 2: Regions in England in which respondents (n= 144) mainly farm/ advise. Respondents were asked to select all regions which were relevant to them; total number of responses = 178; indicating that some respondents worked in more than one region.

3.2. Type of cover crop, main reasons and main perceived benefits of cover cropping

Of the 151 respondents, c. 50% grow or advised on over-winter cover crops ahead of spring cropping, whilst 48% grow or advised on both over winter and summer cover/catch crops; whilst the remaining respondents (<2%) grow or advised on summer cover/catch crops only (Figure 3).

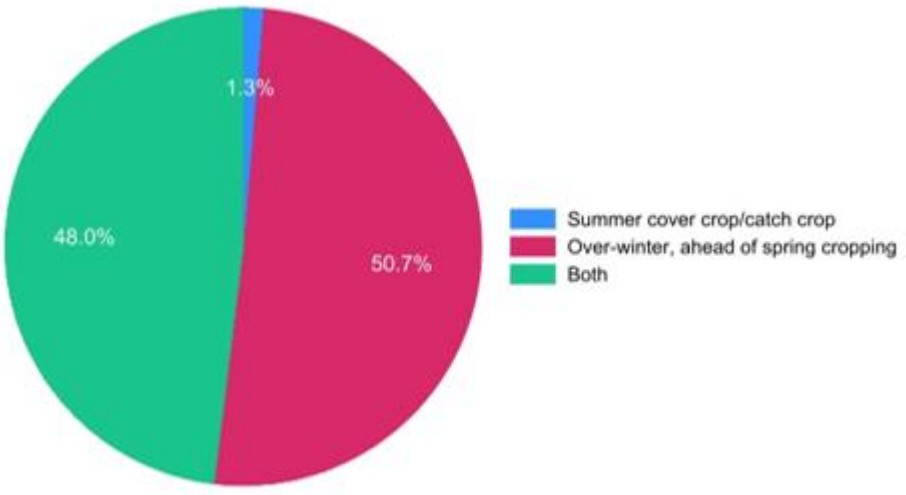

Figure 3: Summary of how respondents (n= 151) included cover crops within their rotation or the rotations which they advise on.

Respondents (n= 151) were asked to give their main reason(s) for cover cropping. The results are presented in Figure 4, the top 5 reasons selected were:

1. To protect the soil surface & help prevent soil erosion (n= 119);

2. To build soil fertility and reduce the need for manufactured fertilisers (n= 104);
3. To reduce nutrient loss (n= 99);
4. To provide forage for livestock grazing (n= 39);
5. Because they get paid to grow cover crops (n= 37)

Notable 'other' reasons specified by respondents included:

- "To feed the soil ecology"
- "As part of a no-till system to help stabilise/ structure soils"
- "Ecological Focus Area (EFA) requirement"
- "Because it is fashionable"

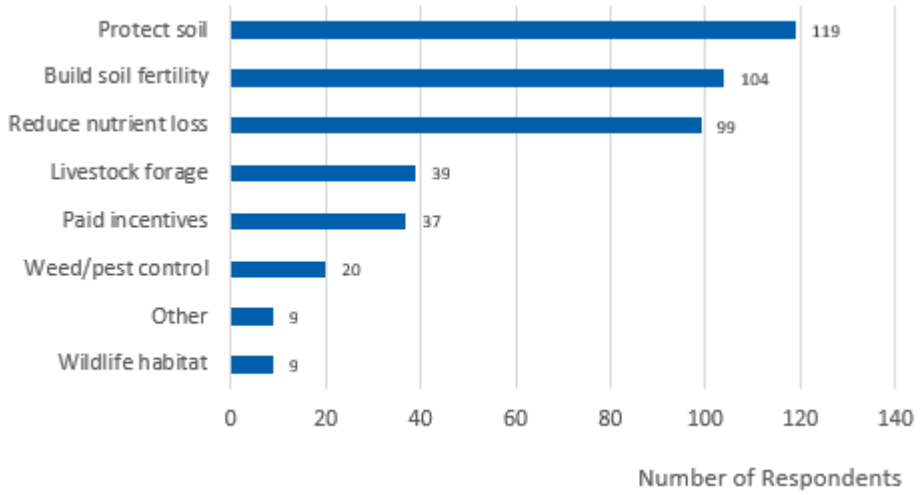

Figure 4: Main reasons for growing cover crops. Respondents (n =151) were asked to select all options that applied to them. Total number of responses = 416; indicating how most respondents selected more than one reason for growing cover crops.

As a follow up, respondents were then asked what (if any) do they perceive to be the main benefit(s) for their farm from growing cover crops? The results are presented in Figure 5, the top 5 benefits selected were:

1. Helps to build soil organic matter (n= 120)
2. Alleviation in soil compaction and improved soil structural condition (n= 82)
3. Provides nutrients to the following crop and reduced the need for manufactured fertilisers (n= 66)
4. Payment from SFI or water companies etc. (n = 61)
5. Reduced runoff (n = 32)

Notably, just one respondent thought that there was no benefit to cover cropping.

