Department for Environment Food & Rural Affairs

Published 31 May 2018

Fertiliser usage on farms: Results from the Farm Business Survey (FBS), England 2016/17

This release provides estimates of the use of precision farming techniques, soil nutrient software, clover and legumes in grass swards[1], green manures, sources of nutrient planning advice, and fertiliser application rates at the farm level in England for 2016/17.

Key findings:

21%
of farm businesses carried out precision farming techniques to guide fertiliser application.

22%
of farm businesses used soil nutrient software packages to help determine fertiliser applications

53%
of farms with grass included clover or legumes in their grass swards

14%
of farmers use green manures in their arable rotations

62%
of farms using either clover and legumes or green manures made adjustments to fertiliser application rates

113 kg of nitrogen
19 kg of phosphate
26 kg of potash
were applied per hectare on average.

[1] Grass sward = land/soil with a layer of grass

Enquiries on this publication to: Hasse Nielsen, Department for Environment, Food and Rural Affairs. Tel: ++ 44 (0)20 8026 6177, email: FBS.queries@defra.gsi.gov.uk.

Detailed results

- Around a fifth of farm businesses carried out **precision farming techniques** i.e. soil mapping and use of satellite technology to guide fertiliser application (21%) in 2016/17. Usage was more likely on cereal (47%) and general cropping farms (42%).
- Just over a fifth of farms (22% in 2016/17) used **soil nutrient software packages** to help determine fertiliser applications. There has been little overall change since 2012/13. Usage was most common on cereal and general cropping farms and very large farms.
- Just over half of farms with grass included **clover or legumes in their grass swards** (53% in 2016/17). Compared to other farm types, sizes and regions, this practice was most common on mixed and dairy farms, larger farms and on farms in the South West.
- Very few farmers use **green manures** in their arable rotations (14% in 2016/17). 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 62% made **adjustments to their fertiliser application** rates in 2016/17. Farms in the South East and the North East, Yorkshire and Humber were less likely to adjust rates, while farmers under 40 and mixed and general cropping farms were more likely to do so.
- Nearly half of farm businesses (48%) relied on their own non-FACTS[2] qualified **advice for nutrient planning**, while 22% relied on independently supplied FACTS advice, and 25% 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 113 kg in 2016/17. 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 19 kg per hectare in 2016/17. General cropping farms had the highest application rates while grazing livestock farms had the lowest.
- The average amount of **potash applied per hectare** of farmed area (excluding rough grazing) was 26 kg per hectare in 2016/17. General cropping farms had the highest application rates, while pigs and poultry farms had the lowest.

The data used for this analysis is from a subset of 1421 farms that completed the fertiliser module in the 2016/17 FBS. Completion of the module was voluntary. The FBS covers those farms with at least 25,000 euros of standard output. Weights were derived for this sub sample in line with the method described in the survey methodology section.

The results for 2016/17 are shown with confidence intervals and comparisons to previous years. Results prior to 2015/16 were restricted to those farms with a farmed area[3] and did not include horticulture farms. This change had a minimal impact on the overall results. Where there is a difference the results are also shown on a comparable basis to 2014/15. The full breakdown of results, by farm type, farm size, region, farm tenure, farmer age, farm economic performance and Nitrate Vulnerable Zones (NVZs)[4], can be found at: https://www.gov.uk/government/statistics/fertiliser-usage-on-farm-england

[2] FACTS= Fertiliser Advisers Certification and Training Scheme.
[3] 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.
[4] 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.

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.

1 Weather

This release provides the main results from the 2016/17 FBS which covered the 2016 harvest. Weather conditions can influence the crops grown and fertiliser usage on farm. This section describes the weather conditions that affected the 2016 harvest, for information about previous years see Appendix A.

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.

Table 1: Crop areas on agricultural holdings on 1 June[(a)] for England, 2012 – 2016

Crops (Thousand hectares)	Jun 2012	Jun 2013	Jun 2014	Jun 2015	Jun 2016
Wheat	1,856	1,505	1,797	1,693	1,684
Barley - total	623	828	709	749	791
- winter	329	257	363	376	376
- spring	294	571	345	373	416
Total cereals (excluding maize) [(b)]	**2,594**	**2,492**	**2,634**	**2,573**	**2,617**
Potatoes (early and maincrop)	112	103	105	96	104
Sugar beet (not for stockfeeding)	120	117	116	90	86
Oilseed rape - total	713	676	632	611	543
- winter	702	584	618	605	534
- spring	11	92	13	6	9
Linseed	28	34	15	15	27
Other crops not for stockfeeding	24	26	22	25	30
Total other arable crops not for stockfeeding [(c)]	**997**	**957**	**889**	**838**	**790**

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.

2 General questions

The survey included 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.

Key findings:

- Around a fifth of farm businesses carried out **precision farming techniques** i.e. soil mapping and use of satellite technology to guide fertiliser application (21%) in 2016/17. Usage was more likely on cereal (47%) and general cropping farms (42%).
- Just over a fifth of farms (22% in 2016/17) used **soil nutrient software packages** to help determine fertiliser applications. There has been little overall change since 2012/13. Usage was most common on cereal and general cropping farms and very large farms.
- Just over half of farms with grass included **clover or legumes in their grass swards** (53% in 2016/17). Compared to other farm types, sizes and regions, this practice was most common on mixed and dairy farms, larger farms and on farms in the South West.
- Very few farmers use **green manures** in their arable rotations (14% in 2016/17). 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 62% made **adjustments to their fertiliser application** rates in 2016/17. Farms in the South East and the North East, Yorkshire and Humber were less likely to adjust rates, while farmers under 40 and mixed and general cropping farms were more likely to do so.
- Nearly half of farm businesses (48%) relied on their own non-FACTS qualified **advice for nutrient planning**, while 22% relied on independently supplied FACTS advice, and 25% received advice from their FACTS-qualified fertiliser supplier.

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 specifically asked if they carried out precision farming techniques (i.e. soil mapping and the use of satellite technology to guide fertiliser applications). In 2016/17 21% of farms used these techniques (Table 2), little changed from 2015/16. The results are broadly comparable with findings from the 2012 Farm Practices Survey[5] (FPS) which found that 25% of farms used either soil mapping or variable rate application techniques.

[5] https://www.gov.uk/government/statistics/farm-practices-survey-october-2012-current-farming-issues

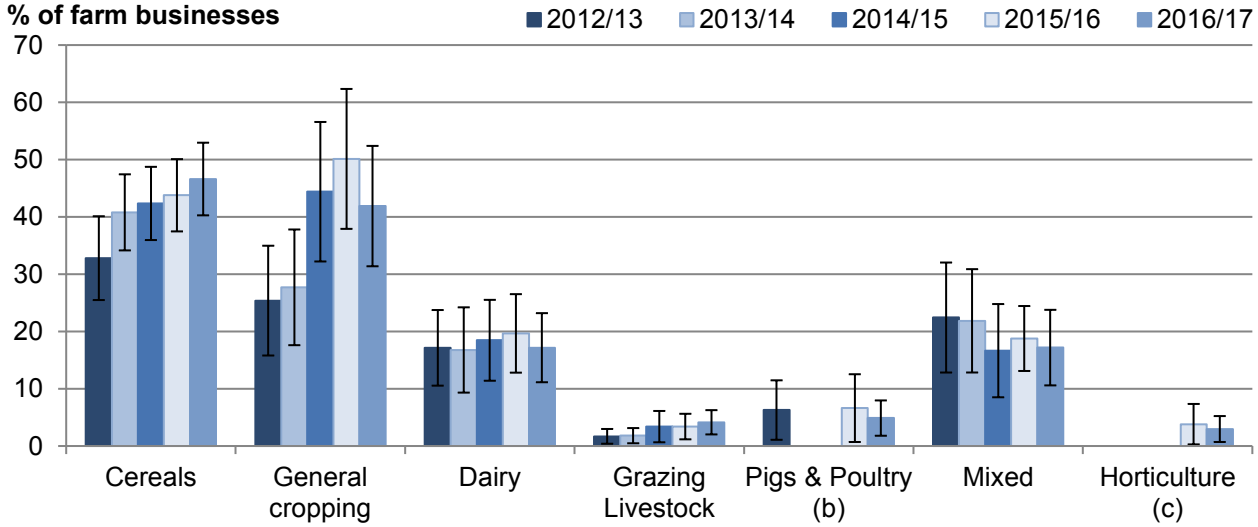
Table 2: Percentage of farm businesses using precision farming techniques, England 2012/13 to 2016/17[(a)(b)]

	Percentage of farm businesses (%)					
	2012/13	2013/14	2014/15	2015/16	2015/16[(d)]	2016/17
Precision farming techniques used [(c)]	16 (±3)	18 (±2)	21 (±3)	23 (±3)	21 (±2)	21 (±2)
No precision farming techniques used	84 (±3)	82 (±2)	79 (±3)	77 (±3)	77 (±2)	75 (±3)
Not applicable[(e)]				1 (±0)	2 (±1)	4 (±1)

Source: Farm Business Survey.
(a) Based on responses from 975 farm businesses in 2012/13 and 2013/14, 968 in 2014/15,1329 in 2015/16, and 1421 in 2016/17.
(b) 95% confidence intervals are shown in brackets.
(c) Includes those that responded 'yes' and 'some' from 2013/14 onwards.
(d) Increased data collection from horticulture farms and those with no farmed area.
(e) This includes farms which do not use any fertilisers and those that do not grow any arable crops.

