Department for Environment Food & Rural Affairs

Fertiliser usage on farms: Results from the Farm Business Survey, England 2017/18

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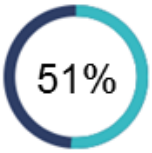
This release presents estimates of the use of precision farming techniques, soil nutrient software, clover and legumes in grass swards, green manures, sources of nutrient planning advice and fertiliser application rates at the farm level in England.
All year on year changes are unlikely to be significant.

Overall fertiliser practice usage...

of farm businesses carried out precision farming techniques to guide fertiliser application, similar to 2016/17 levels.

of farm businesses used soil nutrient packages to help determine fertiliser application, a slight increase from 22% in 2016/17.



of farms with grass included clover or legumes in their grass swards[a], a small decrease from 53% in 2016/17.

of farm businesses used green manures in their arable rotation, at similar levels to 2016/17.

of farms who either user clover, legumes or green manure, made adjustments to their fertiliser application rates.

Average application per hectare in England 2017/18 of key nutrients:

112kg/ha of Nitrogen	21kg/ha of Phosphate	27kg/ha of Potash

There has been little change in overall **application rates** since 2012/13

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(a) Grass sward = land/soil with a layer of grass

Detailed results

- Almost a quarter of farm businesses carried out **precision farming techniques** i.e. soil mapping and use of satellite technology to guide fertiliser application (23%) in 2017/18. Usage was more likely on cereal (46%) and general cropping farms (48%).
- In 2017/18, a quarter of farms used **soil nutrient software packages** to help determine fertiliser applications. There has been little overall change in this since 2012/13. Usage was most common on cereal and general cropping farms and on very large farms.
- Just over half of farms with grass included **clover or legumes in their grass swards** (51% in 2017/18). Compared to other farm types, sizes and regions, this practice was most common on mixed and dairy farms, medium, large and very large farms and on farms in the South West.
- Very few farmers use **green manures** in their arable rotations (15% in 2017/18). General cropping, mixed, and organic farms were more likely to use green manures than other farm types.
- For those farms using either clover and legumes or green manures, 71% made **adjustments to their fertiliser application** rates in 2017/18. Farms in the East and South East of England were less likely to adjust rates, whilst dairy, cereals, mixed and general cropping farms were more likely to do so.
- Nearly half of farm businesses (45%) relied on their own non-FACTS[1] qualified **advice for nutrient planning**, while 25% relied on independently supplied FACTS advice, and 24% received advice from their FACTS-qualified fertiliser supplier.
- There has been little change in overall **application rates** since 2012/13.
- The average amount of **nitrogen applied per hectare** of farmed area (excluding rough grazing) was 112 kg in 2017/18. Cereal farms had the highest application rates whilst grazing livestock farms had the lowest.
- The average amount of **phosphate applied per hectare** of farmed area (excluding rough grazing) was 21 kg per hectare in 2017/18. Horticulture and cereal farms had the highest application rates while grazing livestock and pigs and poultry farms had the lowest.
- The average amount of **potash applied per hectare** of farmed area (excluding rough grazing) was 27 kg per hectare in 2017/18. Horticulture farms had the highest application rates, while pigs and poultry farms had the lowest.

[1] FACTS= Fertiliser Advisers Certification and Training Scheme.

1 Introduction

The data used for this analysis is from a sample of 1762 farms that completed the fertiliser module in the 2017/18 Farm Business Survey (FBS). Completion of the module was compulsory in 2017/18 following a planned, phased introduction of the module since 2012/13. The FBS covers those farms with at least 25,000 euros of standard output in England.

Nutrients, particularly nitrogen, are the biggest determinant of yield and also have a major impact on crop structure and the quality of the end product. Over recent years there has been an increasing focus on agriculture's environmental footprint, and how nutrient losses to the ground and water can negatively affect biodiversity and the quality of drinking water. Data collected on the quantity of nitrogen (N), phosphate (P_2O_5) and potash (K_2O) applied as fertiliser in their manufactured form can help estimate the environmental footprint. The British Survey of Fertiliser Practice[2] (BSFP) is the primary source of data on inorganic and organic fertiliser use in Great Britain, and collects a more detailed breakdown of the crops that fertilisers are applied too. Comparisons are made throughout this publication.

The results for 2017/18 are shown with confidence intervals and comparisons to previous years. The full breakdown of results by farm type, farm size, region, farm tenure, farmer age, farm economic performance and Nitrate Vulnerable Zones (NVZs)[3], can be found at: https://www.gov.uk/government/statistics/fertiliser-usage-on-farm-england.

Regression models were fitted to the key results to help determine the main factors driving response. In each case seven factors were considered - farm type, farm size, farm tenure, farmer's age, region, farm economic performance and Nitrate Vulnerable Zones (NVZs). In the case of using green manures, organic status was also considered.

This release provides the main results from the 2017/18 FBS which covered the 2017 harvest. Weather conditions can influence which crops are grown and the application rates of manufactured fertilisers. For a summary of the 2017/18 weather conditions and the 2017 crop areas on agricultural holdings see appendix A.

[2] For more information on the BSFP please see: https://www.gov.uk/government/collections/fertiliser-usage

[3] An NVZ is designated where land drains and contributes to the nitrate found in "polluted" waters. Farms with land in NVZs must comply with certain rules regarding nutrient planning, storage and application.

2 General Questions

The Farm Business Survey includes six general questions covering the use of precision farming techniques, soil nutrient software, clover and legumes in grass swards, green manures and nutrient planning advice. The results are presented below for 2017/18. The small year on year changes observed are unlikely to be significant.

2.1 Precision farming techniques

Precision farming techniques can make processes such as fertiliser application more efficient. Growers must balance the cost of inputs with a demand for higher yields and the pressure of increased environmental awareness and compliance. Precision technology can help to improve the efficiency of farm operations, including cultivation and better targeted fertiliser and agrochemical applications. This can reduce input use (and cost) and improve soil structure.

Farmers were asked if they carried out precision farming techniques (i.e. soil mapping and the use of satellite technology to guide fertiliser applications). In 2017/18, 23% of farms used these techniques (Table 2), little change from 2016/17 (this change is highly unlikely to be significant due to the increase in responses received).

Table 2: Percentage of farm businesses using precision farming techniques, England 2015/16 to 2017/18[(a)(b)]

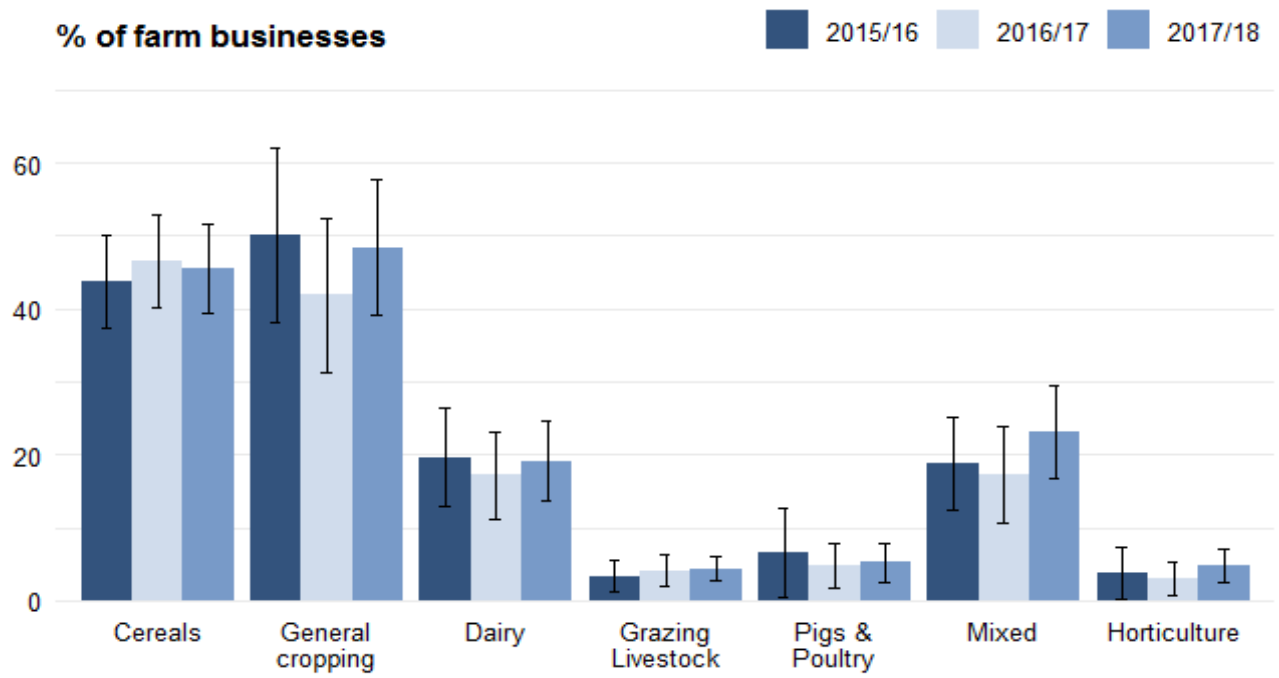
	Percentage of farm businesses (%)		
	2015/16	**2016/17**	**2017/18**
Precision farming techniques used	21 (±2)	21 (±2)	23 (±2)
No precision farming techniques used	77 (±2)	75 (±3)	75 (±2)
Not applicable[(c)]	2 (±1)	4 (±1)	3 (±1)

(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.
(b) 95% confidence intervals are shown in brackets.
(c) This includes farms who do not use any fertilisers and those that do not grow any arable crops.