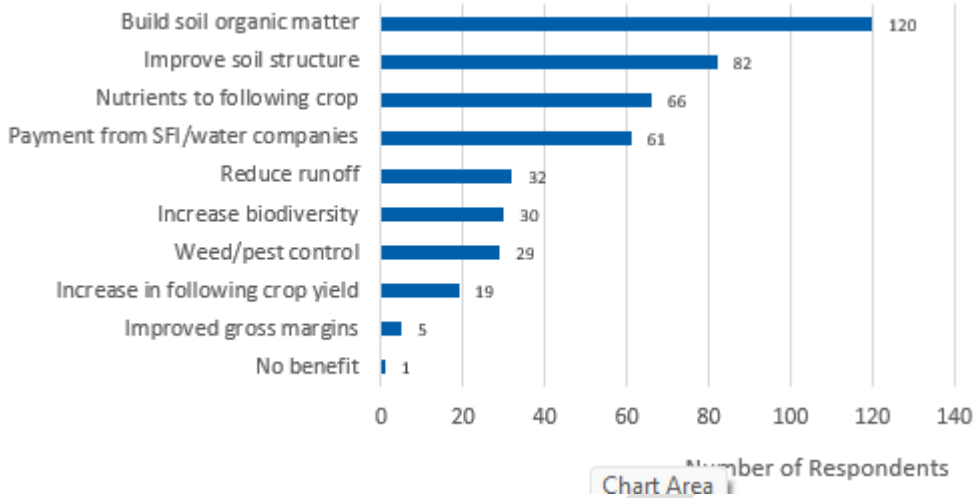

Figure 5: Main perceived benefit(s) from growing cover crops. Respondents (n =151) were asked to select all options that applied to them. Total number of responses = 426 indicating how most respondents selected more than one perceived benefit for their farm.

3.3. Factor analysis of reasons for and perceived benefits of growing cover crops

3.3.1. Reasons for growing cover crops

The factor analysis results for reasons for growing cover crops are displayed in Table 1. Four distinct factors emerge which have been characterised as follows:

Forage for livestock vs. nutrient management

- Strong positive loading (0.63) for reducing nutrient losses, and
- Very strong negative loading (-0.87) for producing livestock forage.
- This suggests respondents tend to focus either on livestock forage or nutrient management, but rarely on both.

Conservation vs. paid incentives

- Very strong negative loading (-0.86) for paid incentives, and
- Positive loading (0.54) for wildlife habitat.
- This suggests those motivated by financial payments are less motivated by conservation benefits.

Weed/pest disruption vs. soil protection

- Strong positive loading (0.78) for weed/pest disruption, and
- Negative loading (-0.56) for soil protection.
- This suggests different management priorities.

Build soil fertility vs. provide wildlife habitat

- Very strong positive loading (0.86) for building soil fertility, and
- Slight negative loading (-0.46) for wildlife habitat.
- This suggests a focus on productive capacity rather than ecological benefits.

These four distinct patterns in motivations for growing cover crops collectively explain 71.3% of variance in responses and suggest that cover crop users have divergent primary motivations, which may influence their nutrient accounting practices and interest in different DST features. A DST designed to appeal to all user groups would need to address multiple objectives, potentially with customisable interfaces for different primary use cases.

The emergence of several distinct patterns in motivations suggest that different user groups might prioritise different aspects of cover crop management, perhaps necessitating tailored approaches with regards to development of a DST.

Table 1: Factor analysis of reasons for growing cover crops

Reason for growing cover crops	**Factor 1: Forage for livestock vs. nutrient management**	**Factor 2: Conservation vs. paid incentives**	**Factor 3: Weed/ Pest disruption vs. soil protection**	**Factor 4: Soil fertility focus vs. provide wildlife habitat**
Protect soil surface	-0.17	0.39	-0.56	0.27
Reduce nutrient losses	0.63	0.18	-0.48	-0.17
Build soil fertility	0.20	0.17	0.06	0.86
Forage for livestock	-0.87	0.10	-0.11	-0.23
Disrupt weed/pest cycles	-0.01	0.08	0.78	0.08
Provide wildlife habitat	0.31	0.54	0.28	-0.46
Paid incentives	0.08	-0.86	0.08	-0.19
Variance explained	**19.1%**	**18.1%**	**17.8%**	**16.4%**

Note: Values highlighted in grey indicate strong factor loadings (>0.5). Varimax rotation was applied to enhance interpretability of findings .

3.4. Accounting for nutrient supply from cover crops

3.4.1. Number of respondents who account for nutrient supply from cover crops

When producing a nutrient management plan 57% of respondents (n = 86) have not taken account of nutrient availability from cover crops when calculating the fertiliser requirements of the following crop (i.e. 'no' responses). Notably, 43% of respondents (n =65) answered 'Yes' and have taken account of nutrient supply from cover crops when calculating the fertiliser requirements of the following crop (Figure 6).

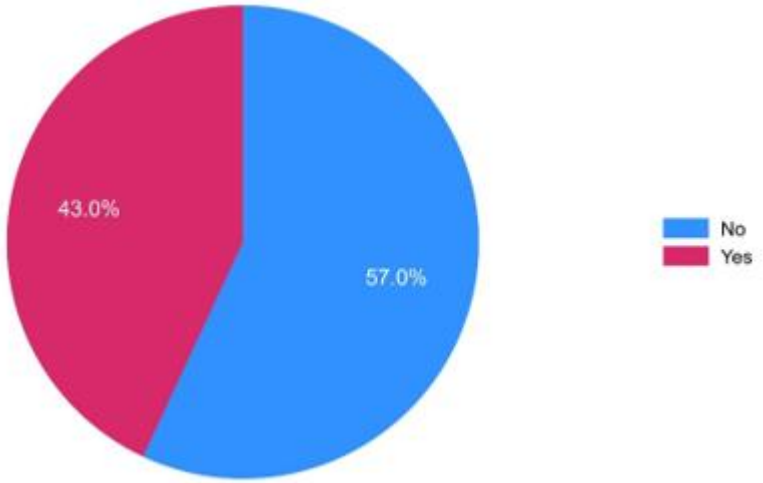

Figure 6: Responses to the question: "when producing a nutrient management plan, do you take into account nutrient availability from cover crops when calculating the fertiliser requirements of the following crop?" Respondents (n =151) were permitted to select either 'yes' or 'no' only.