The use of precision farming techniques was significantly[6] related to farm type, farm size (as in previous years) and there was some evidence of a relationship with region[7]. Cereal and general cropping farms were more likely to use these techniques than other farm types (47% in 2016/17 for cereal farms; 42% for general cropping farms, Figure 1). Usage was more common on very large farms (34% in 2016/17). Farms in the East Midlands and East of England were more likely to use precision farming techniques than farms in other regions. Although use of precision farming techniques tends to be greater for higher economically performing farms, the difference between performance groups is not significant after allowing for other factors such as farm type and size.

Figure 1: Percentage of farm businesses using precision farming techniques by farm type, England 2012/13 to 2016/17 [(a)]



Source: Farm Business Survey.
(a) Based on responses from 975 farm businesses in 2012/13 and 2013/14, 968 in 2014/15,1329 in 2015/16, and 1421 in 2016/17.
(b) There are insufficient observations to show results for pig and poultry farms in 2013/14 and 2014/15
(c) Data was collected from horticulture farms for the first time in 2015/16.

[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.
[7] Region was borderline significant (p=0.051)

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 GHG 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.

Just over a fifth of farms used soil nutrient software packages to help determine fertiliser applications (22% in 2016/17, Table 3). There has been little overall change since 2012/13. Results from the 2016 British Survey of Fertiliser Practice[8] (BSFP) showed similar levels; 29% of farms in England used a computer program to record manufactured fertiliser applications (20% for organic manures).

Table 3: Percentage of farm businesses using soil nutrient software packages to help determine fertiliser applications, England 2012/13 to 2016/17 [(a)(b)]

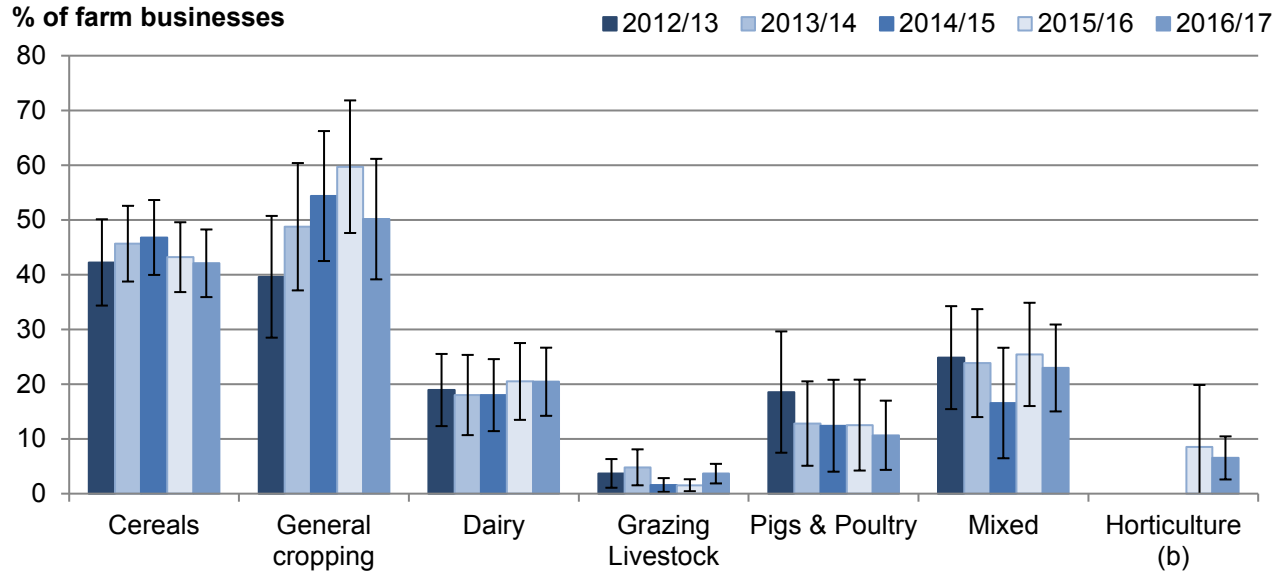
	Percentage of farm businesses (%)					
	2012/13	2013/14	2014/15	2015/16	2015/16[(c)]	2016/17
Soil nutrient software used	22 (±3)	23 (±3)	23 (±3)	24 (±3)	23 (±2)	22 (±2)
No soil nutrient software used	78 (±3)	77 (±3)	77 (±3)	76 (±3)	76 (±3)	74 (±3)
Not applicable[(d)]				0 (±0)	1 (±1)	3 (±1)

Source: Farm Business Survey.
(a) Based on responses from 975 farm businesses in 2012/13 and 2013/14, 968 in 2014/15,1329 in 2015/16, and 1421 in 2016/17.
(b) 95% confidence intervals are shown in brackets.
(c) Increased data collection from horticulture farms and those with no farmed area.
(d) This includes farms which do not use any fertilisers and those that do not grow any arable crops.

Use of soil nutrient software was significantly[9] related to farm type and farm size in all years. In 2016/17, use of soil nutrient software was also significantly related to having land in a Nitrate Vulnerable Zone (NVZ). Usage was most common on cropping farms (42% in 2016/17 for cereal farms; 50% for general cropping farms, Figure 2). Grazing livestock farms were least likely to use such software (4% in 2016/17). Usage was more likely on very large farms (34% in 2016/17) than for other farm size groups. Farms not in an NVZ were less likely to use soil nutrient software (16% in 2016/17), while farms fully in an NVZ were more likely to use such software (30% in 2016/17, Figure 3).

[8] For more information on the BSFP please see: https://www.gov.uk/government/collections/fertiliser-usage
[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. 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 2012/13 to 2016/17 [(a)]

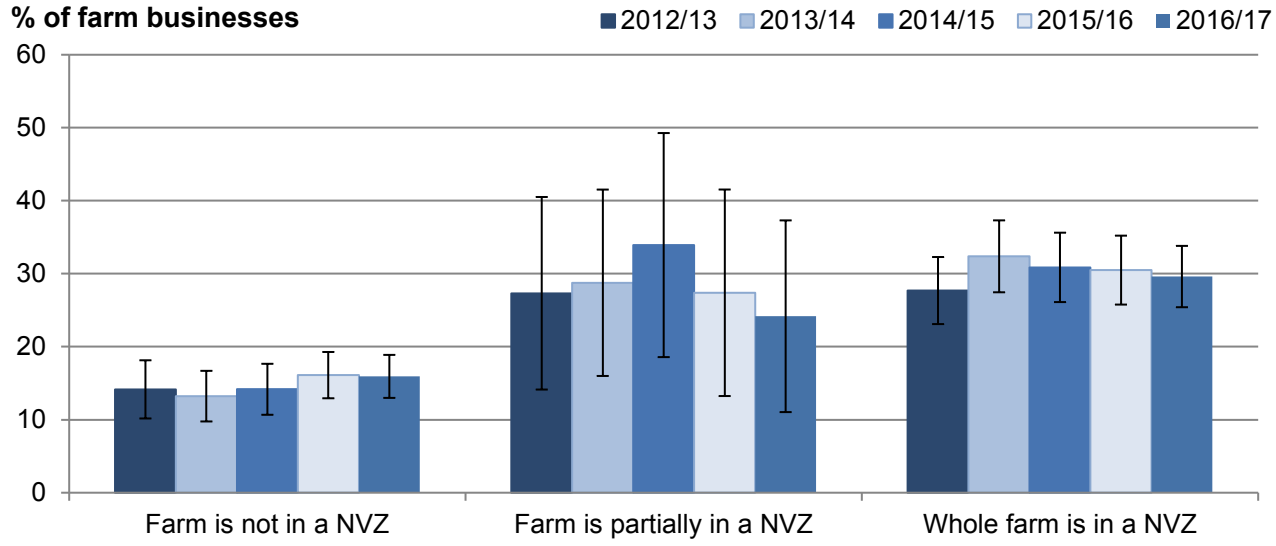


Source: Farm Business Survey.