The use of precision farming techniques was related[4] to farm type, farm size and region (as in previous years). Cereal and general cropping farms were more likely to use these techniques than other farm types (46% in 2017/18 for cereal farms; 48% for general cropping farms, Figure 1). Usage was more common on very large farms (34% in 2017/18). Farms in the East Midlands were more likely to use precision farming techniques than farms in other regions (39%). Although use of precision farming techniques tends to be greater for higher economically performing farms, the relationship is less strong in comparison to other factors such as farm type and size.

[4] A generalised linear regression model was fitted to examine which factors (farm type, farm size, region, farm tenure, farmer age, farm performance and NVZ status) were significant. Farm type, size and region were significant at the 5% level.

Figure 1: Percentage of farm businesses using precision farming techniques by farm type, England 2015/16 to 2017/18[(a)]



Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.

2.2 Soil nutrient software

Effective nutrient management provides sufficient nutrients to meet the growth requirements of crops and grassland whilst managing environmental impacts; it can help minimise Green House Gas emissions, reduce the incidence of diffuse water pollution and increase productivity by reducing input costs. There are a variety of tools and sources of advice that farmers can use to assess soil nutrient requirements; bespoke software packages provide one such means.

A quarter of farms used soil nutrient software packages to help determine fertiliser applications in 2017/18 (Table 3). There has been little change since 2015/16. Results from the 2017 British Survey of Fertiliser Practice[5] (BSFP) showed similar levels; 26% of farms in England used a computer program to record manufactured fertiliser applications (19% for organic manures).

[5] For more information on the BSFP please see: https://www.gov.uk/government/collections/fertiliser-usage

Table 3: Percentage of farm businesses using soil nutrient software packages to help determine fertiliser applications, England 2015/16 to 2017/18[(a)(b)]

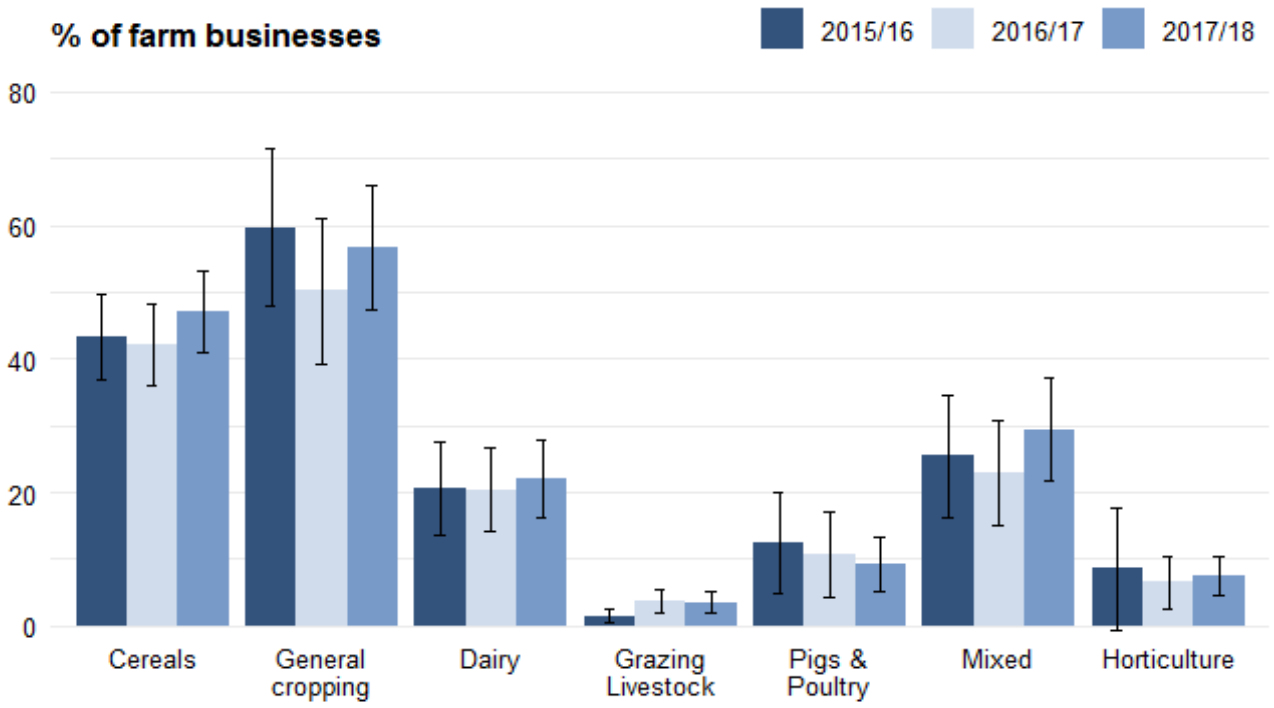
	Percentage of farm businesses (%)		
	2015/16	**2016/17**	**2017/18**
Soil nutrient software used	23 (±2)	22 (±2)	25 (±2)
No soil nutrient software used	76 (±3)	74 (±3)	72 (±2)
Not applicable[(c)]	1 (±1)	3 (±1)	3 (±1)

Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.
(b) 95% confidence intervals are shown in brackets.
(c) This includes farms which do not use any fertilisers and those that do not grow any arable crops.

As in previous years, the use of soil nutrient software was related[6] to farm type and farm size. With the exception of 2015/16, use of soil nutrient software was also related to having land in a Nitrate Vulnerable Zone (NVZ). Usage was most common on cropping farms; 47% in 2017/18 for cereal farms and 57% for general cropping farms, Figure 2. Grazing livestock farms were least likely to use such software (4% in 2017/18). Usage was more likely on very large farms (34% in 2017/18) than for other farm size groups. Farms not in an NVZ were less likely to use soil nutrient software (19% in 2017/18 Figure 3).

[6] A generalised linear regression model was fitted to examine which factors (farm type, farm size, region, farm tenure, farmer age, farm performance and NVZ status) were significant. Farm type and farm size were significant at the 5% level.

Figure 2: Percentage of farm businesses using soil nutrient software packages by farm type, England 2015/16 to 2017/18[(a)]



Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.

Figure 3: Percentage of farm businesses using soil nutrient software packages by NVZ status, England 2015/16 to 2017/18[(a)]

Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.

2.3 Clover and legumes in grass swards

In many situations, sowing grassland with a clover mix or legumes can be a cost effective method of increasing production and improving environmental protection. For example, clover's nitrogen fixing properties (although not suitable for all soil types) can reduce the amount of nitrogen required and improve grassland yields. Of those farms with permanent or temporary grass, 51% included clover or legumes in their grass swards in 2017/18 (Table 4); 8% thought that the method was not applicable.

Table 4: Percentage of farm businesses with temporary and/or permanent grass[(a)] that include clover or legumes in grass swards, England 2015/16 to 2017/18[(b)(c)]

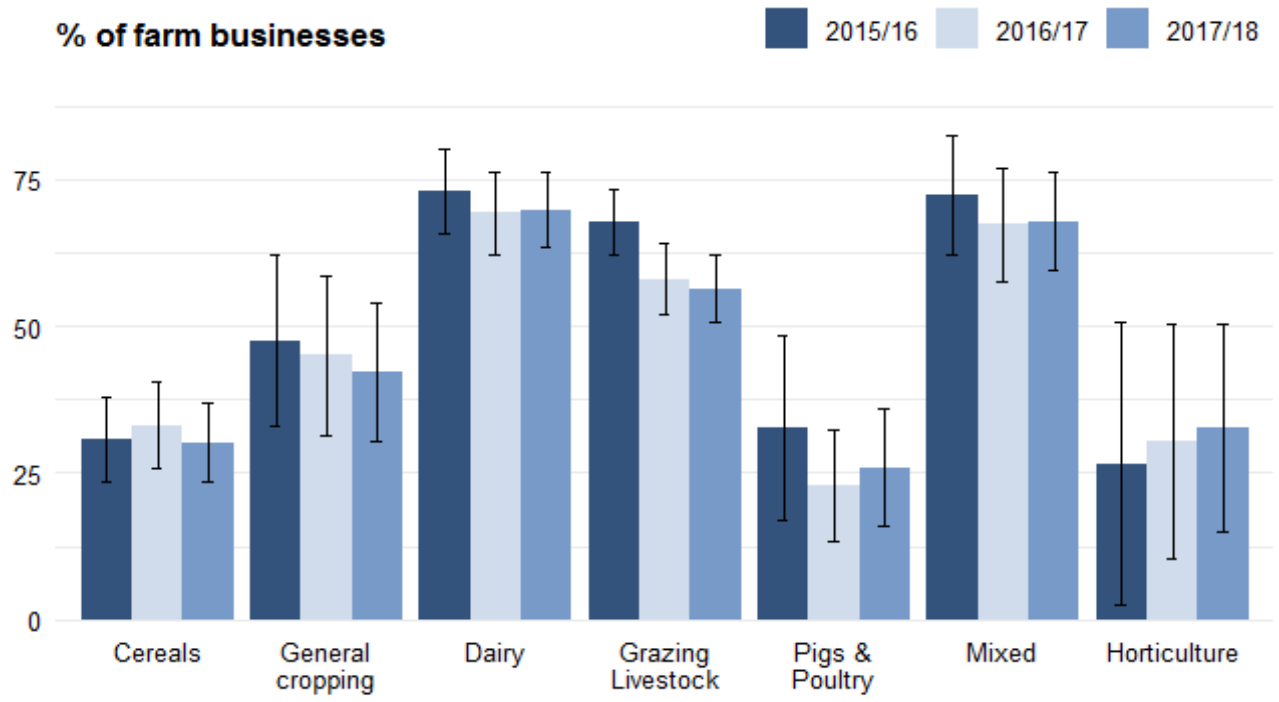
	Percentage of farm businesses (%)		
	2015/16	**2016/17**	**2017/18**
Includes clover or legumes	58 (±3)	53 (±3)	51 (±3)
Does not include clover or legumes	33 (±3)	38 (±3)	40 (±3)
Not applicable	9 (±2)	9 (±2)	8 (±2)

Source: Farm Business Survey
(a) Excludes rough grazing
(b) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.
(c) 95% confidence intervals are shown in brackets.