3.4.2. Summary of why respondents do not account for nutrient supply from cover crops

Respondents who answered "no" (n =86) to the question "do you take account of nutrient supply from cover crops when calculating the fertiliser requirements of the following crop"; were then asked to select the main reason for not doing this (Figure 7). More than half of the respondents who answered this question selected the main reason as being "nutrient availability is too difficult to quantify" (n= 44); followed by respondents being "unsure of the type of nutrient(s), and reliability in amount and timing of availability" (n= 22); and "I require more support/ information to make an informed decision on this" (n= 12).

Notable "other" answers included:

- "Most of the cover crop is removed by grazing livestock".
- "Perception that the nutrients are available not to the immediate crop following but actually benefits crops later in the rotation".

- “Nitrogen is the main nutrient captured by cover crops, which is in the organic N form. This is very much slow release and shows up more in later autumn sown crops. Quantifying this is extremely difficult and dependent on many factors”.
- “Cover crops if still ‘green’ when I plant the cash crop actually hold back nutrient availability to the following cash crop”.
- “When a full year cover crop is used we tend to account for nutrients specifically if it was a legume rich cover crop. But with over-winter mixes we tend not to account for nutrient supply due to the variability in crop growth, and growing season etc.”

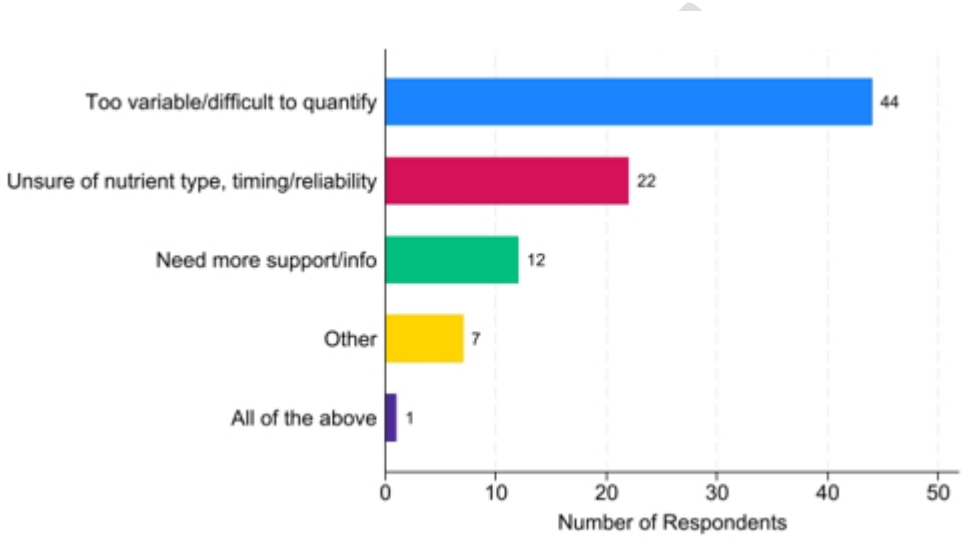

Figure 7: The main reason why respondents do not take account of potential nutrient availability from cover crops. Respondents (n= 86) were allowed to select one option only.

3.4.3. Summary of which nutrient type and factors respondents account for

The 65 respondents who have taken account of nutrient supply following cover crops were asked which nutrients they accounted for (Figure 8). By far the majority of respondents accounted for nitrogen (n= 61), phosphate (n= 25) followed by potash (n= 19). Respondents were asked to select all answers that were applicable to them with a total of 105 responses indicating that many respondents accounted for more than one nutrient type.

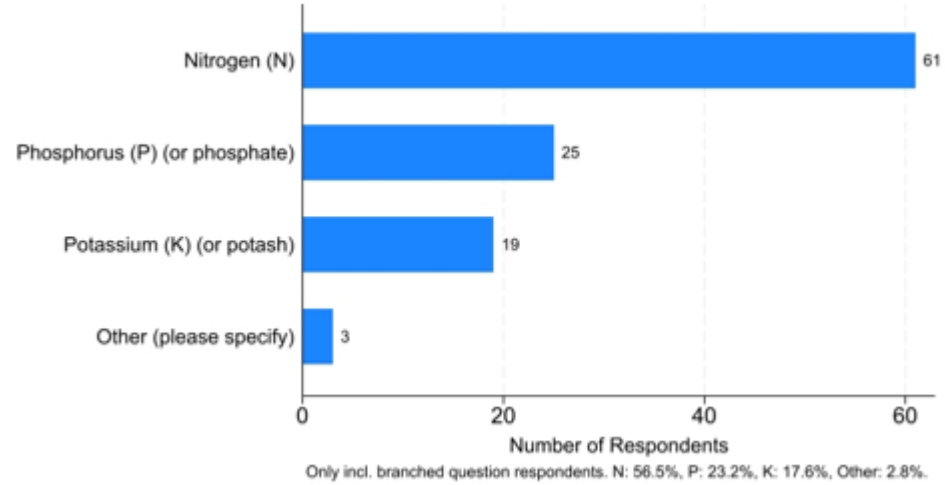

Figure 8: Nutrient type accounted by respondents. Respondents (n = 65) were asked to select all options that applied to them. Total number of responses = 105 indicating how most respondents account for more than one nutrient type.

When estimating the amount of nutrients supplied by cover crops, respondents (n= 65) were asked to select all the factors which they take account of. The results indicate a roughly even spread across the different factors listed with "cover crop type including mix of species" being most frequently taken into consideration (n= 43), followed by soil type (n= 37), destruction timing (n= 37), over-winter rainfall (n= 34) and following crop type (n= 26) (Figure 9).