(a) Based on responses from 975 farm businesses in 2012/13 and 2013/14, 968 in 2014/15,1329 in 2015/16, and 1421 in 2016/17.

(b) Data was collected from horticulture farms for the first time in 2015/16.

Figure 3: Percentage of farm businesses using soil nutrient software packages by NVZ status, England 2012/13 to 2016/17 [(a)(b)]



Source: Farm Business Survey.

(a) Based on responses from 975 farm businesses in 2012/13 and 2013/14, 968 in 2014/15,1329 in 2015/16, and 1421 in 2016/17.

(b) Results shown for 2015/16 and 2016/17 include horticulture farms and those farms without a farmed area.

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. Over half of those farms with permanent or temporary grass included clover or legumes in their grass swards (53% in 2016/17, Table 4); 9% 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 2012/13 to 2016/17 [(b)(c)]

	Percentage of farm businesses (%)				
	2012/13	**2013/14**	**2014/15**	**2015/16[(d)]**	**2016/17**
Yes	52 (±4)	52 (±4)	55 (±4)	58 (±3)	53 (±3)
No	38 (±4)	37 (±4)	36 (±4)	33 (±3)	37 (±3)
Not applicable	10 (±3)	11 (±3)	9 (±2)	9 (±2)	9 (±2)

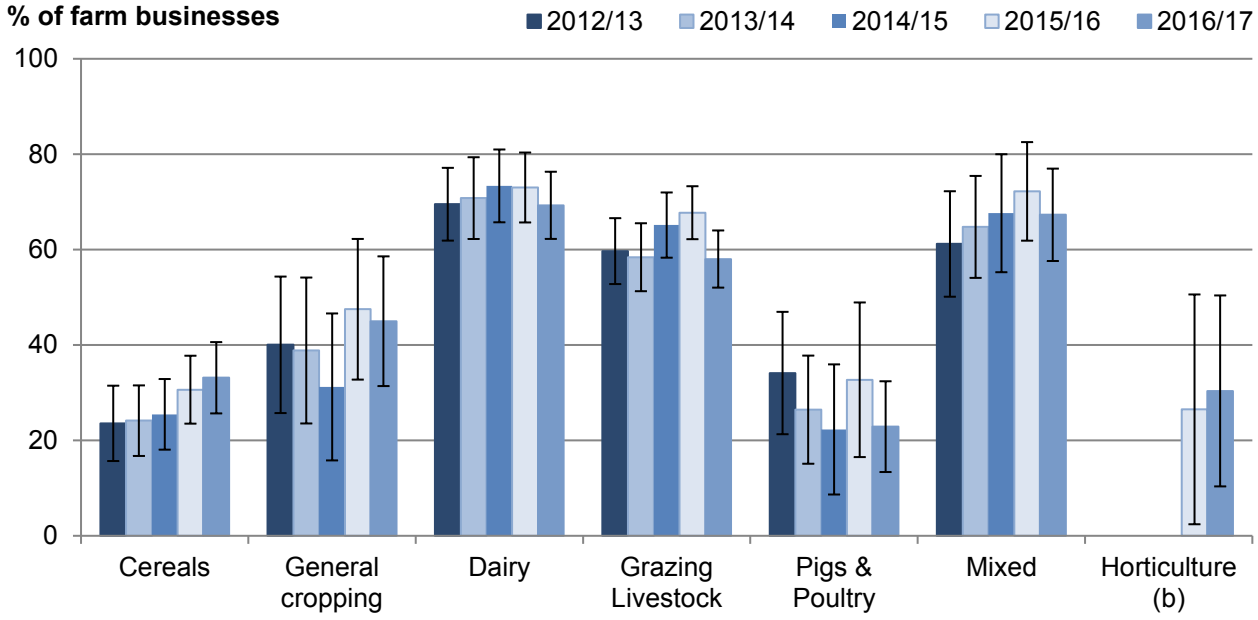
Source: Farm Business Survey.
(a) Excludes rough grazing.
(b) Based on responses from 847 farm businesses with temporary or permanent grass in 2012/13, 819 in 2013/14, 817 in 2014/15, 1094 in 2015/16, and 1142 in 2016/17.
(c) 95% confidence intervals are shown in brackets.
(d) Results shown for 2015/16 and 2016/17 include horticulture farms and those farms without a farmed area. The change in sample coverage for 2015/16 had minimal impact on the results.

These results are in line with those from the Farm Practices Survey (FPS)[10]; 74% of livestock farms with temporary grass in the FPS had sown grass with a clover mix in 2015 and 2016. Across all farm types in the FBS with temporary grass, 73% had sown grass with clover or legumes in 2016/17.

The use of clover and legumes in grass swards was significantly[11] related to farm type, farm size, and region in 2016/17, as in 2015/16. Usage was most common on mixed and dairy farms (67% and 69% respectively in 2016/17, Figure 4) and least likely on pigs and poultry farms (23% in 2016/17). 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 (79% in 2016/17) in grass swards than those in other regions (Figure 5).

[10] https://www.gov.uk/government/statistics/farm-practices-survey-february-2016-greenhouse-gas-mitigation-practices
[11] 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 2012/13 to 2016/17 [a]

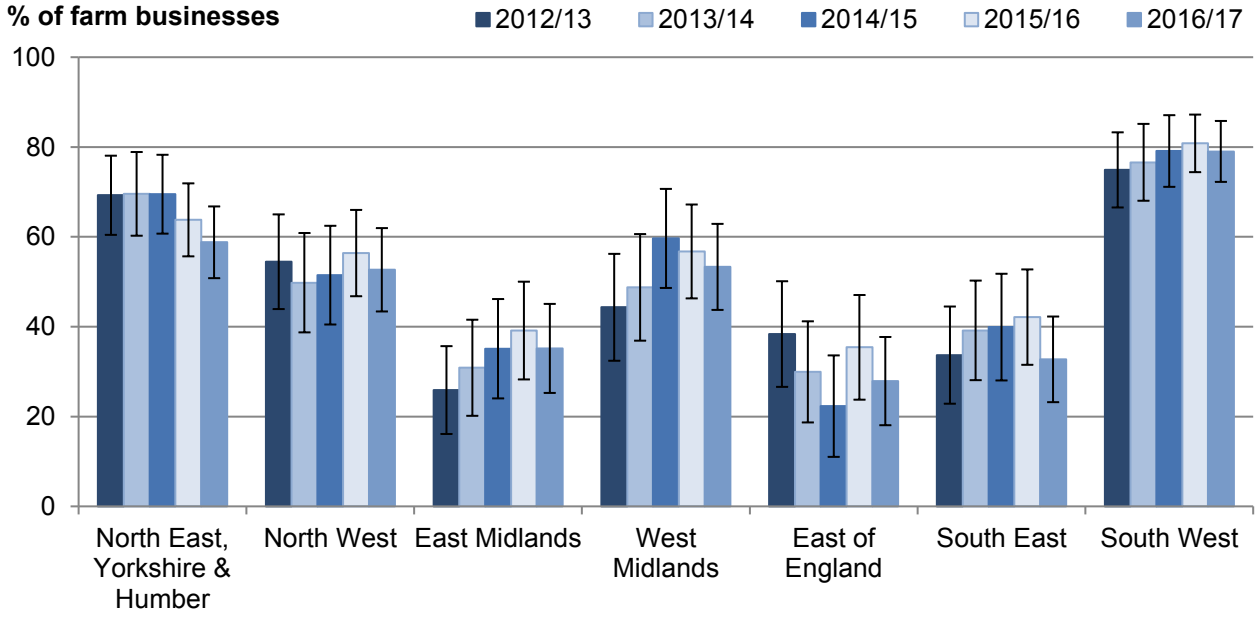


Source: Farm Business Survey.

(a) Based on responses from 847 farm businesses with temporary or permanent grass in 2012/13, 819 in 2013/14, 817 in 2014/15, 1094 in 2015/16, and 1142 in 2016/17.

(b) Data was collected from horticulture farms for the first time in 2015/16.

Figure 5: Percentage of farm businesses with permanent or temporary grass using clover or legumes in grass swards by region, England 2012/13 to 2016/17 [a][b]



Source: Farm Business Survey.

(a) Based on responses from 847 farm businesses with temporary or permanent grass in 2012/13, 819 in 2013/14, 817 in 2014/15, 1094 in 2015/16, and 1142 in 2016/17.

(b) Results shown for 2015/16 include horticulture farms and those farms without a farmed area.