The use of clover and legumes in grass swards was related[7] to farm type, farm size, and region in 2017/18, as in 2016/17. Usage was most common on dairy and mixed farms (70% and 68% respectively) in 2017/18, Figure 4, and least likely on pigs and poultry farms (26%). Larger farms were more likely to use these crops than smaller farms. Farms in the South West were more likely to use clover and legumes (77%) in grass swards than those in other regions (Figure 5).

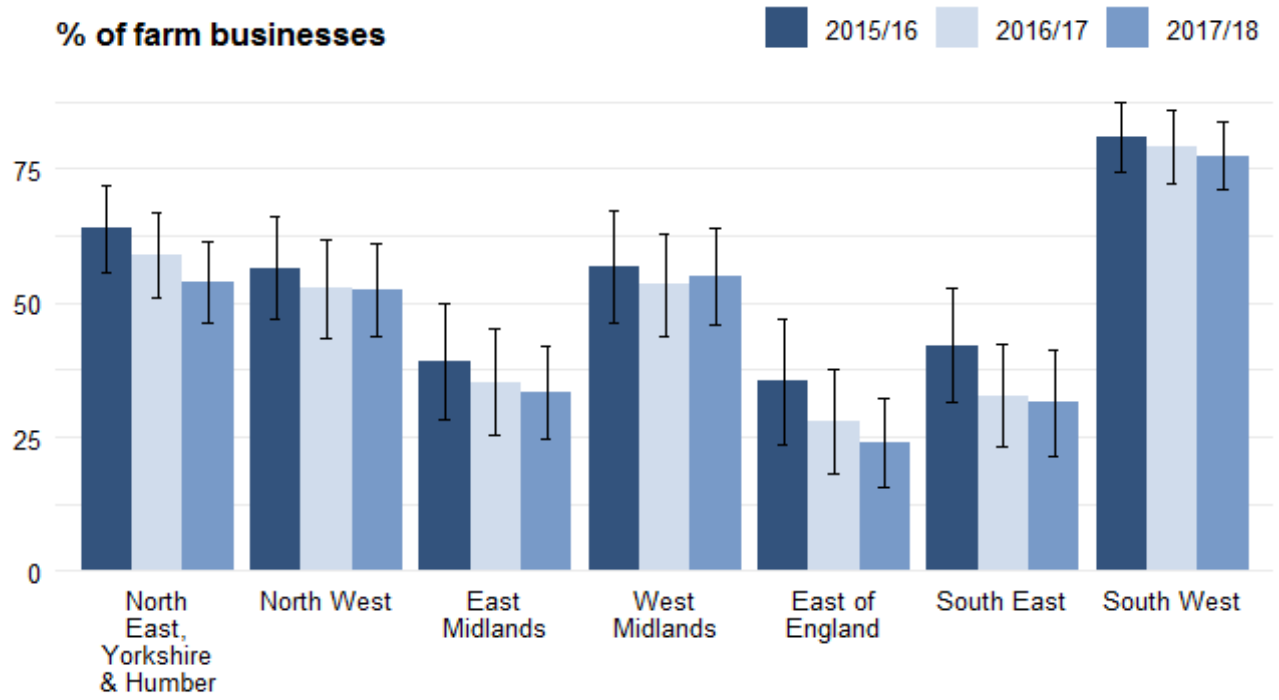
[7] A generalised linear regression model was fitted to examine which factors (farm type, farm size, region, farm tenure, farmer age, farm performance and NVZ status) were significant. Farm type, farm size, region and performance band were significant at the 5% level.

Figure 4: Percentage of farm businesses with permanent or temporary grass using clover or legumes in grass swards by farm type, England 2015/16 to 2017/18[(a)]



Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.

Figure 5: Percentage of farm businesses with permanent or temporary grass using clover or legumes in grass swards by region, England 2015/16 to 2017/18[(a)]



Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.

2.4 Green manures

Green manures are crops grown specifically for building and maintaining soil fertility and structure, although they may also have other functions such as weed control and preventing leaching of soluble nutrients. They are normally incorporated back into the soil, either directly, or after removal and composting. A minority of farmers use green manures in their arable rotations (15% in 2017/18), Table 5, similar to 2016/17.

Table 5: Percentage of farm businesses employing green manures in arable rotation, England 2015/16 to 2017/18[(a)(b)]

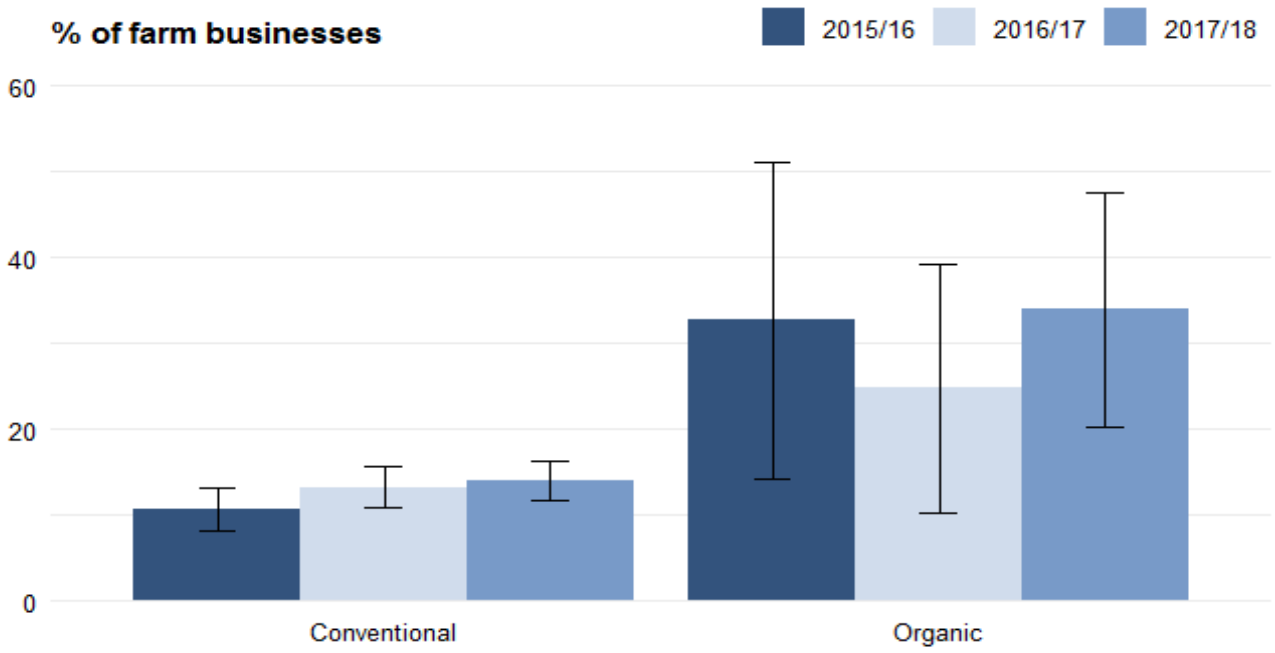
	Percentage of farm businesses (%)		
	2015/16	**2016/17**	**2017/18**
Yes	12 (±2)	14 (±2)	15 (±2)
No	73 (±3)	72 (±3)	71 (±3)
Not applicable	16 (±3)	14 (±2)	15 (±2)

Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.
(b) 95% confidence intervals are shown in brackets.

Use of green manures was related[8] to farm type, organic status and farm size in 2017/18. Organic farms were more likely to use green manures than conventional farms (34% and 14% respectively), Figure 6. General cropping and mixed farms (26% and 27% respectively in 2017/18) were more likely to use green manures (Figure 7) than other farm types. Use of green manures was more likely on small and on very large farms. While the practice was more likely for organic farms, there is a large degree of uncertainty around these results (due to small number of organic farms in the sample) and they should be treated with caution.