Notable 'other' responses included:

- "Combination of experience and measurements"
- "Grazing – assume no benefit following grazing"

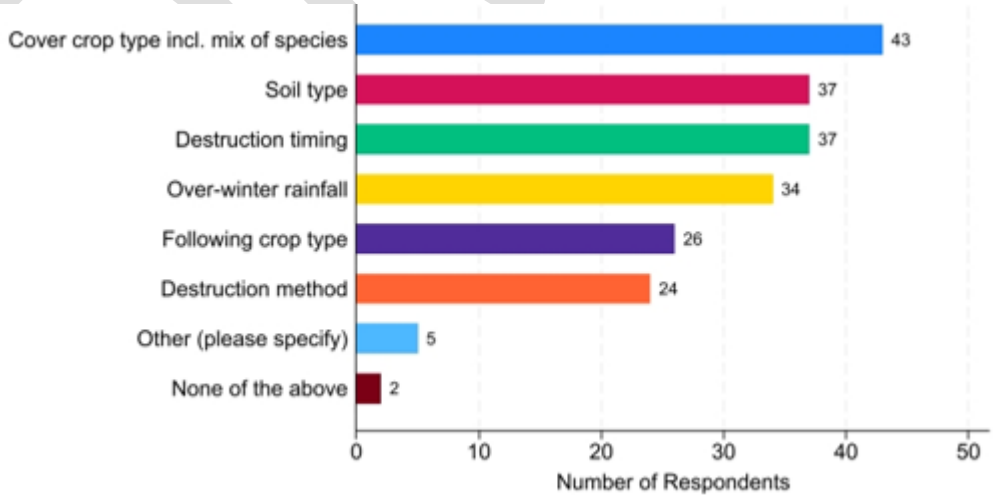

Figure 9: Factors which are taken account of when estimating the amount of nutrients supplied by cover crops. Respondents (n =65) were asked to select all options that applied to them. Total number of responses = 208 indicating how most respondents take account of more than one factor.

3.4.4. How are nutrients supplied by cover crops accounted for

The 65 respondents who have taken account of nutrient supply following cover crops were asked "how do you take account for nutrient availability from cover crops" (Figure 10). There was a fairly even distribution in the responses with "adjust following recommendations from my agronomist/ developed by companies' own guidance" being most popular (n= 18); followed jointly by "carry out own measurements/ estimates" and "adjust following guidance in RB209" (n =14, for both options).

Notable 'other' responses included:

- "I use Hutchinson's cover crop assessment tool"
- "I use the French tool Merci" (n= 2)

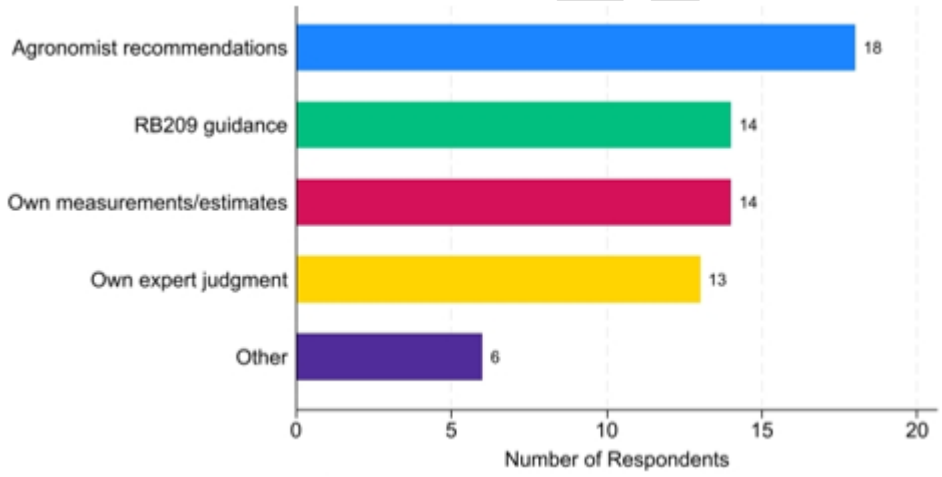

Figure 10: The main approach by which nutrient availability from cover crops is accounted for. Respondents (n =65) were asked to select the one main option which applied to them.

The 65 respondents who have taken account of nutrient supply following cover crops were asked "how do you carry out any measurements or estimates for nutrient availability from cover crops" (Figure 11). Respondents (n= 65) were asked to select all options that applied to them; in total 44 out of 65 respondents do carry out some kind of measurement or estimate of nutrient to the following crop. Whilst 23 respondents replied that they do not carry out any measurements. Followed by respondents measuring soil mineral nitrogen alone (n= 15) or measuring both cover crop biomass and nutrient content (n= 15); and 13 respondents measuring both soil and cover crop N-content.

Notable 'other' responses included:

- "I estimate using The Nutrient Management Guide (RB209)"
- "I use previous research (n =2)"
- "Crop scans in following cash crop and adjustments to N-fertiliser rate in growing season"

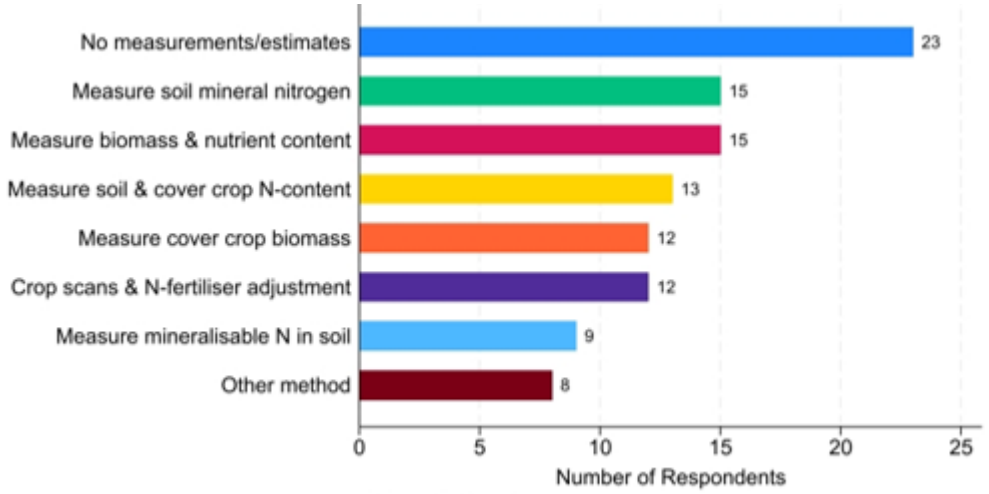

Figure 11: The different methods by which respondents carry out any measurements or estimates for nutrient availability from cover crops. Respondents (n= 65) were asked to select all options that applied to them. Total number of responses = 107 indicating how most respondents carry out more than one approach.