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. Few farmers use green manures in their arable rotations (14% in 2016/17, Table 5).

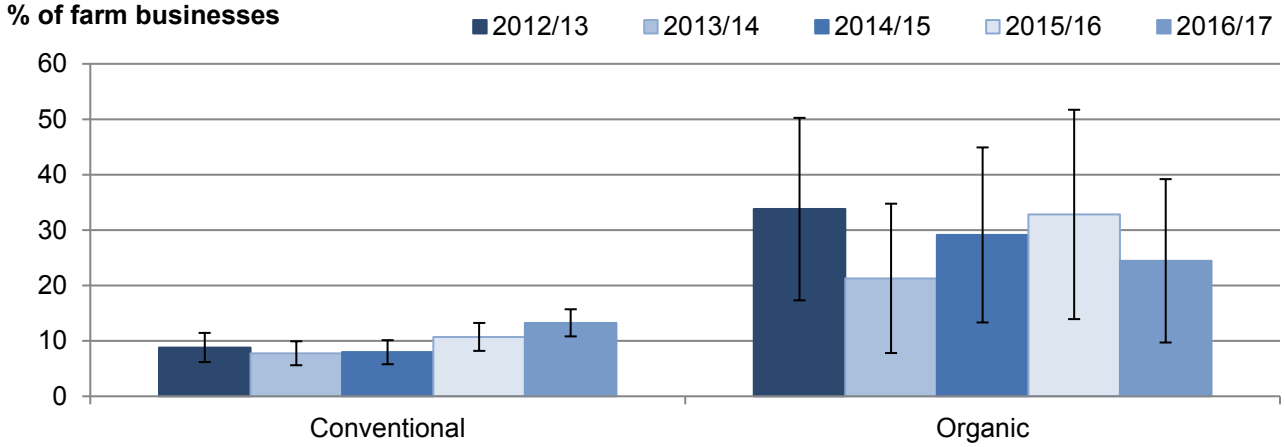
Table 5: Percentage of farm businesses employing green manures in arable rotation[(a)], England 2012/13 to 2016/17 [(a)(b)]

	Percentage of farm businesses (%)					
	2012/13	2013/14	2014/15	2015/16	2015/16[(c)]	2016/17
Yes	10 (±3)	8 (±2)	8 (±2)	11 (±3)	12 (±2)	14 (±2)
No	78 (±4)	80 (±3)	79 (±3)	77 (±4)	73 (±3)	72 (±3)
Not applicable	12 (±3)	12 (±3)	12 (±3)	13 (±3)	16 (±3)	14 (±2)

Source: Farm Business Survey.
Restricted to those with a tillage area but excluding temporary grass.
(a) Based on responses from 670 farm businesses in 2012/13, 688 in 2013/14, 684 in 2014/15, 927 in 2015/16, and 1033 in 2016/17.
(b) 95% confidence intervals are shown in brackets.
(c) Increased data collection from horticulture farms and those with no farmed area.

Use of green manures was significantly[12] related to farm type, organic status, farm size, and NVZ status in 2016/17. Organic farms were more likely to use green manures than conventional farms (24% and 13% respectively, Figure 6). General cropping and mixed farms (25% and 22% respectively in 2016/17) 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 farms partially in an NVZ, there is a large degree of uncertainty around these results and they should be treated with caution.

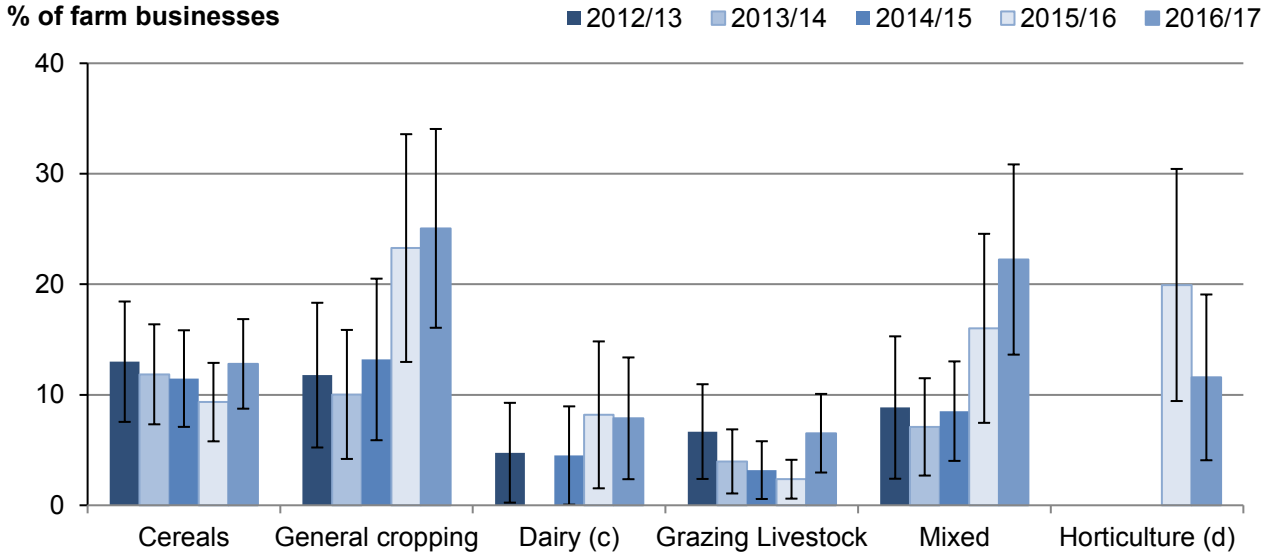
Figure 6: Percentage of farm businesses using green manures in arable rotation by organic status, England 2012/13 to 2016/17 [(a)(b)]



Source: Farm Business Survey. Results only for those farms with a tillage area (excluding temporary grass).
(a) Based on responses from 670 farm businesses in 2012/13, 688 in 2013/14, 684 in 2014/15, 927 in 2015/16, and 1033 in 2016/17.
(b) Results shown for 2015/16 include horticulture farms and those farms without a farmed area.

[12] 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, region and NVZ status were significant at the 5% level.

Figure 7: Percentage of farm businesses using green manures in arable rotation by farm type, England 2012/13 to 2016/17 [a][b]



Source: Farm Business Survey. Results only for those farms with a tillage area (excluding temporary grass).
(a) Based on responses from 670 farm businesses in 2012/13, 688 in 2013/14, 684 in 2014/15, 927 in 2015/16, and 1033 in 2016/17.
(b) There are insufficient observations to show results for pig and poultry farms.
(c) There are insufficient observations to show results for dairy farms in 2013/14.
(d) Data was collected from horticulture farms for the first time in 2015/16.

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). Around two thirds of farmers that had used these crops reported that they had made adjustments to their fertiliser application rates (Table 6).

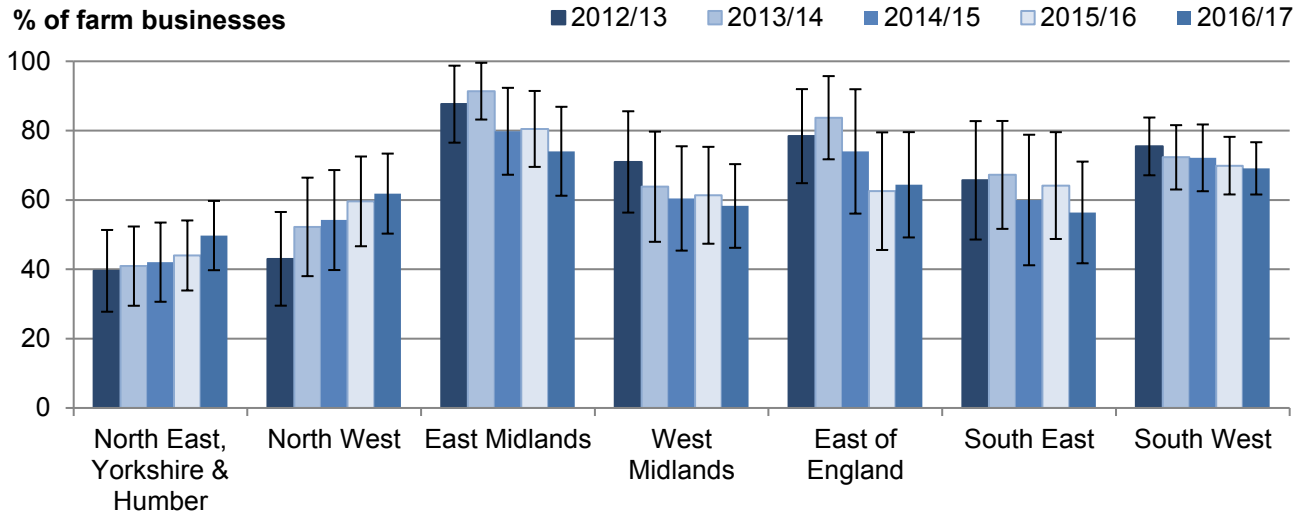
Table 6: Percentage of farm businesses making adjustments to fertiliser application rates after using clover/legumes or green manures, England 2012/13 to 2016/17 [a][b]