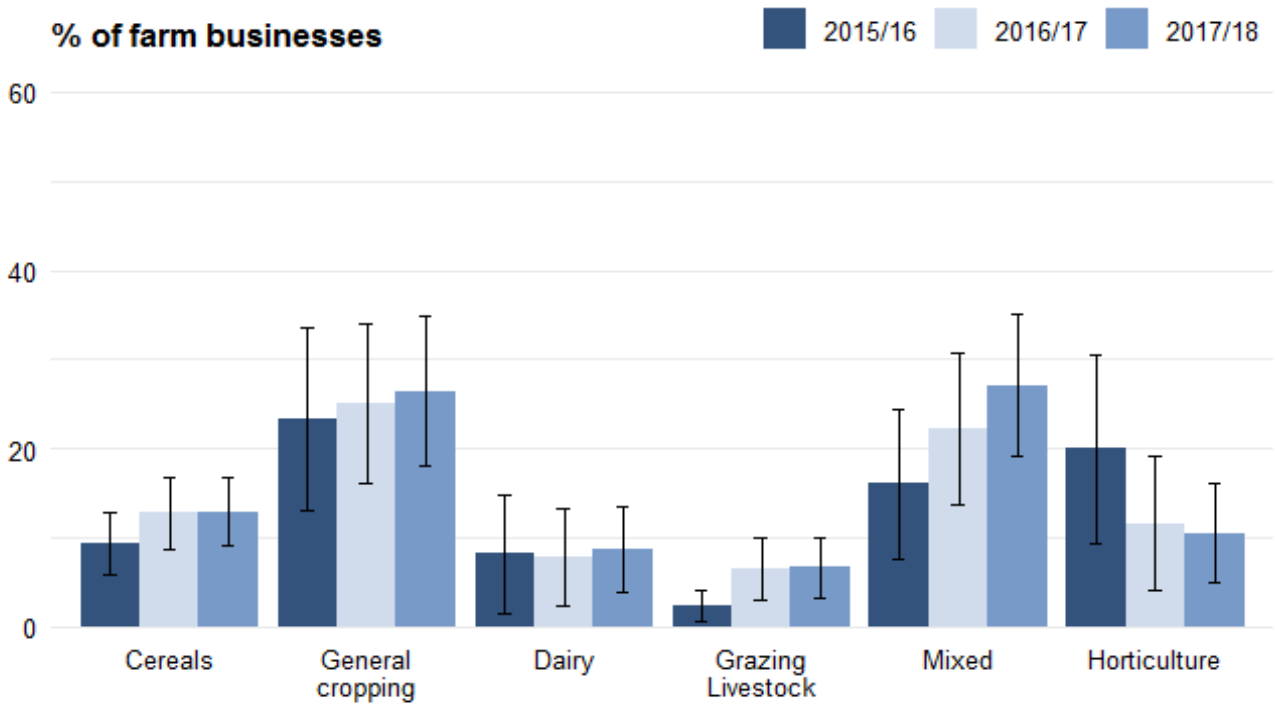
[8] A generalised linear regression model was fitted to examine which factors (farm type, farm size, region, farm tenure, farmer age, farm performance, NVZ status and organic status) were significant. Farm type, organic status, and NVZ status were significant at the 5% level. Farmer age was almost significant at the 5% level.

Figure 6: Percentage of farm businesses using green manures in arable rotation by organic status, England 2015/16 to 2017/18 [(a)]



Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.

Figure 7: Percentage of farm businesses using green manures in arable rotation by farm type, England 2015/16 to 2017/18 [(a)(b)]



Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.
(b) There are insufficient observations to show results for pig and poultry farms

2.5 Adjustments to fertiliser applications

Including clover/legume mixes in grass swards and using green manures are alternative methods to increase the quantities of available nitrogen and will reduce the requirement for additional nutrients from manufactured fertilisers (or slurry/manures). In 2017/18, 71% of farmers that had used these crops reported that they had made adjustments to their fertiliser application rates (Table 6). In 2017/18, improved data checks were introduced for this question; farmers could only answer yes or no. This has resulted in a break in the data series as the yes and no categories are no longer comparable to previous years due to the not applicable option being removed.

Table 6: Percentage of farm businesses making adjustments to fertiliser application rates after using clover/legumes or green manures, England 2015/16 to 2017/18[(a)(b)]

	Percentage of farm businesses (%)		
	2015/16	**2016/17**	**2017/18[(c)(d)]**
Yes	63 (±5)	62 (±4)	71 (±4)
No	30 (±5)	28 (±4)	29 (±4)
Not applicable[(c)]	8 (±3)	10 (±3)	

Source: Farm Business Survey

(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.

(b) 95% confidence intervals are shown in brackets.

(c) There were no recorded responses for not applicable in 2017/18 due to improved validation checks on the data; all farms were required to answer yes or no.

(d) Due to the improved data checks, a break in the series has occurred. 2017/18 is not comparable to previous years data.

Adjusting fertiliser application rates was related[9] to farm type, region and farm size in 2017/18. Pigs and poultry and horticulture farms were least likely to adjust application rates than other farm types (55% and 57% respectively) in 2017/18. Farm businesses in the South West were more likely to adjust their application rates (77%) whilst the South East and East of England are least likely (62% and 65% respectively).

[9] A generalised linear regression model was fitted to examine which factors (farm type, farm size, region, farm tenure, farmer age, farm performance and NVZ status) were significant at the 5% level.

2.6 Sources of nutrient planning advice

Some farmers and their advisors may pay greater attention to the calculation of fertiliser application rates, sourcing their advice from qualified individuals so that their application rates match crop requirements. The Fertiliser Advisers Certification and Training Scheme (FACTS) provides training in an evidence based approach to fertiliser applications.

Table 7: Main source of advice for nutrient planning, England 2017/18 [(a)]

	Percentage of farm businesses (%)	
	2016/17	**2017/18**
Own advice (not FACTS)	48 (±3)	45 (±3)
Own advice (FACTS)	5 (±1)	5 (±1)
Independent advice (FACTS)	22 (±2)	25 (±2)
Fertiliser supplier advice (FACTS)	25 (±3)	24 (±3)

Source: Farm Business Survey.

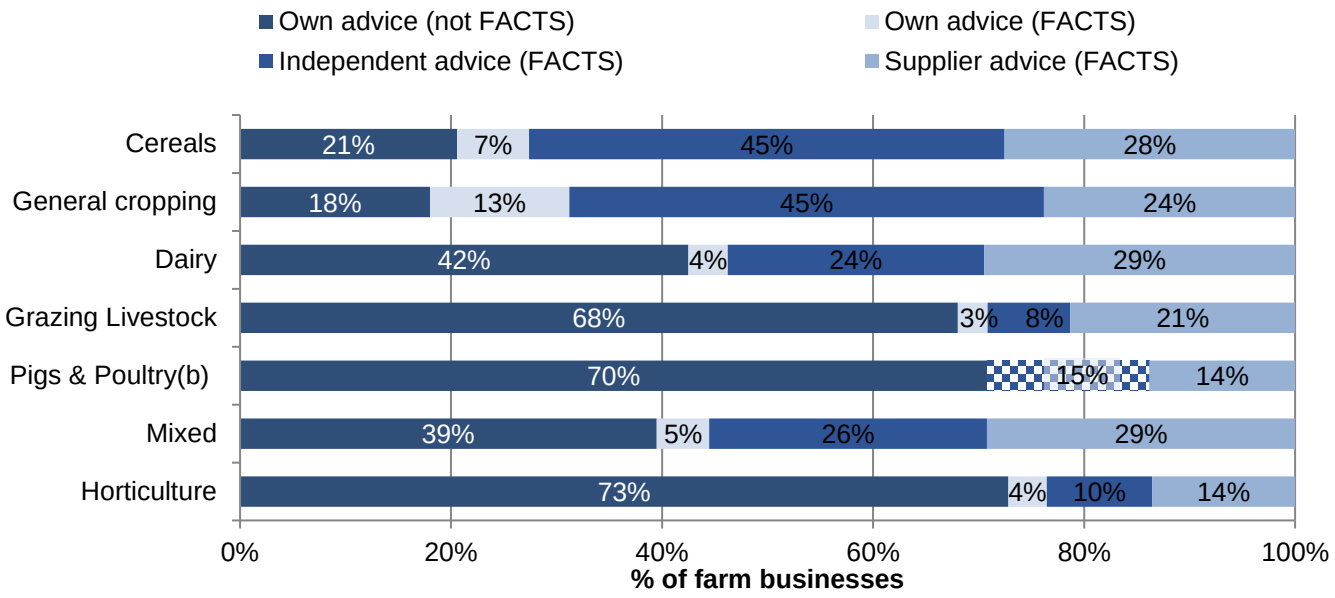
(a) Based on responses from 1403 farm businesses for which the question was applicable in 2016/17, and 1736 in 2017/18. It was not applicable to farms without a utilised agricultural area (UAA) and farms letting out their full UAA

The main source of advice remains similar to 2016/17, nearly half (45%) of farm businesses relied primarily on their own advice (not FACTS), while very few farm businesses relied on their own FACTS-qualified advice (5%) in 2017/18. A quarter relied primarily on independently supplied FACTS advice, and almost a quarter mainly received their advice from a FACTS-qualified fertiliser supplier (24%).

All sources of nutrient planning advice in 2017/18 were related to type, with own advice (not Facts qualified). Independent advice was additionally related[10] to farm size whilst supplier and independent advice were also related to region. Cereal and general cropping farms were less likely than other farm types to rely on their own advice (non FACTS), but more likely to be FACTS qualified or to rely on independent advice from FACTS qualified advisers (Figure 8). Grazing livestock, horticulture, and pig and poultry farms were more likely than other farm types to rely on their own non-FACTS qualified advice.

[10] A generalised linear regression model was fitted to examine which factors (farm type, farm size, region, farm tenure, farmer age, farm performance and NVZ status) were significant at the 5% level.

Figure 8: Main source of advice used in nutrient by farm type, England 2017/18[(a)(c)]



Source: Farm Business Survey.

(a) Based on responses from 1403 farm businesses for which the question was applicable in 2016/17, and 1762 in 2017/18. It was not applicable to farms without a utilised agricultural area (UAA) and farms letting out their full UAA
(b) Own FACTS-qualified and independent FACTS-qualified advice merged due to insufficient observations.
(c) Due to rounding some figures may not add to 100

3 Manufactured fertiliser application rates

This section examines the quantity of nitrogen (N), phosphate (P_2O_5) and potash (K_2O) applied by farms from manufactured fertilisers. The quantities of manufactured fertiliser were collected for the farm as a whole, not at the crop level. In the case of horticulture farms, application rates describe total levels of nutrients being applied to what might be more than one crop being grown during the year on the same parcel of land. The amount of nutrients applied will be correlated with the types of crops that are grown, for example potato crops require high amounts of potassium. The farmed area includes rough grazing, but this has been excluded from the farmed area when calculating the overall application rate as it doesn't tend to receive applications.