3.4.5. How do respondents interpret the Nutrient Management Guide (RB209) or make changes to N-fertiliser rates

Respondents were asked to indicate "how do they interpret the recommendations given by The Nutrient Management Guide (RB209)". In total 60 respondents answered this question, indicating that around 5 respondents failed to fully complete the survey.

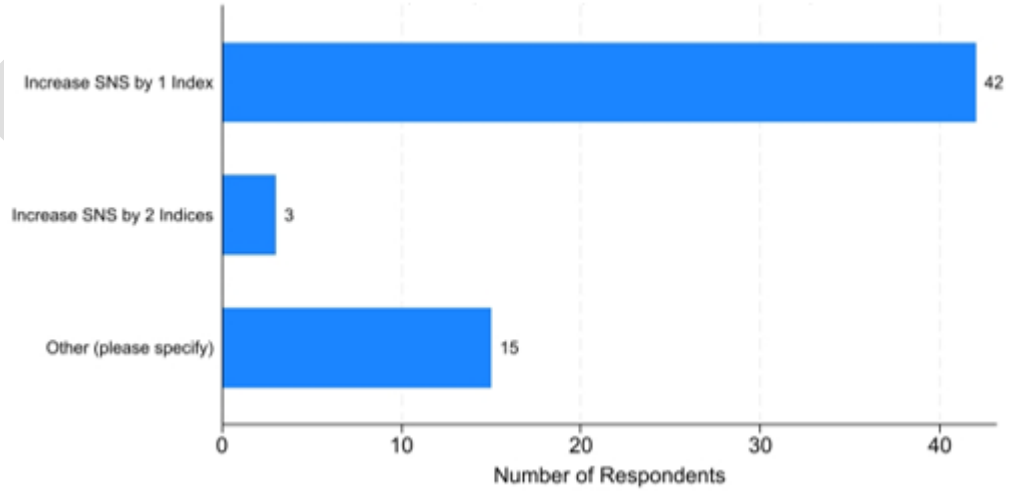

Figure 12: Summary of how respondents (n= 60) interpret the recommendations given by The AHDB Nutrient Management Guide (RB209). Respondents were asked to select one option only.

By far the majority of respondents increase soil nitrogen supply (SNS) by 1-Index (n= 42). A large proportion of respondents answered 'other' (n= 15); with few respondents increasing SNS by 2

Indices (n= 3) (Figure 12). The high proportion of non-standard responses highlights variability in how guidance from the Nutrient Management Guide (RB209) is interpreted.

More specifically, 'other' interpretations can be grouped into three distinct categories, detailed as follows:

Variable/conditional approaches

Some respondents suggest that how and when they adjust depends on specific conditions:

- "Increase depends on growth of cover"
- "Depends on season, next crop and cover crop"
- "Depends entirely on the cover species"
- "0-1 Indices depending on size of crop"
- "Depends very much on the size/quality of the cover crop"
- "Depends on cover crop and crop prior to cover crop"

No increase/conservative approaches

Some respondents take a more cautious approach than that suggested by the RB209 recommendations:

- "No increase – release time long and unknown"
- "Leave the same"
- "Assume no benefit to following crop"

Alternative measurement methods

Some respondents use different approaches entirely:

- "Based on C ratio of cover crop"
- "MGA Nitrogen Predictor"
- "Educated guess"
- "Reduce nitrogen by 30 kg ha"
- "Case by case"
- "If applicable reduce rate based on potential nutrient capture & recycle"

This distribution of "other" responses reveals several insights, firstly, that there appears to be significant variability in how practitioners interpret and apply RB209 recommendations for cover crops. In addition, many would appear to believe that there is need for more nuanced, context-specific approaches.

Ultimately, this variability in RB209 interpretation underscores the potential value of a DST that could provide more tailored guidance on specific conditions. The fact that 25% of responses were "other" suggests substantial uncertainty or a degree of dissatisfaction with the standard index-based approach. There appears to be demand for flexibility to account for other variables, with

many practitioners appearing to believe that recommendations do not adequately address the complexity of cover crop nutrient dynamics.

When accounting for N-supply from cover crops, respondents (n= 65) were asked typically by how much is N-fertiliser rate reduced in the following crop (Figure 13). The majority of respondents reduced N-fertiliser rates in the following crop by up to 30 kg N/ha (n= 33); followed by “varies each year” (n= 18) and reductions in the range of 31 to 60 kg N/ha.