	Percentage of farm businesses (%)				
	2012/13	2013/14	2014/15	2015/16[c]	2016/17
Yes	65 (±5)	65 (±5)	62 (±5)	63 (±5)	62 (±4)
No	28 (±5)	29 (±5)	30 (±5)	30 (±5)	28 (±4)
Not applicable	8 (±3)	6 (±2)	8 (±3)	8 (±3)	10 (±3)

Source: Farm Business Survey.
(a) Based on responses from 509 farm businesses in 2012/13, 497 in 2013/14, 499 in 2014/15, 691 in 2015/16, and 708 in 2016/17.
(b) 95% confidence intervals are shown in brackets.
(c) Results shown for 2015/16 include horticulture farms and those farms without a farmed area. The change in sample coverage for 2015/16 had minimal impact on the results.

Adjusting fertiliser application rates was significantly[13] related to farm type, region, farm size, farmer age, and performance in 2016/17. Farm businesses in the South West and the East Midlands were more likely to adjust fertiliser rates than those in other regions in 2016/17 (Figure 8). Mixed and general cropping farms were more likely to adjust application rates than other farm types (72% of farms for both types in 2016/17).

Figure 8: Percentage of farm businesses making adjustments to fertiliser application rates after using clover/legumes or green manures by farm region, England 2012/13 to 2016/17 (a)(b)



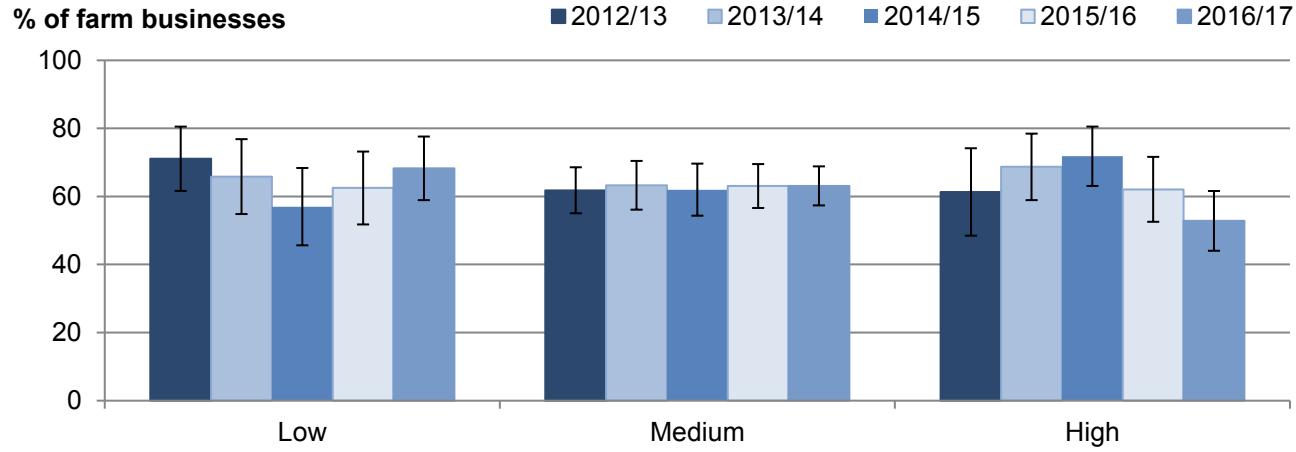
Source: Farm Business Survey.

(a) Based on responses from 509 farm businesses in 2012/13, 497 in 2013/14, 499 in 2014/15, 691 in 2015/16, and 708 in 2016/17.

(b) Results shown for 2015/16 include horticulture farms and those farms without a farmed area.

Farmers under the age of 40 were more likely to adjust application rates (76% in 2016/17) than older farmers. High performing farmers were more likely to make adustments than low performing farms in 2016/17, although this was not the case in earlier years (Figure 9).

Figure 9: Percentage of farm businesses making adjustments to fertiliser application rates after using clover/legumes or green manures by farm performance, England 2012/13 to 2016/17 (a)(b)



Source: Farm Business Survey.

(a) Based on responses from 509 farm businesses in 2012/13, 497 in 2013/14, 499 in 2014/15, 691 in 2015/16, and 708 in 2016/17.

(b) Results shown for 2015/16 include horticulture farms and those farms without a farmed area.

[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.

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 2016/17 [(a)]

	Percentage of farm businesses (%)	95% Confidence Interval (±) (%)
Own advice (not FACTS)	48	±3
Own advice (FACTS)	5	±1
Independent advice (FACTS)	22	±1
Fertiliser supplier advice (FACTS)	25	±3

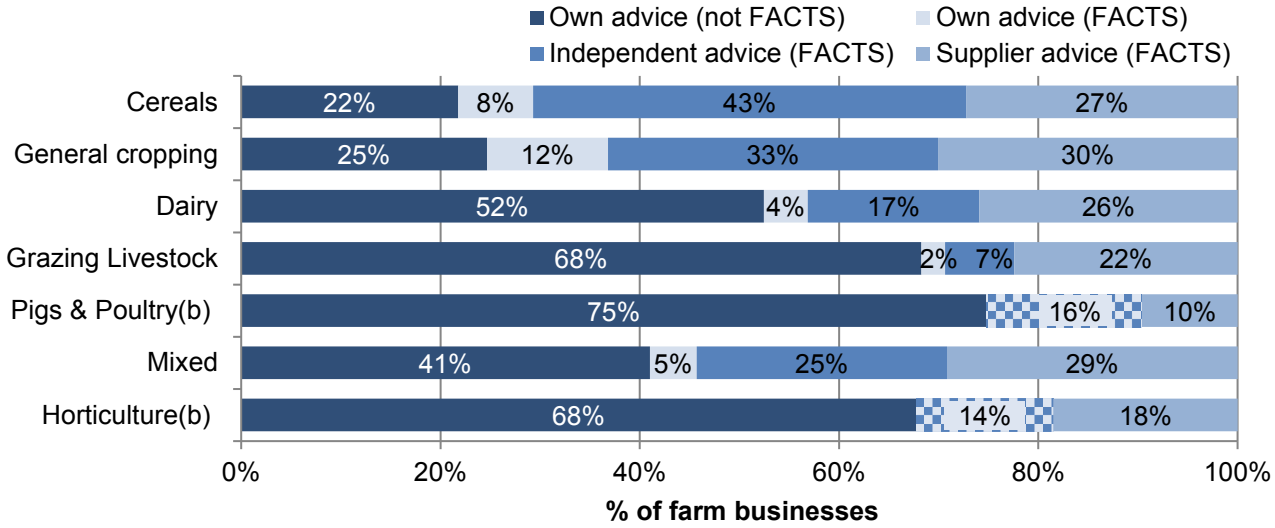
Source: Farm Business Survey.

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

Nearly half of farm businesses relied primarily on their own non-FACTS qualified advice (48%), while very few farm businesses relied on their own FACTS-qualified advice (5%). Around a fifth relied primarily on independently supplied FACTS advice (22%), and a quarter mainly received advice from their FACTS-qualified fertiliser supplier (25%).

All sources of nutrient planning advice, excluding own FACTS-qualified[14], were significantly[15] related to farm type, and all sources with the exception of advice by a fertiliser supplier were significantly related to region. Cereal and general cropping farms were less likely than other farm types to rely on their own non-FACTS qualified advice, but more likely to be FACTS qualified or to rely on independent advice from FACTS qualified advisers (Figure 10). Grazing livestock, horticulture, and pig and poultry farms were more likely than other farm types to rely on their own non-FACTS qualified advice.

Figure 10: Main source of advice used in nutrient by farm type, England 2016/17 [(a)]



Source: Farm Business Survey.