Following a planned, phased introduction of the fertiliser module into the FBS since 2012/13, 2017/18 is the first year for which data is available for all farms in the sample, see Appendix B table 1 for the levels of data available for each farm type over the three year period. All year on year changes are unlikely to be significant.

Where information is not directly available from the farmer, estimates have been made based on available information. Estimates have been made for 12% of farms in the sample. For 9% an estimate has been based on further information available from the farmer. For 3% an estimate has been made based on their expenditure and known usage on other, similar

farms. Horticulture farms are most likely to be in this latter group, see Appendix B table 2 for a full breakdown by farm type.

3.1 Nitrogen (N)

The average amount of nitrogen applied per hectare of farmed area[11] (excluding rough grazing) was 112 kg in 2017/18 (Table 8), showing little difference from previous years. This is slightly higher and showing less year on year variation than the overall application rates for manufactured fertilisers for England from the British Survey of Fertiliser Practice (BSFP)[12] [95 kg per hectare in 2017]. The BSFP collects detailed data on fertiliser application rates at crop level.

Table 8: Overall nitrogen application rates per hectare of farmed area (excluding rough grazing), England 2015/16 to 2017/18[(a)(b)]

	Overall application rates (kg per hectare)		
	2015/16	**2016/17**	**2017/18**
Nitrogen (N)	113 (±5)	113 (±5)	112 (±4)

Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.
(b) 95% confidence intervals are shown in brackets.

Application rates for nitrogen from the FBS were related[13] to farm type and size in 2017/18, as was the case in 2016/17. Region also had an influence in 2017/18. Cereal farms (Figure 9) tended to have the highest application rates (150 kg/ha in 2017/18), whilst grazing livestock farms had the lowest (41 kg/ha in 2017/18). Horticulture also saw an increase in application rates; this was partly due to the increase in fertiliser data available in the sample in 2017/18[14] but also an increase in application rates was observed from farms who responded in both 2016/17 and 2017/18. Larger farms tended to have higher application rates than smaller farms (Figure 10).

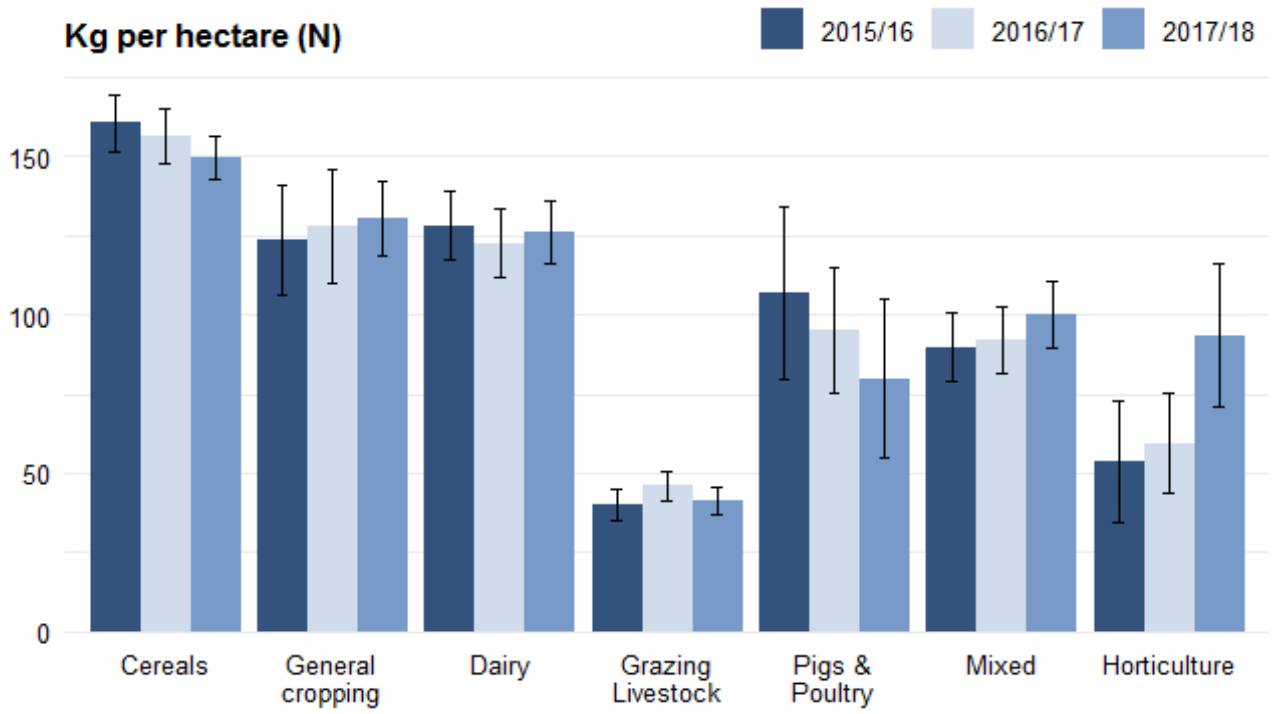
[11] Farmed area = Utilised Agricultural Area + bare land rented in + forage area hired in - bare land let out - forage area let out. Some specialist pig and poultry farms have no farmed area.

[12] For more information on the BSFP please see: https://www.gov.uk/government/collections/fertiliser-usage

[13] A generalised linear regression model was fitted to examine which factors (farm type, farm size, region, farm tenure, farmer age, farm performance and NVZ status) were significant. Farm type, size and region were significant at the 5% level.

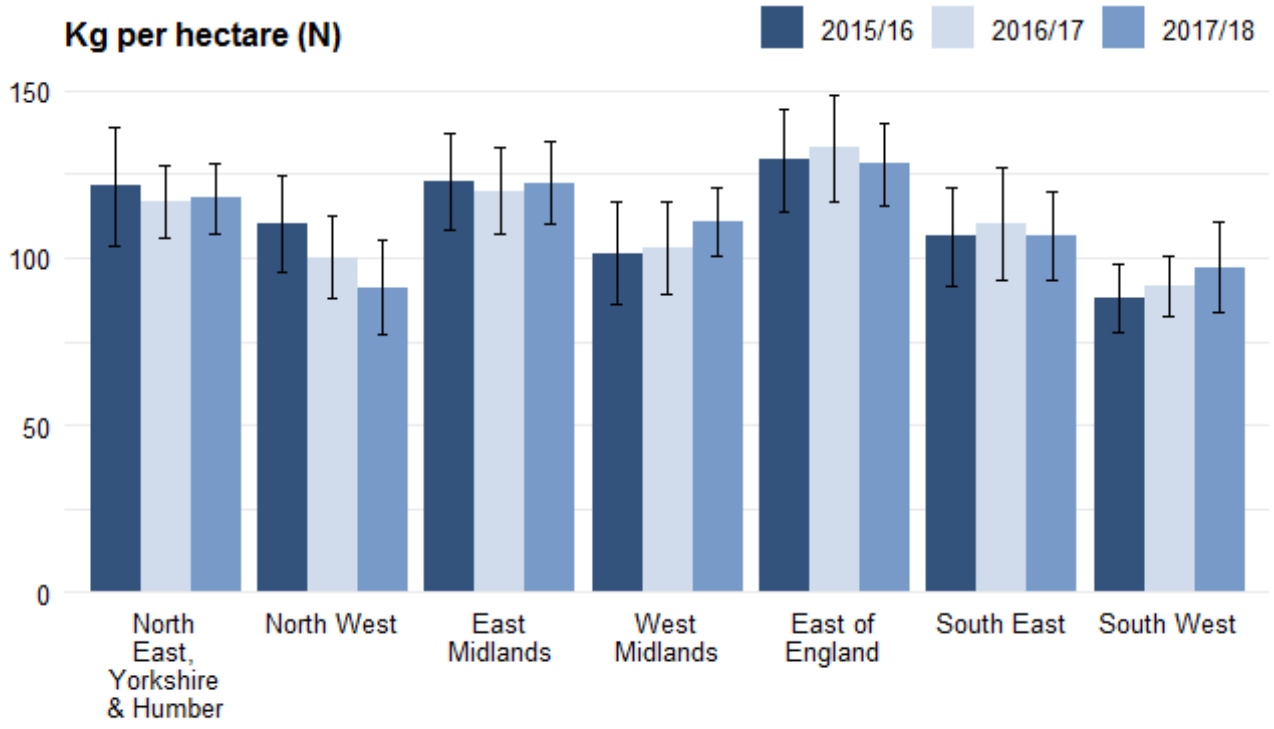
[14] For more information on this see the survey and methodology section in survey details at the end of the report

Figure 9: Overall nitrogen application rates per hectare of farmed area (excluding rough grazing) by farm type, England 2015/16 to 2017/18[(a)]



Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.

Figure 10: Overall nitrogen application rates per hectare of farmed area (excluding rough grazing) by farm size, England 2015/16 to 2017/18[(a)]



Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.

3.2 Phosphate (P_2O_5)

The average amount of manufactured phosphate applied per hectare of farmed area (excluding rough grazing) was 21 kg in 2017/18 (Table 9), little changed from the previous two years. Manufactured phosphate application rates (for total crops and grassland) for England from BSFP[15] were 16 kg per hectare (sown land area) in 2017.