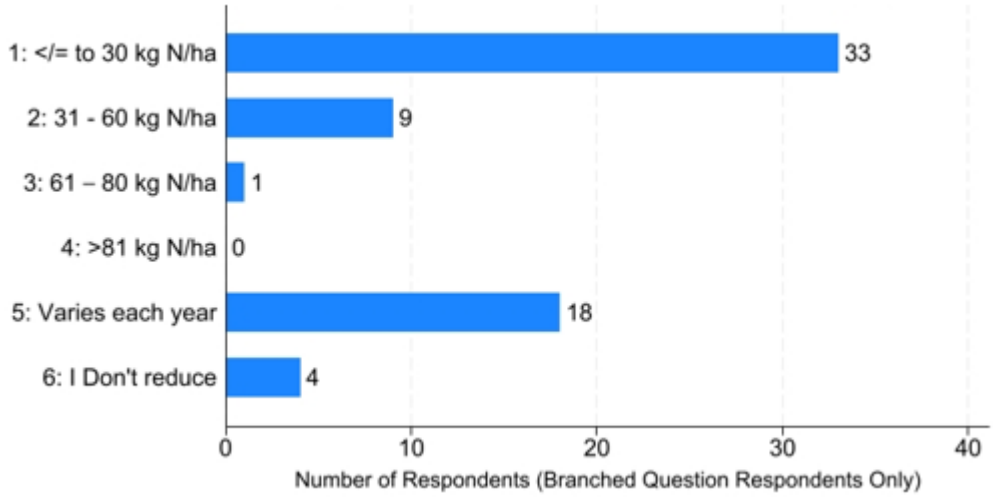

Figure 13: Typical reduction in nitrogen (N) fertiliser rate in the following crop, when accounting for N supply from cover crops. Respondents (n= 65) were asked to select one option only.

3.4.6. Adjustments to phosphate and potash fertiliser application rates

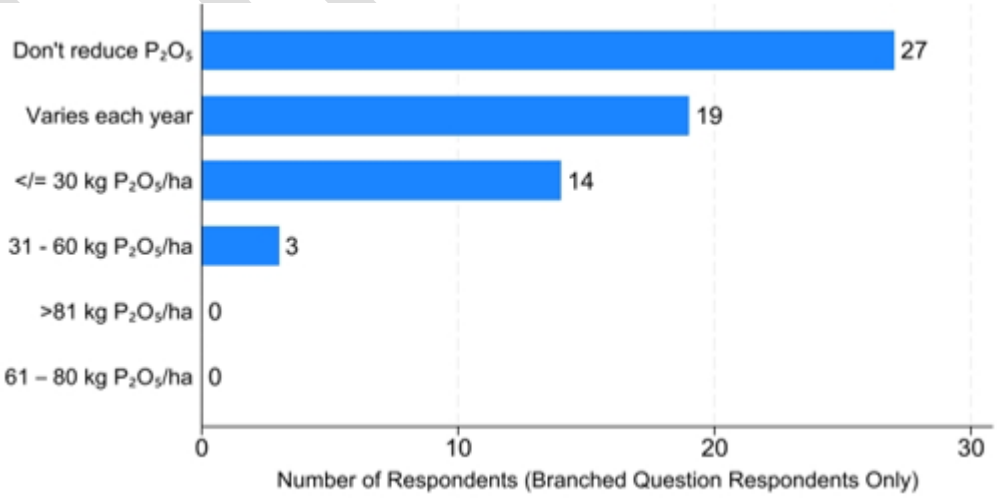

Figure 14: Typical reduction in phosphate (P2O5) fertiliser rate in the following crop, when accounting for N supply from cover crops. Respondents (n= 64) were asked to select one option only.

When accounting for phosphate (P_2O_5) supply from cover crops, respondents (n= 65) were asked typically by how much is P_2O_5 fertiliser rate reduced in the following crop. Overall, most did not reduce P_2O_5 application in the following crop (n= 27), followed by varying the amount each year (Figure 14).

When accounting for potash (K_2O) supply from cover crops, respondents (n= 64) were asked typically by how much is K_2O fertiliser rate reduced in the following crop (Figure 15). Overall, most did not reduce K_2O application in the following crop (n= 31), followed by varying the amount each year (n= 16).

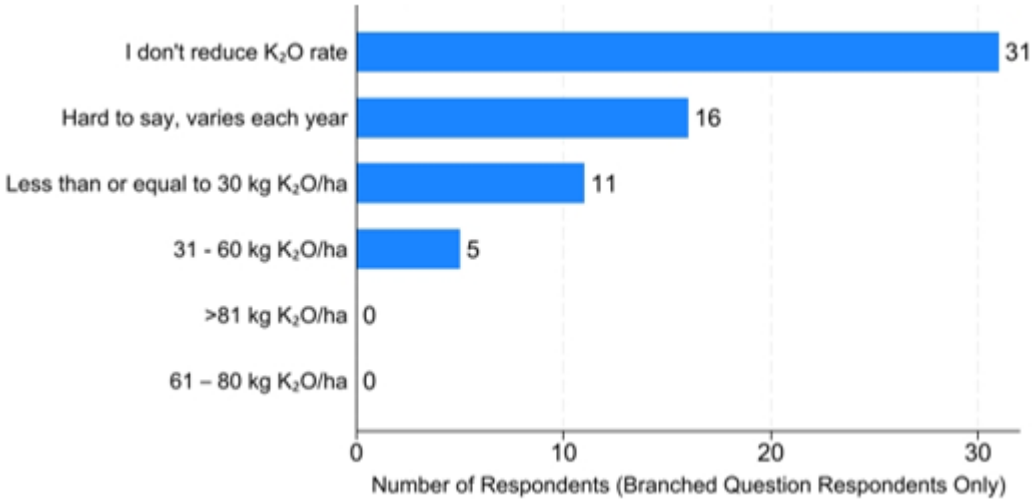

Figure 15: Typical reduction in potash (K_2O) fertiliser rate in the following crop, when accounting for N supply from cover crops. Respondents (n= 63) were asked to select one option only.

3.5. Interest in a DST to support nutrient management decisions after cover crops

At the end of the questionnaire all respondents were asked questions to help understand the potential uptake of a DST and the features which would be most important. The majority (86%) of respondents (n= 129) indicated that, if available, they would use a DST that will help guide nutrient management planning following cover cropping; whilst 8% of respondents (n= 12) indicated that they are not interested, and the remaining 6% (n= 9) indicated that they already use a DST (Figure 16).