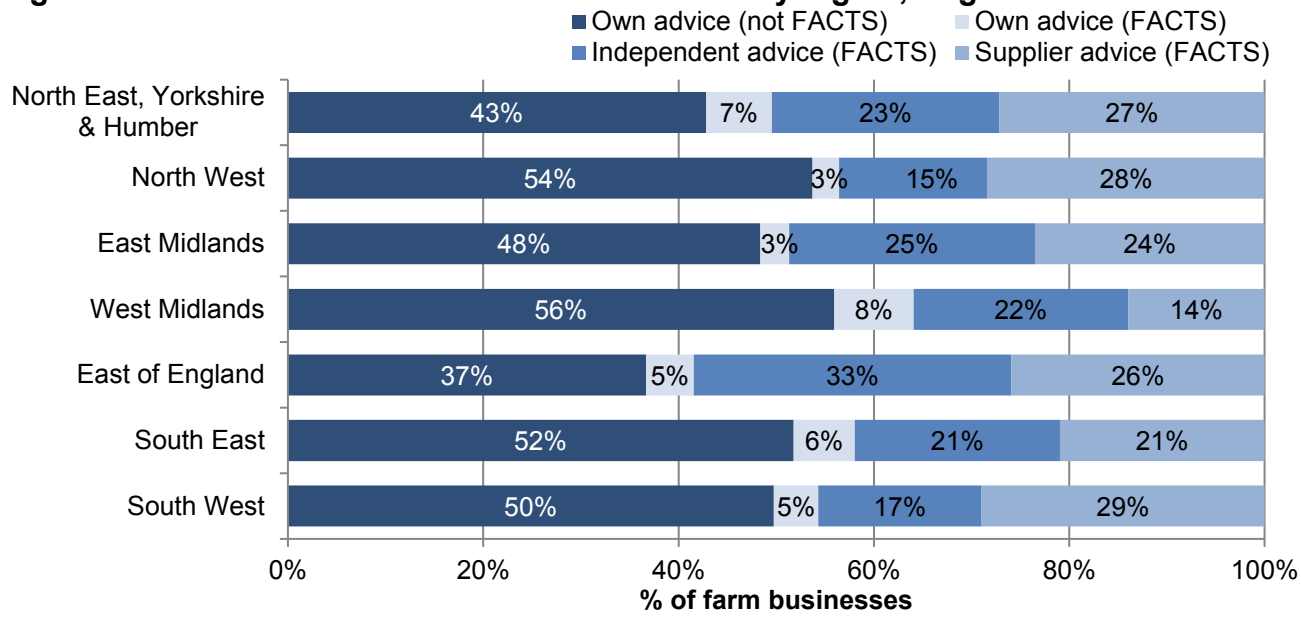
(a) Based on responses from 1403 farm businesses to which the question was applicable in 2016/17. It was not applicable to farms without a utilised agricultural area (UAA) and farms letting out their full UAA.

(b) Own FACTS-qualified and independent FACTS-qualified advice merged due to insufficient observations.

[14] It was not possible to carry out modelling as too few farms reported using own FACTS-qualified advice.

[15] 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. Region was significant at the 5% level.

Figure 11: Main source of advice used in nutrient by region, England 2016/17 [(a)]



Source: Farm Business Survey.

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

The relationship with region for relying on own non-FACTS qualified advice appears more complicated. Whilst over half of farms in the North West rely on this source of advice, after allowing for farm type and size, these farms are much less likely than those in other regions to rely on their own non-FACTS qualified advice. There is also a significant relationship with farm size, with smaller farms being more reliant.

3 Manufactured fertiliser application rates

Key findings:

- 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 113 kg in 2016/17. 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 19 kg per hectare in 2016/17. General cropping farms had the highest application rates while grazing livestock farms had the lowest.
- The average amount of **potash applied per hectare** of farmed area (excluding rough grazing) was 26 kg per hectare in 2016/17. General cropping farms had the highest application rates, while pigs and poultry farms had the lowest.

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.

3.1 Nitrogen (N)

The average amount of nitrogen applied per hectare of farmed area[16] (excluding rough grazing) was 113 kg in 2016/17 (Table 8), unchanged 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)[17] [100 kg per hectare in 2016]. 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 2012/13 to 2016/17 [(a)(b)]

	Overall application rates (kg per hectare)				
	2012/13	**2013/14**	**2014/15**	**2015/16[(c)]**	**2016/17**
Nitrogen (N)	113 (±8)	113 (±6)	113 (±5)	113 (±5)	113 (±5)

Source: Farm Business Survey.

(a) Based on responses from 975 farm businesses in 2012/13 and 2013/14, 968 in 2014/15,1329 in 2015/16, and 1421 in 2016/17.

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

(c) Increased data collection from horticulture farms and those with no farmed area. The change in sample coverage for 2015/16 had minimal impact on the results.

Although the overall nitrogen application rates are similar for each year, the factors influencing these rates differ between years. For example, in 2012/13, region was not found to influence application rates, whereas this was the case in 2013/14. These differences could be due to the weather. For example, the very wet autumn of 2012 made drilling difficult and led to some partial and total crop failures through the winter. This resulted in a switch to spring sown crops which often require less fertiliser.

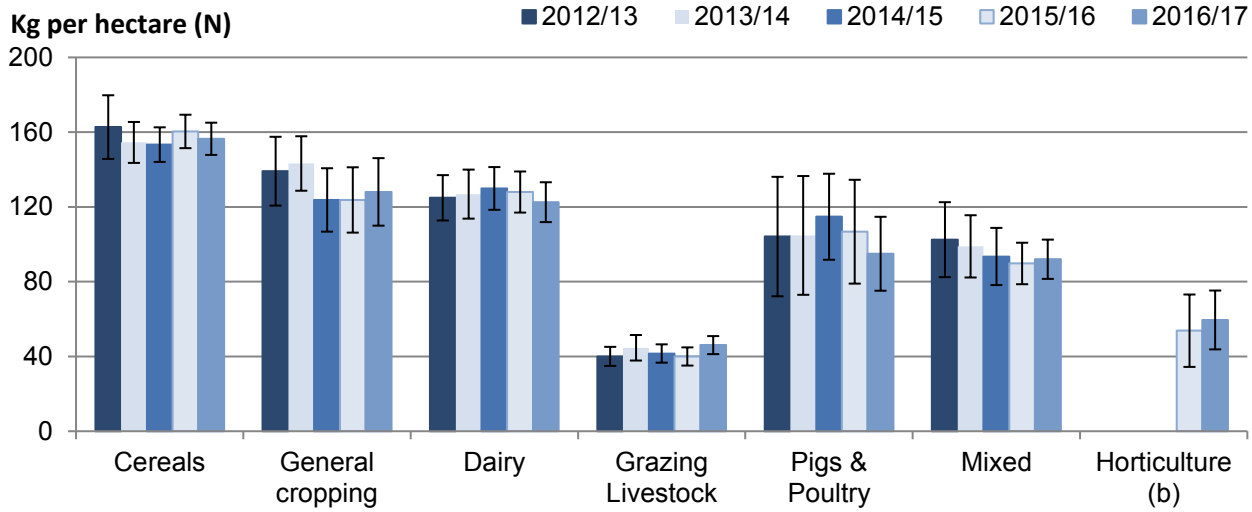
Application rates for nitrogen from the FBS were significantly[18] related to farm type and size in 2016/17, as was the case in 2015/16. Cereal farms (Figure 12) tended to have the highest application rates (156 kg/ha in 2016/17), whilst grazing livestock farms had the lowest (46 kg/ha in 2016/17). Larger farms tended to have higher application rates than smaller farms (Figure 13).

[16] 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.

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

[18] 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 tenure were significant at the 5% level. Region was borderline significant (p=0.061).

Figure 12: Overall nitrogen application rates per hectare of farmed area (excluding rough grazing) by farm type, England 2012/13 to 2016/17 [(a)]

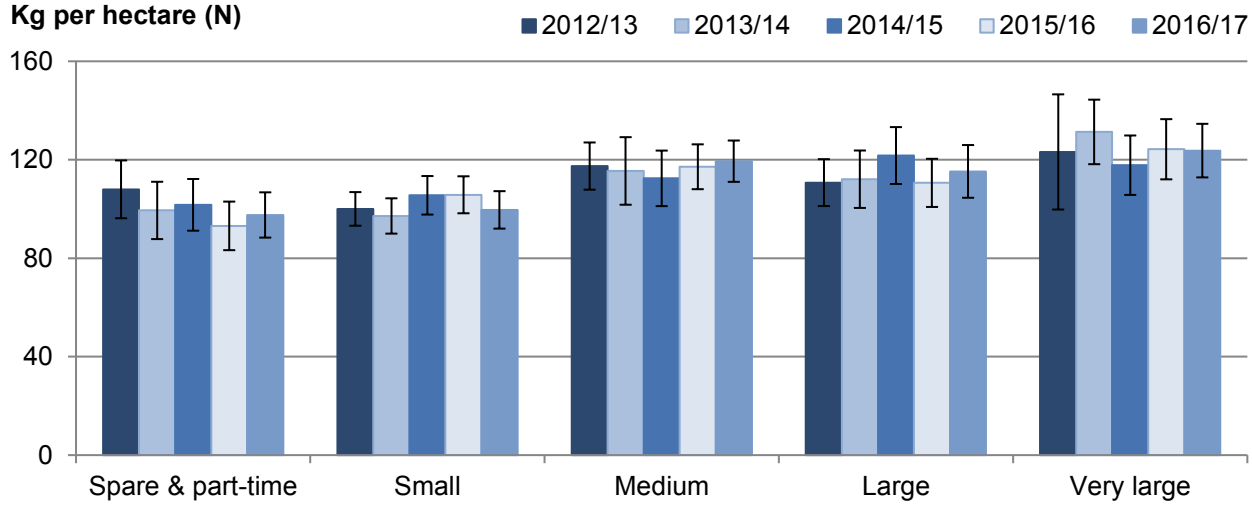


Source: Farm Business Survey.