Table 9: Overall phosphate application rates per hectare of farmed area (excluding rough grazing), England 2015/16 to 2017/18[(a)(b)]

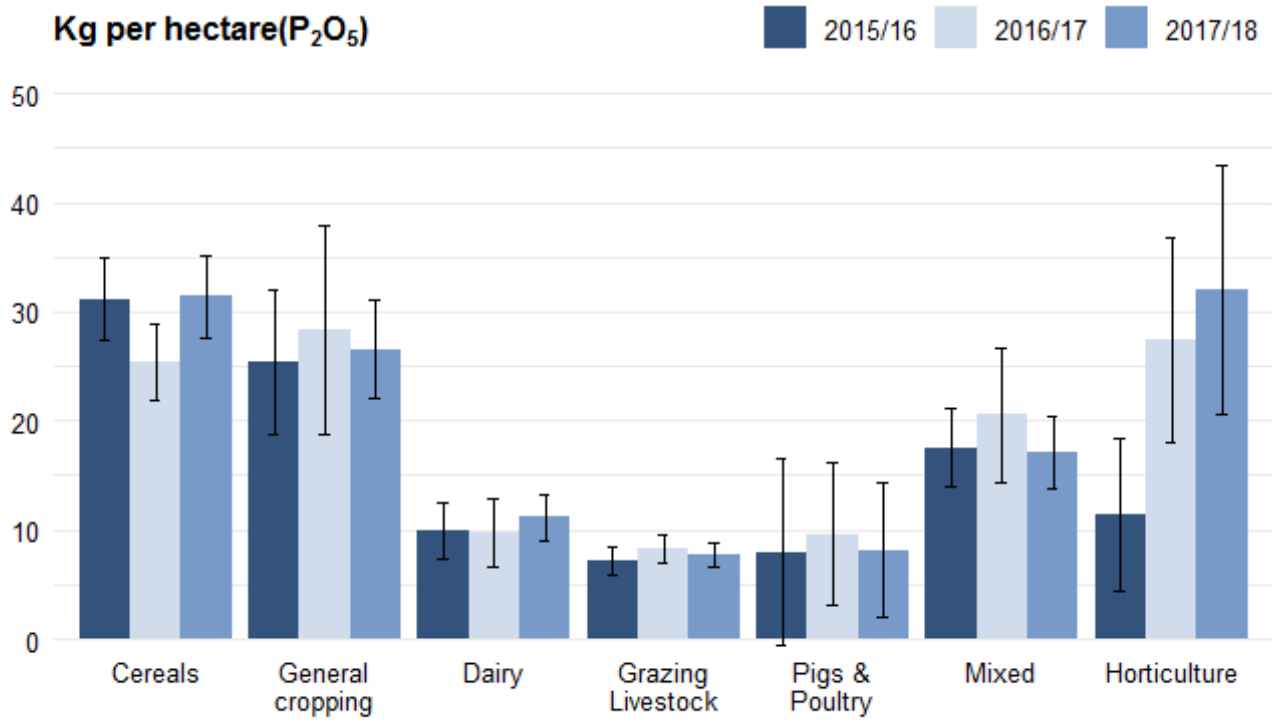
	Overall application rates (kg per hectare)		
	2015/16	**2016/17**	**2017/18**
Phosphate (P_2O_5)	20 (±2)	19 (±2)	21 (±2)

Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.
(b) 95% confidence intervals are shown in brackets.

[15] For more information on the BSFP please see: https://www.gov.uk/government/collections/fertiliser-usage

Application rates for phosphate from the FBS were related[16] to farm type and region in 2017/18. Horticulture farms had the highest average application rates (32 kg/ha) in 2017/18, Figure 11; this was driven by the increase in the number of responses submitted for this farm type[17]. Horticulture farms who returned data in both 2016/17 and 2017/18 saw similar application rates between the two years. Grazing livestock and pig & poultry farms had the lowest rates (8 kg/ha for both in 2017/18). Farm businesses in the North West tended to have lower application rates than those in the rest of the country (Figure 12).

Figure 11: Overall phosphate application rates per hectare of farmed area (excluding rough grazing) by farm type, England 2015/16 to 2017/18[(a)]

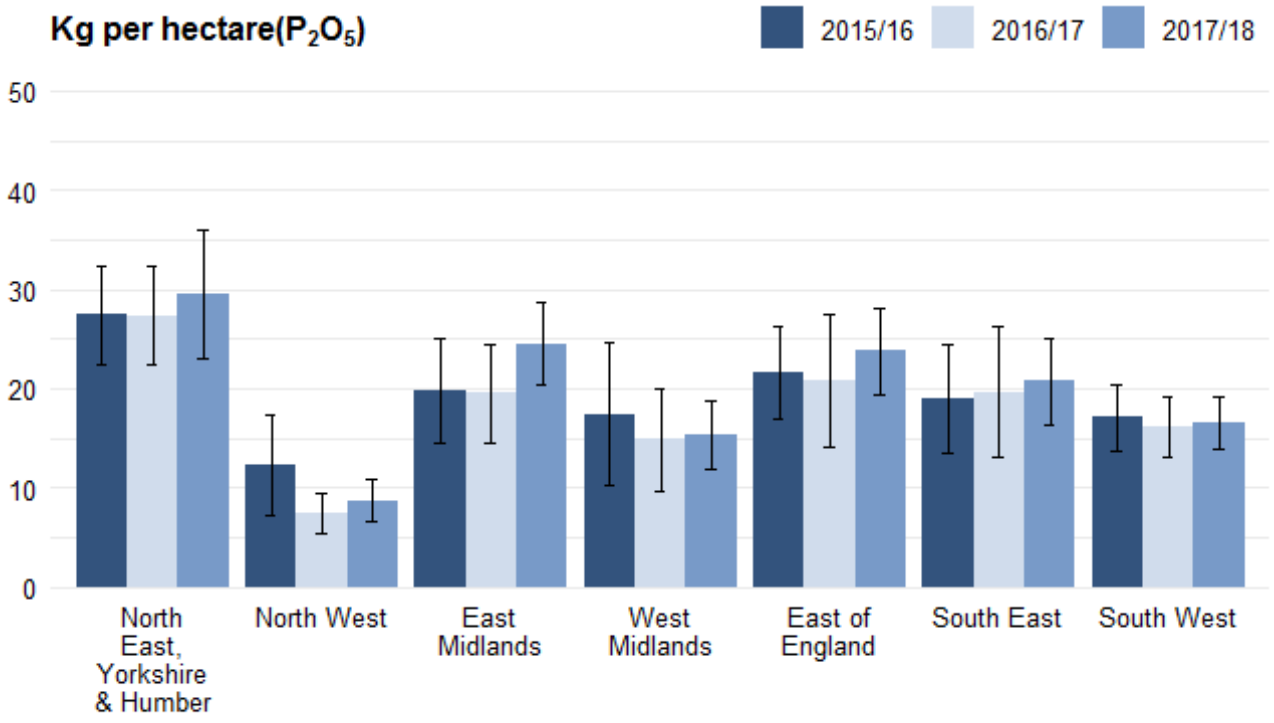


Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.

[16] A generalised linear regression model was fitted to examine which factors (farm type, farm size, region, farm tenure, farmer age, farm performance and NVZ status) were significant. Farm type, and region were significant at the 5% level.

[17] For more information on this see the survey and methodology section in survey details at the end of the report.

Figure 12: Overall phosphate application rates per hectare of farmed area (excluding rough grazing) by farm size, England 2015/16 to 2017/18[(a)]



Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.

3.3 Potash (K_2O)

The average amount of manufactured potash applied per hectare of farmed area (excluding rough grazing) was 27 kg in 2017/18 (Table 10), similar to previous years. Manufactured potash application rates (for total crops and grassland) for England from the BSFP[18] were 20 kg/ha (sown land area) in 2017.

Table 10: Overall potash application rates per hectare of farmed area (excluding rough grazing), England 2015/16 to 2017/18[(a)(b)]

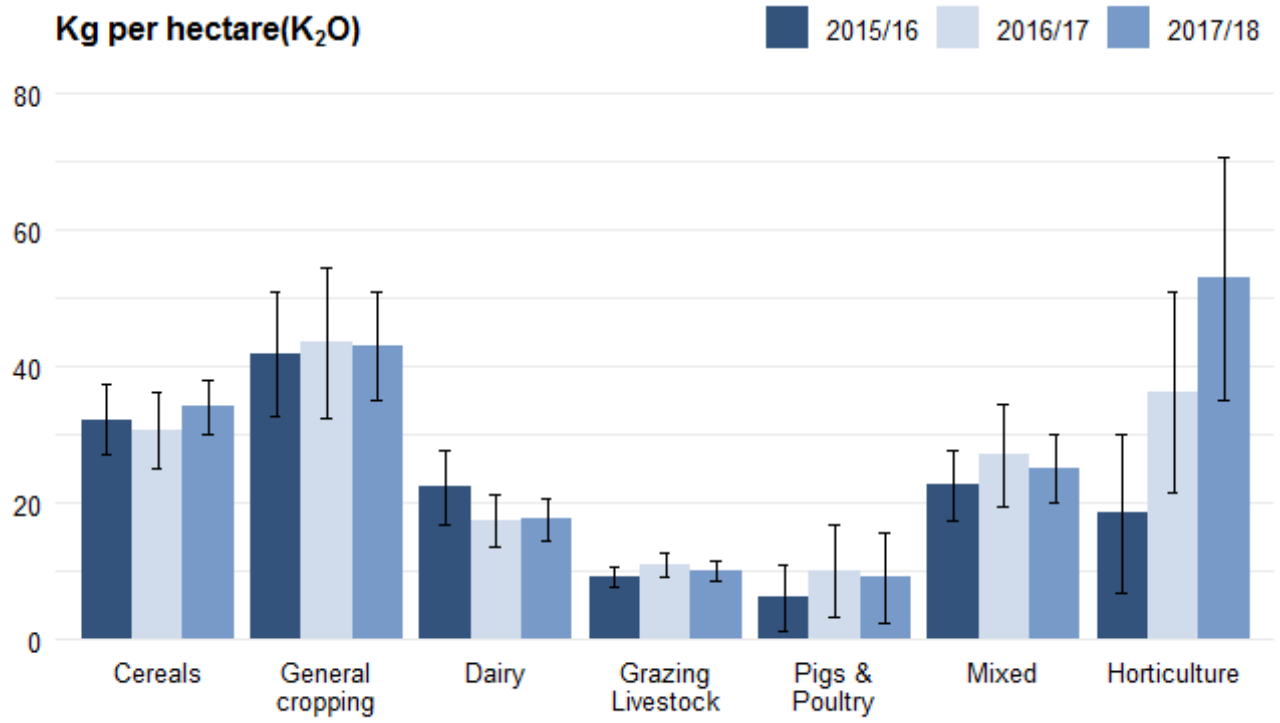
	Overall application rates (kg per hectare)		
	2015/16	**2016/17**	**2017/18**
Potash (K_2O)	25 (±2)	26 (±3)	27 (±2)

Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.
(b) 95% confidence intervals are shown in brackets.