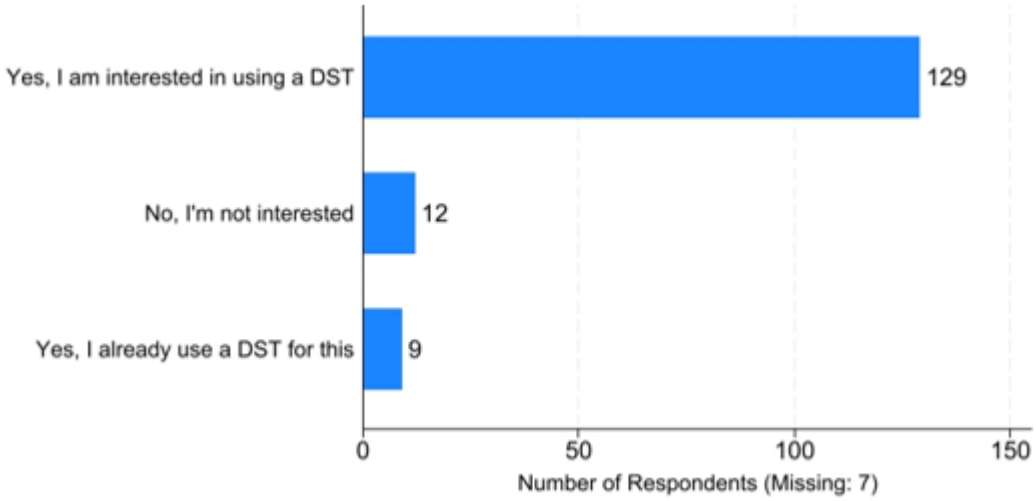

Figure 16: Respondents who would, if available, use a decision support tool (DST) that will help guide nutrient management planning following cover cropping. Respondents (n= 150) were asked to select one option only.

Respondents (n= 150) were asked to select the top three features that are most important for a DST (Figure 17). Overall, respondents selected a range of different features, with all options scoring well. The top 3 features, however, included:

1. Providing the fertiliser replacement value (n= 107);
2. Information on the type and amount of nutrient released (n= 105); and
3. The impact of destruction timing and method on nutrient release (n= 86).

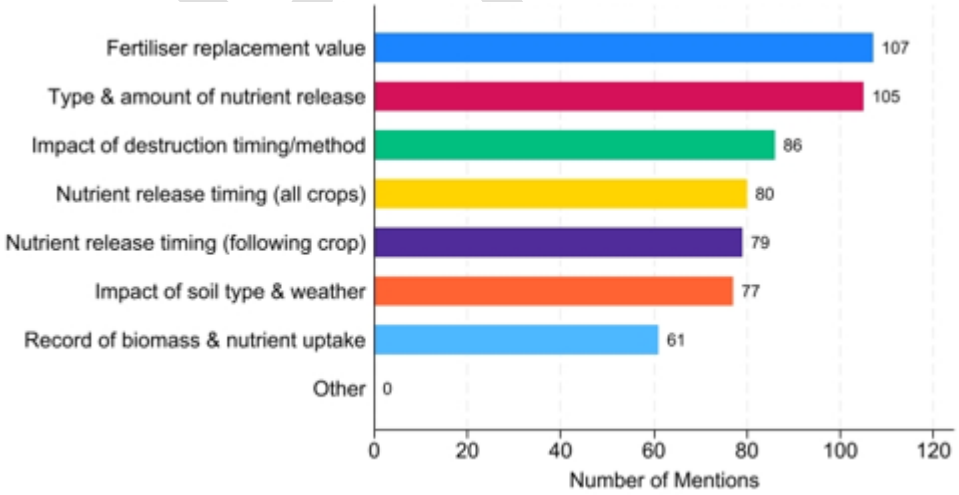

Figure 17: Features which respondents consider would be most beneficial to include in a decision support tool. Respondents (n= 150) were asked to select the top 3 features.

3.6. Workshop to discuss nutrient management following cover crops

As a follow-up to the survey, participants who completed the survey were invited to join an online workshop (on 29 April 2025). Twenty-four participants took part in the workshop, during the discussion session, participants were separated into 4 breakout groups. Each group was led by a facilitator from the project team and were asked to discuss the following 4 key questions:

1. What are your thoughts on what you've heard today?
2. What changes (if any) do you currently make to nutrient management plans following cover cropping?
3. Given the potential level of input required to use a cover crop DST to inform nutrient management plans (i.e. similar to the MERCI model which requires inputs on: cover crop type, biomass amount by species, establishment/ destruction timing, soil type, location etc.), would you use it and make changes to fertiliser requirements?
4. Or do you consider improved general guidance on nutrient management planning following cover cropping would be more appropriate?

The main points raised were captured by the project team and Tables 3 to 6 summarise the key themes raised by each of the breakout groups.

There was a range of different opinions on what a DST should be able to achieve, in particular whether it should inform nutrient management planning alone or be expanded to account for other benefits which cover crops provide, suggesting that a varied/ diverse DST may be required. Regarding the complexity of the tool, participants expressed both an interest in tools that would inform nutrient management planning (particularly if validated for the UK and integrated with other nutrient management planning tools); something in-between and general guidance.

Table 3: Summary of responses related to question 1: What are your thoughts on what you've heard today?

	Difficult to sample a cover crop mix (by plant type) as required for MERCI tool	Robust measurement of cover crop biomass inherently variable	Too many variables to consider (e.g. weather and method of destruction) which influences cover crop biomass and nutrients availability	Difficult to determine below ground biomass	Producing biomass and maximising nutrient return not main objective of cover cropping (priority is improving soil health, specifically soil biology and soil structure)	Agronomist response: encourage Farmers to make an adjustment following cover crops, but difficult to determine timing of nutrient release	Interested in amount of nutrients exported by sheep when grazing cover crops	A DST to inform cover crop species selection would be valuable
Group 1	✓	✓	✓	✓		✓		
Group 2					✓		✓	
Group 3			✓	✓	✓	✓		
Group 4								✓

Table 4: Summary of responses to question 2: What changes (if any) do you currently make to nutrient management plans following cover cropping?