(a) Based on responses from 975 farm businesses in 2012/13 and 2013/14, 968 in 2014/15,1329 in 2015/16, and 1421 in 2016/17.

(b) Data was collected from horticulture farms for the first time in 2015/16.

Figure 13: Overall nitrogen application rates per hectare of farmed area (excluding rough grazing) by farm size, England 2012/13 to 2016/17 [(a)]



Source: Farm Business Survey.

(a) Based on responses from 975 farm businesses in 2012/13 and 2013/14, 968 in 2014/15,1329 in 2015/16, and 1421 in 2016/17.

(b) Results for 2015/16 and 2016/17 include horticulture farms and those farms without a farmed area.

3.2 Phosphate (P_2O_5)

The average amount of manufactured phosphate applied per hectare of farmed area (excluding rough grazing) was 19 kg per hectare in 2016/17 (Table 8), little changed from the previous three years. Manufactured phosphate application rates (for total crops and grassland) for England from BSFP[19] were 16 kg per hectare (sown land area) in 2016

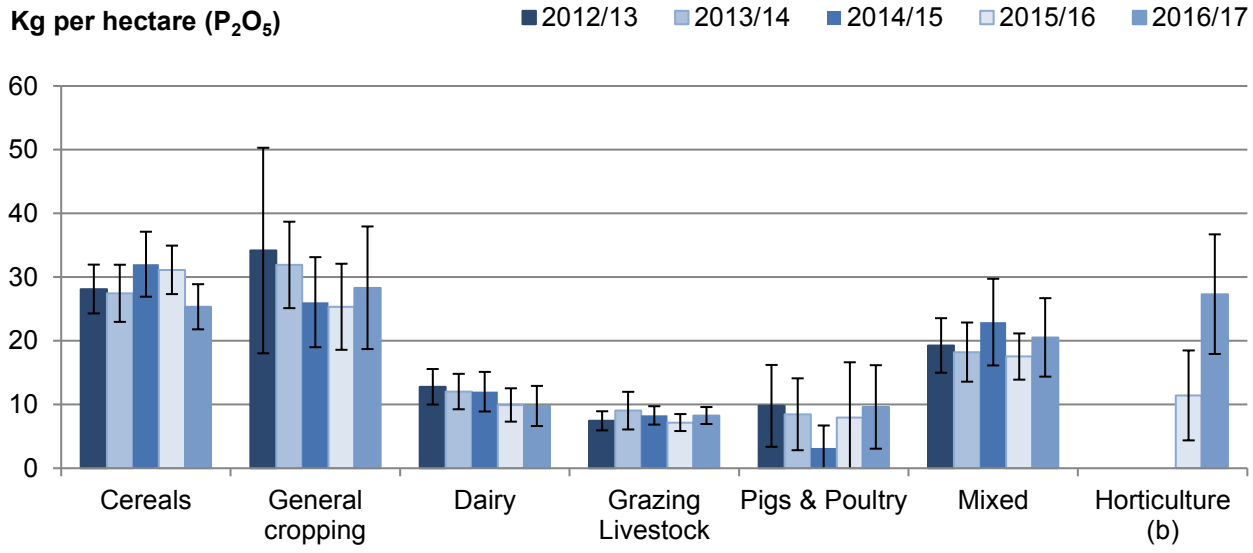
Table 8: Overall phosphate application rates per hectare of farmed area (excluding rough grazing), England 2012/13 to 2016/17 [(a)(b)]

	Overall application rates (kg per hectare)				
	2012/13	2013/14	2014/15	2015/16[(c)]	2016/17
Phosphate (P_2O_5)	20 (±3)	20 (±2)	21 (±2)	20 (±2)	19 (±2)

Source: Farm Business Survey.
(a) Based on responses from 975 farm businesses in 2012/13 and 2013/14, 968 in 2014/15,1329 in 2015/16, and 1421 in 2016/17.
(b) 95% confidence intervals are shown in brackets.
(c) Results shown for 2015/16 include horticulture farms and those farms without a farmed area. The change in sample coverage for 2015/16 had minimal impact on the results.

Application rates for phosphate from the FBS were significantly[20] related to farm type and region in 2016/17. General cropping farms had the highest average application rates (28 kg/ha in 2016/17, Figure 14). Grazing livestock farms had the lowest rates (8 kg/ha in 2016/17). Farm businesses in the North West tended to have lower application rates than those in the the rest of the country (Figure 15), potentially related to the crops grown in different regions.

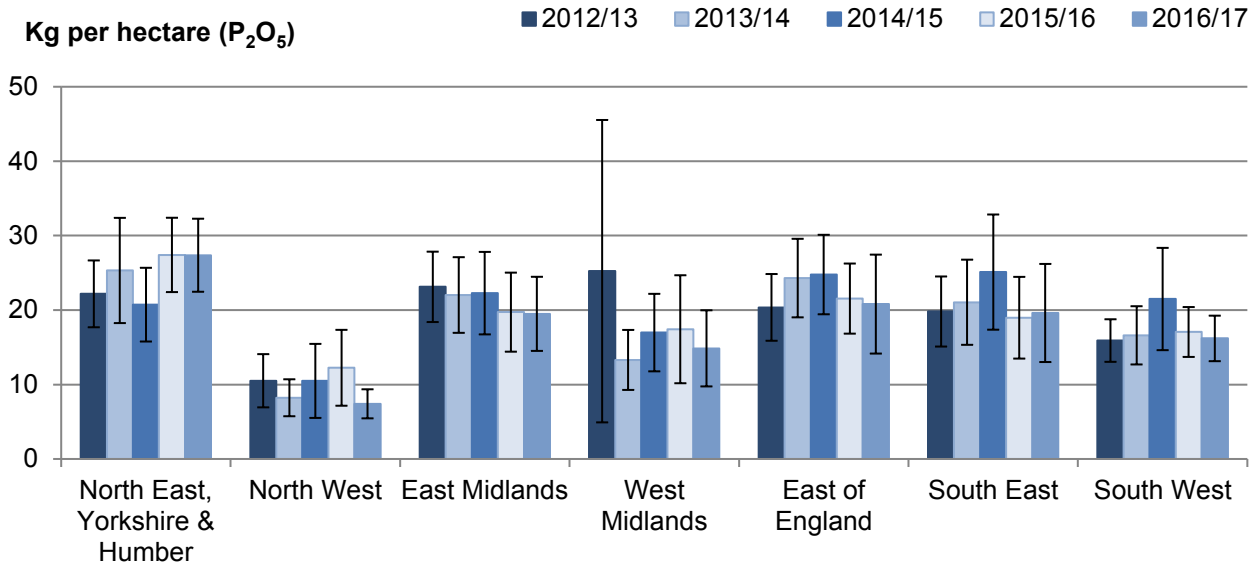
Figure 14: Overall phosphate application rates per hectare of farmed area (excluding rough grazing) by farm type, England 2012/13 to 2016/17 [(a)]



Source: Farm Business Survey.
(a) Based on responses from 975 farm businesses in 2012/13 and 2013/14, 968 in 2014/15,1329 in 2015/16, and 1421 in 2016/17.
(b) Data was collected from horticulture farms for the first time in 2015/16.

[19] For more information on the BSFP please see: https://www.gov.uk/government/collections/fertiliser-usage
[20] 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, farmer age, region, tenure and NVZ status were significant at the 5% level.

Figure 15: Overall phosphate application rates per hectare of farmed area (excluding rough grazing) by region, England 2012/13 to 2016/17 [(a)(b)]



Source: Farm Business Survey.
(a) Based on responses from 975 farm businesses in 2012/13 and 2013/14, 968 in 2014/15,1329 in 2015/16, and 1421 in 2016/17.
(b) Results shown for 2015/16 include horticulture farms and those farms without a farmed area.