[18] For more information on the BSFP please see: https://www.gov.uk/government/collections/fertiliser-usage

Application rates for potash from the FBS were related[19] to farm type and region in 2017/18. Horticulture farms had the highest average application rates (53 kg/ha in 2017/18); farms who responded in both 2016/17 and 2017/18 saw an increase in their application rates which is driving the overall horticulture increase seen in Figure 13[20]. Grazing livestock and pigs and poultry farms had the lowest average rates (10 kg/ha and 9kg/ha respectively in 2017/18). Farms in the North East, Yorkshire & Humber had the highest average application rates (37kg/ha in 2017/18, Figure 14).

Figure 13: Overall potash application rates per hectare of farmed area (excluding rough grazing) by farm type, England 2015/16 to 2017/18[(a)]

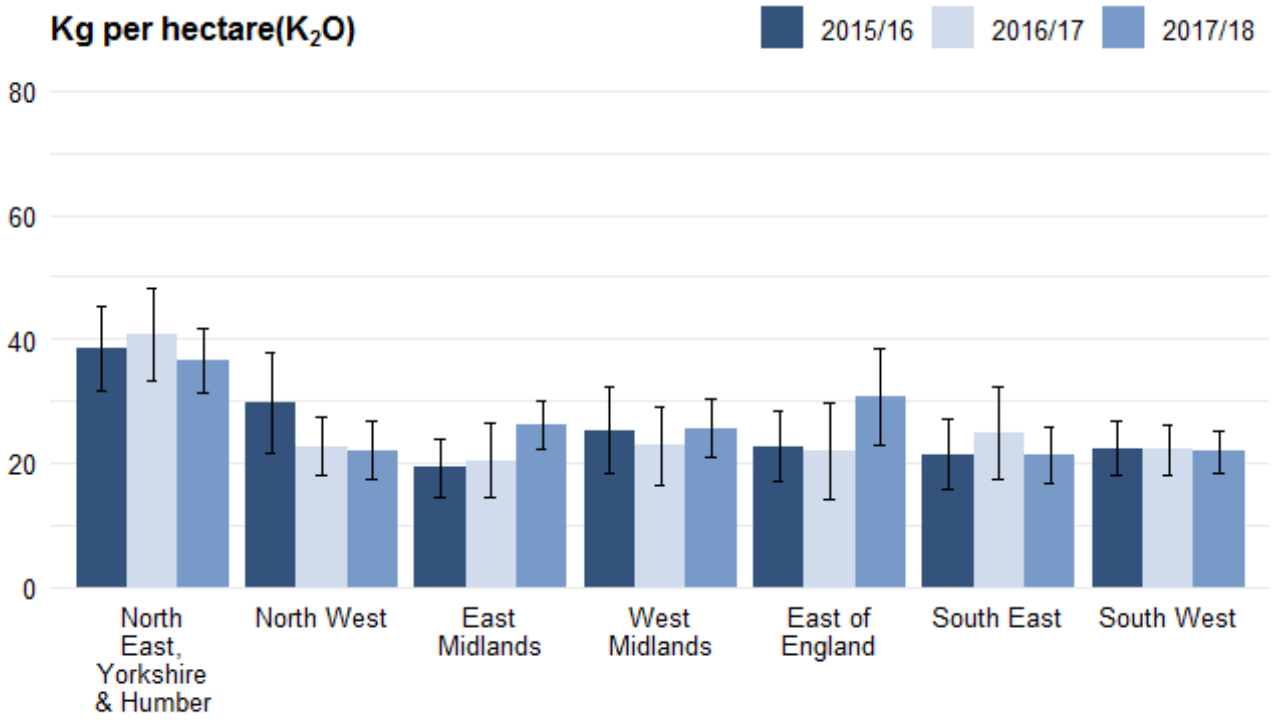


Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.

[19] A generalised linear regression model was fitted to examine which factors (farm type, farm size, region, farm tenure, farmer age, farm performance and NVZ status) were significant. Farm type, and region were significant at the 5% level.

[20] For more information on this see the survey and methodology section in survey details at the end of the report.

Figure 14: Overall potash application rates per hectare of farmed area (excluding rough grazing) by farm size, England 2015/16 to 2017/18[(a)]



Source: Farm Business Survey
(a) Based on responses from 1329 in 2015/16, 1421 in 2016/17 and 1762 in 2017/18.

Survey details

Background

Historically, the Farm Business Survey (FBS) has focused on the collection of financial rather than physical data for agricultural inputs. Over recent years attention has turned to agriculture's environmental footprint and the need to develop a more sustainable industry. Nutrients, particularly nitrogen, are the biggest determinant of yield and also have a major impact on crop/sward structure and the quality of the end product. Nutrient losses to ground and surface waters can cause pollution affecting biodiversity (through eutrophication) and the quality of drinking water. Gaseous losses as ammonia and oxides of nitrogen also cause air pollution, can contribute to the eutrophication of sensitive habitats and to climate change. Any measures taken to reduce nutrient losses should also result in better financial returns to the farmer.

In order to better measure a farm's environmental footprint one of the most important data gaps to address is the quantity of nitrogen (N), phosphate (P_2O_5) and potash (K_2O) applied as fertiliser in their manufactured form. In 2012/13 these quantities were collected for the first time within the FBS. The data collected:

- provides important data needed to estimate the environmental footprint of farming
- enables farms to benchmark their environmental as well as their financial performance
- meets Farm Accountancy Data Network (FADN) requirements for data on fertiliser quantities.

Survey content and methodology

The Farm Business Survey (FBS) is an annual survey providing information on the financial position and physical and economic performance of farm businesses in England. The sample of around 1,750 farm businesses covers all regions of England and all types of farming with the data being collected by face to face interview with the farmer. Results are weighted to represent the whole population of farm businesses that have at least 25,000 Euros of standard output[21] as recorded in the annual June Survey of Agriculture and Horticulture. In 2017, this accounted for approximately 54,700 farm businesses[22].

For further information about the Farm Business Survey please see: https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs/series/farm-business-survey

Since 2012/13, the FBS has included an additional module to collect information on fertiliser usage from a sub-sample of farm businesses. The information collected covered:

- Use of precision farming techniques.

[21] For a definition of standard output please see the UK classification document here https://www.gov.uk/farm-business-survey-technical-notes-and-guidance

[22] Prior to the 2010/11 campaign, the coverage of the FBS was restricted to those farms of size ½ Standard Labour Requirement (SLR) or more. For a definition of SLR please see the UK classification document here: https://www.gov.uk/farm-business-survey-technical-notes-and-guidance

- Use of soil nutrient software packages.
- Inclusion of clover/legumes in grass swards.
- Use of green manures.
- Adjustments to fertiliser application rates.
- Amount of UAA subjected to restricted fertiliser applications (up until 2015/16).
- Sources of nutrient planning advice (in 2016/17).
- Volumes of nitrogen (N), phosphate (P_2O_5) and potash (K_2O) used.

Full details of the information collected on fertiliser usage can be found here: https://www.gov.uk/farm-business-survey-technical-notes-and-guidance#fbs-documents

Completion of the fertiliser module was voluntary until 2017/18 when it became compulsory following a planned phased introduction. The module covered all the main farm types. Fertiliser data was collected from 1329 farms in 2015/16 (74% of the FBS sample), 1421 farms in 2016/17 (81% of the FBS sample) and from the full FBS sample of 1762 farms in 2017/18. See Annex B table 1 for a summary of responses by farm type in each year. For some farms (3% of all farms), nutrient data has been derived using a fertiliser calculator rather than from exact quantities. Horticulture saw the highest use (12% of responses) of the calculator, table 2 in Appendix B.

Data analysis

The results from the FBS relate to farms which have a standard output of at least 25,000 Euros. Initial weights are applied to the FBS records based on the inverse sampling fraction for each design stratum (farm type by farm size). These weights are then adjusted (calibration weighting[23]) so that they can produce unbiased estimators of a number of different target variables.

Accuracy and reliability of the results

We show 95% confidence intervals against the results. These show the range of values that may apply to the figures. They mean that we are 95% confident that this range contains the true value. They are calculated as the standard errors (se) multiplied by 1.96 to give the 95% confidence interval (95% CI). The standard errors only give an indication of the sampling error. They do not reflect any other sources of survey errors, such as non-response bias. For the Farm Business Survey, the confidence limits shown are appropriate for comparing groups within the same year only; they should not be used for comparing with previous years since they do not allow for the fact that many of the same farms will have contributed to the Farm Business Survey in both years.