	Carry out soil analysis after cover cropping to inform nutrient management planning	Use hand held crop sensors, or satellite data to assess how much nitrogen from the cover crop is available to the following crop	No change to nutrient management plans	Crop yield and quality reduced, when cutting back on N-fertiliser rates following cover crops	Motivated to reduce N-fertiliser rates	Cover cropping to both reduce N-fertiliser rates and improve soil health or to provide livestock forage	Cover crops do not provide phosphate or potash to the following crop	Variable between years as a lot of factors impact cover crop N uptake and release
Group 1	✓	✓	✓					
Group 2	✓		✓	✓	✓	✓	✓	✓
Group 3		✓	✓			✓		✓
Group 4		✓						✓

Table 5: Summary of responses to question 3: Given the potential level of input required to use a cover crop DST to inform nutrient management plans (i.e. similar to the MERCI model), would you use it and make changes to fertiliser requirements?

	Yes, would use to change fertiliser requirements	**Yes, would use if outputs validated for UK conditions**	**Yes, would use to change fertiliser requirements; for a short while (or a few fields) to get a feel for typical nutrient supply, then will stop using the tool**	**Yes, would use to change fertiliser requirements, but if DST only focused on this then it would miss other benefits of cover cropping**	**Would prefer something simple, like photos to guide decisions to assess cover crop performance**	**No, would not use to change fertiliser requirements**
Group 1	✓	✓				
Group 2					✓	
Group 3			✓	✓		✓
Group 4		✓	✓		✓	

Table 6: Summary of responses to question 4: Or do you consider improved general guidance on nutrient management planning following cover cropping would be more appropriate. Note: group 2 ran out of time to directly answer this question.

	A tool would be more useful than general guidance	Something in-between full DST and general guidance	Something that informed on costs and benefits of cover cropping	Simple guidance would be more appropriate	A tool which could be integrated with PLANET software	Cost effectiveness of cover cropping should be considered
Group 1	✓	✓	✓	✓		✓
Group 3		✓			✓	
Group 4	✓	✓		✓		

4. Discussion

Overall, the survey achieved a good response with over 151 farmers and/ or agronomists completing the survey. Notably, a high proportion of respondents grow or advise on both over-winter and summer catch/cover crops this most likely reflects that Sustainable Farming Incentive (SFI) payment (CSAM2 and SOH2) is available for both summer and winter cover crops.
In total, 43% of respondents take account of nutrient supply when producing a nutrient management plan for the following crop; whilst the remaining 57% do not. Key reasons for not accounting for nutrient supply from cover crops included "nutrient availability is too difficult to quantify" followed by respondents being "unsure of the type of nutrient(s), and reliability in amount and timing of availability".

By far nitrogen, rather than phosphate or potash supply from cover crops was most frequently accounted for, this was in agreement with the findings from the evidence review for Task 1 (Lloyd et al., 2025) of this project, which reported that there was limited evidence to support that cover crops supply meaningful amounts of phosphate or potash to the following cash crop.
When adjusting N-fertiliser rates in the following crop, most farmers and advisors responded that they typically reduce N-fertiliser rates in the following crop by up to 30 kg N/ha; followed by varying the amount each year. Reductions of up to 30 kg N/ha is consistent with the UK evidence reviewed as part of the evidence review for Task 1 (Lloyd et al., 2025) of this project.

The Nutrient Management Guide (RB209) recommends that following a well-established cover crop, SNS Index can be increased by up to 2 Indices (AHDB 2023). As a result of this 'Indices approach' the impact on N-fertiliser rate for the following crop varies greatly (with reductions ranging from 10 up to 50 kg N/ha) and is arbitrarily influenced by crop type rather than any factors known to impact crop N-availability. When interpreting the recommendations given by the Nutrient Management Guide (RB209) most farmers and agronomists increase SNS Index by 1, whilst a large proportion provided 'other' (or non-standard) responses. The high proportion and distribution of 'other' responses reveals several insights. Firstly, that there appears to be significant variability in how practitioners interpret and apply RB209 recommendations for cover crops. In addition, many would appear to believe that there is need for more nuanced, context-specific approaches.

The majority (86%) of respondents indicated that, if available, they would use a DST that will help guide nutrient management planning following cover cropping. When asked to select their top 3 features, these included: 1) providing the fertiliser replacement value; 2) information on the type and amount of nutrient released and 3) the impact of destruction timing and method on nutrient release.

The online workshop provided opportunity to gain feedback on the project interim findings and to gather further information on how farmers/ agronomists currently account for nutrient release from cover crops and what they require from a tool. The groups expressed a range of different opinions on what a DST should be able to achieve. In particular, discussion from two of the groups included whether a tool should inform nutrient management planning alone or be widened out to account for other benefits which cover crops provide. Regarding the complexity of the tool participants expressed an interest in a DST that would inform nutrient management planning (particularly if validated for the UK and integrated with other nutrient management planning tools); something in-between and update to general guidance.

The findings from the survey and online workshop will be used to inform the options explored in Task 5, the results highlight that a diverse/ varied DST maybe required to meet the different requirements of end users. Task 5 will, therefore, set out high level roadmaps for developing a cover crop DST to inform nutrient management planning that meets the diverse needs of end users. Start typing here. This should aim to put project results in the context of other relevant research. Pay special attention to recommendations for uptake of results by the industry and suggestions for further R&D.

5. References

AHDB (2023). The AHDB Nutrient Management Guide (RB209). Section 1 Principles of Nutrient Management and Fertiliser Use. (updated June 2023). Page 19.

Lloyd, I. Smith K.E., White, C., Bhogal, A. (2025). Quick Scoping Review on the evidence and methodologies for estimating and predicting timing and amount of nutrients released from cover crops. AHDB project code 21250001.