We have also shown error bars on the figures in this notice. These error bars represent the 95% confidence intervals (as defined above).

[23] Further information on calibration weighting can be found here: https://www.gov.uk/guidance/farm-business-survey-technical-notes-and-guidance

Where possible we have provided comparisons with other data sources, particularly the British Survey of Fertiliser Practice.

Availability of results

This release contains headline results for each section. The full breakdown of results, by farm type, farm size, region, farm tenure, farmer age, farm economic performance and Nitrate Vulnerable Zones (NVZs), can be found at: https://www.gov.uk/government/collections/farm-business-survey

Defra statistical notices can be viewed on the Food and Farming Statistics pages on the Defra website at https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs/about/statistics. This site also shows details of future publications, with pre-announced dates.

Data Uses

Data from the Farm Business Survey (FBS) are provided to the EU as part of the Farm Accountancy Data Network (FADN). The data have been used to help inform policy decisions (e.g. Reform of Pillar 1 and Pillar 2 of the Common Agricultural Policy) and to help monitor and evaluate current policies relating to agriculture in England (and the EU). It is also widely used by the industry for benchmarking and informs wider research into the economic performance of the agricultural industry.

The data collected will provide important data needed to estimate the environmental footprint of farming. It will enable farms to benchmark their environmental performance as well as their financial performance.

User engagement

As part of our ongoing commitment to compliance with the Code of Practice for Official Statistics http://www.statisticsauthority.gov.uk/assessment/code-of-practice/index.html, we wish to strengthen our engagement with users of these statistics and better understand the use made of them and the types of decisions that they inform. Consequently, we invite users to make themselves known, to advise us of the use they do, or might, make of these statistics, and what their wishes are in terms of engagement. Feedback on this notice and enquiries about these statistics are also welcome.

National Statistics Status

National Statistics status means that our statistics meet the highest standards of trustworthiness, quality and public value, and it is our responsibility to maintain compliance with these standards. The statistics last underwent a full assessment [Assessment Report 271 Statistics on Agriculture] against the Code of Practice for Statistics in 2014.

Since the last review by the Office for Statistics Regulation, we have continued to comply with the Code of Practice for Statistics across the FBS. For contractual reasons, the fertiliser

module was introduced in 2012/13; 2017/18 is the first year that data is available for all farms in the FBS sample. This has generally resulted in improved data quality with smaller confidence intervals produced across all fertiliser questions and within the various breakdowns that are published.

Definitions

Farm Type

Where reference is made to the *type of farm* in this document, this refers to the 'robust type', which is a standardised farm classification system.

Farm Sizes

Farm sizes are based on the estimated labour requirements for the business, rather than its land area. The farm size bands used within the detailed results tables which accompany this publication are shown in the table below. Standard Labour Requirement (SLR) is defined as the theoretical number of workers required each year to run a business, based on its cropping and livestock activities.

Farm size	Definition
Spare & Part time	Less than 1 SLR
Small	1 to less than 2 SLR
Medium	2 to less than 3 SLR
Large	3 to less than 5 SLR
Very Large	5 or more SLR

Farm Economic performance

Economic performance for each farm is measured as the ratio between economic output (mainly sales revenue) and inputs (costs). The inputs for this calculation include an adjustment for unpaid manual labour. The higher the ratio, the higher the economic efficiency and performance. The farms are then ranked and allocated to performance bands based on economic performance percentiles:

- **Low performance band** - farms who took part in the fertiliser survey and were in the bottom 25% of economic performers
- **Medium performance band** - farms who took part in the fertiliser survey and were in the middle 50% of performers
- **High performance band** - farms who took part in the fertiliser survey and were in the top 25% of performers.

Utilised Agricultural Area (UAA)

Utilised Agricultural Area (UAA) is the crop area, including fodder, set-aside land, temporary and permanent grass and rough grazing in sole occupation (but not shared rough grazing) i.e. the agricultural area of the farm. It includes bare land and forage let out for less than one year.

Farmed area

Farmed area = Utilised Agricultural Area + bare land rented in + forage area hired in - bare land let out - forage area let out. Some specialist pig and poultry farms have no farmed area.

Grass swards
Land or soil which features a layer of grass.

Nitrate Vulnerable Zones
The European Commission (EC) nitrates directive requires areas of land that drain into waters polluted by nitrates to be designated as Nitrate Vulnerable Zones (NVZs)[24]. Farmers with land in NVZs must follow rules to tackle nitrate loss from agriculture. The regulations that apply in England and Wales were reviewed and updated in 2013, including NVZ boundaries.

[24] A map of NVZs that apply from 2013 can be found at http://www.magic.gov.uk/StaticMaps/Nitrate%20Vulnerable%20Zones%20(England).pdf

Appendix A. Weather conditions

2017/18 (2017 harvest)

Autumn 2016 started off notably warm compared to previous years, with September having unusually high temperatures in South-East England. November was often cold and sunny, especially in the North. Rainfall was below normal for most of the UK, with September being particularly wet in western parts of England, however October was mostly very dry. Winter 2016/17 was dry and mild, with December and January sunnier than average. However towards the end of February included two of the winter's five 'named storms' which gave the most widespread impacts over farms in England. Spring 2017 was generally warmer than average in March and early April, but the second half of April was cool with some cold nights and numerous late frosts. Top and soft fruit growers benefited from these winter frosts and mild spring conditions. This summer was rather wet, with rainfall above average for the UK in each individual month. It was also slightly warmer than average, but that is largely due to a warm June, as from mid-July onwards the weather was often on the cool side with an unsettled westerly regime.

Table 1 shows the crop areas on agricultural holdings in England.

Table 1: Crop areas on agricultural holdings on 1 June[(a)] for England, 2015 – 2017

Crops (Thousand hectares)	Jun 2015	Jun 2016	Jun 2017
Wheat	1,693	1,684	1,652
Barley - total	749	791	842
- winter	376	376	361
- spring	373	416	482
Total cereals (excluding maize) [(b)]	**2,573**	**2,617**	2,660
Potatoes (early and maincrop)	96	104	108
Sugar beet (not for stockfeeding)	90	86	111
Oilseed rape - total	611	543	523
- winter	605	534	515
- spring	6	9	8
Linseed	15	27	26
Other crops not for stockfeeding	25	30	28
Total other arable crops not for stockfeeding [(c)]	**838**	**790**	**797**

Source: Defra June Survey of Agriculture.
(a) Figures relate to commercial holdings only.
(b) Including minor cereals (oats, rye, triticale, mixed corn).
(c) Includes borage

2016/17 (2016 harvest)

Autumn 2015 was generally settled allowing good progress to be made with autumn cultivations and crop establishment in most regions. November brought several storms which continued into December, this led to record rainfall totals and severe flooding in the northern and western parts of the UK. Winter 2015/16 was the third-warmest since 1910 and the

second wettest. This had a detrimental effect on autumn sown crops, particularly those on heavy waterlogged soils. In northern England, large areas of cereal and vegetable crops were written off. Spring 2016 saw temperatures and rainfall overall very close to average. However, March was particularly wet in the south and east. Summer rainfall totals were above average for most areas, with the exception of southern and eastern England, where some areas received exceptional rainfall and flooding. More settled weather in the second half of August allowed harvest to progress in most areas and crop drying was kept to a minimum. Table 1 shows the crop areas on agricultural holdings in England.

2015/16 (2015 harvest)

Autumn 2014 was warmer than average, the third warmest on record since 1910, which aided the remaining harvest and the establishment of winter crops. Winter temperatures were around average although there were some significant regional wintry storms. Spring 2015 saw average temperatures, sunshine and rainfall; April was the sunniest on record since 1929. Summer 2015 temperatures were below average; June was drier but July and August were wetter than average. Harvesting of cereals started earlier in some regions with little need for crop drying. However, the wet conditions in August impacted on the harvest in other areas with increased downtime and crop drying. September was the coldest since 1994. Temperatures in November were well above average and good progress was made on drilling crops for the 2016 harvest.

Appendix B: Characteristics of responders to the FBS fertiliser module

Table 1: Proportion of FBS sample for which there is fertiliser data

	2015		2016		2017	
Farm type	Number	Proportion[(a)]	Number	Proportion	Number	Proportion
Cereals	270	75%	283	80%	344	100%
General Cropping	112	78%	123	80%	150	100%
Dairy	193	76%	200	81%	239	100%
LFA Grazing	182	81%	179	87%	202	100%
Lowland Grazing	230	81%	251	88%	296	100%
Pigs	45	73%	49	74%	68	100%
Poultry	62	71%	73	77%	101	100%
Mixed	144	74%	134	79%	174	100%
Horticulture	91	47%	129	69%	188	100%
All farms	**1329**	**74%**	**1421**	**81%**	**1762**	**100%**

(a) Proportion of sample for which there is fertiliser data = number of farms with fertiliser data (actual and estimated) / FBS sample.

Table 2: Source of data on fertiliser application rates for 2017/18 FBS sample

Farm type	Actual Data	Data estimated (from farmer information)	Fertiliser calculator used	No fertiliser usage
Cereals	82%	9%	6%	3%
General Cropping	85%	9%	6%[(a)]	
Dairy	74%	12%		14%
LFA Grazing	72%	5%	0%	22%
Lowland Grazing	65%	11%	0%	24%
Pigs	40%	4%		56%
Poultry	26%	2%		72%
Mixed	75%	12%		13%
Horticulture	63%	8%	12%	17%
All farms	**70%**	**8%**	**3%**	**19%**

(a) Data merged due to insufficient observations