3.3 Potash (K_2O)

The average amount of manufactured potash applied per hectare of farmed area (excluding rough grazing) was 26 kg per hectare in 2016/17 (Table 9), similar to previous years. Manufactured potash application rates (for total crops and grassland) for England from the BSFP[21] were 22 kg/ha (sown land area) in 2016.

Table 9: Overall potash application rates per hectare of farmed area (excluding rough grazing), England 2012/13 to 2016/17 [(a)(b)]

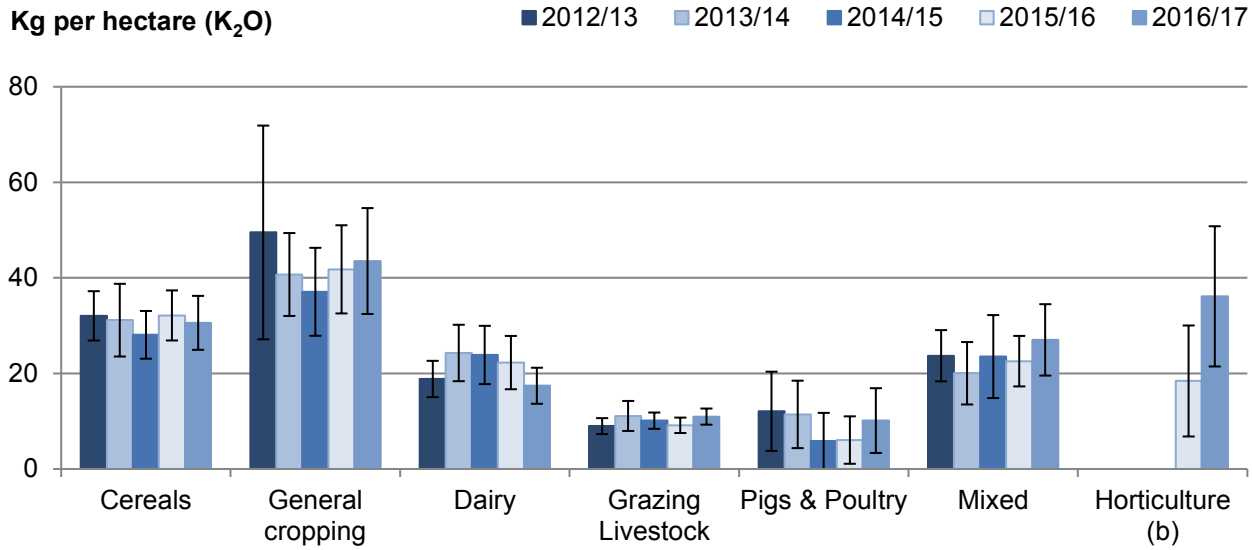
	Overall application rates (kg per hectare)				
	2012/13	**2013/14**	**2014/15**	**2015/16[(c)]**	**2016/17**
Potash (K_2O)	25 (±4)	25 (±3)	24 (±3)	25 (±2)	26 (±3)

Source: Farm Business Survey.
(a) Based on responses from 975 farm businesses in 2012/13 and 2013/14, 968 in 2014/15,1329 in 2015/16, and 1421 in 2016/17.
(b) 95% confidence intervals are shown in brackets.
(c) Results shown for 2015/16 include horticulture farms and those farms without a farmed area. The change in sample coverage for 2015/16 had minimal impact on the results.

Application rates for potash from the FBS were significantly[22] related to farm type and region in 2016/17. General cropping farms had the highest average application rates (44 kg/ha in 2016/17), whilst pigs and poultry farms had the lowest average rates (10 kg/ha in 2016/17, Figure 16). Potatoes, which have a much higher potash requirement than other crops, tend to be grown on general cropping farms. Farms in the North East, Yorkshire & Humber had the highest average application rates (41 kg/ha in 2016/17, Figure 17).

[21] For more information on the BSFP please see: https://www.gov.uk/government/collections/fertiliser-usage
[22] 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, region, NVZ status and tenure were significant at the 5% level.

Figure 16: Overall potash application rates per hectare of farmed area (excluding rough grazing) by farm type, England 2012/13 to 2016/17 [(a)]

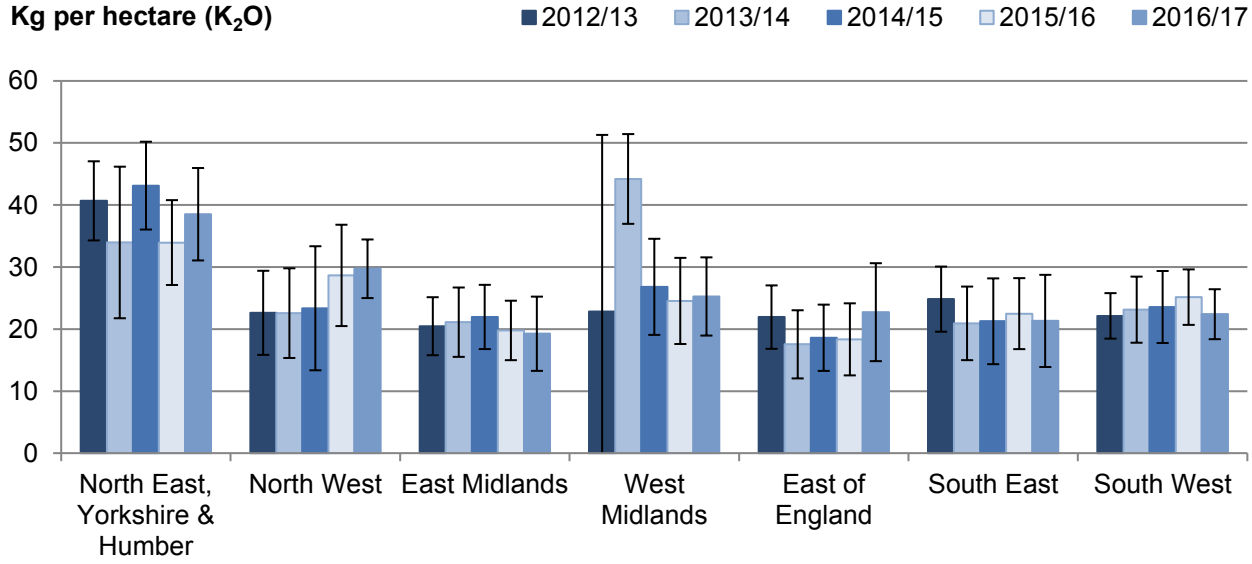


Source: Farm Business Survey.

(a) Based on responses from 975 farm businesses in 2012/13 and 2013/14, 968 in 2014/15,1329 in 2015/16, and 1421 in 2016/17.

(b) Data was collected from horticulture farms for the first time in 2015/16.

Figure 17: Overall potash application rates per hectare of farmed area (excluding rough grazing) by region, England 2012/13 to 2016/17 [(a)]



Source: Farm Business Survey.

(a) Based on responses from 975 farm businesses in 2012/13 and 2013/14, 968 in 2014/15,1329 in 2015/16, and 1421 in 2016/17.

(b) Results shown for 2015/16 include horticulture farms and those farms without a farmed area.

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 will:

- provide important data needed to estimate the environmental footprint of farming
- enable farms to benchmark their environmental as well as their financial performance
- meet 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[23] as recorded in the annual June Survey of Agriculture and Horticulture. In 2016, this accounted for approximately 56,700 farm businesses[24].

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.
- 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.

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

[24] 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

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. The module covered all the main farm types. Prior to 2015/16 the survey was restricted to those farms with a farmed area[25] and excluded horticulture farms.

A sample of 975 farms was achieved in both 2012/13 and 2013/14, 968 farms in 2014/15, 1329 farms in 2015/16, and 1421 in 2016/17. Horticulture farms and those farms without a farmed area (e.g. some specialist pig and poultry farms) were included for the first time in 2015/16. The farms that responded to the fertiliser module had similar characteristics to those farms in the main FBS in terms of farm type, farm size, and geographical location (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[26]) so that they can produce unbiased estimators of a number of different target variables.

A sample of 975 farms was achieved in both 2012/13 and 2013/14, 968 farms in 2014/15, 1329 farms in 2015/16, and 1421 in 2016/17. The increase in 2015/16 reflects the inclusion of horticulture farms and those farms without a farmed area. Results have also been calculated on a comparable basis and are shown where a difference arises.

In order to take account of non-response, the results have been reweighted using a method that preserves marginal totals for populations according to farm type and farm size[24] groups. The farms in the fertiliser module represent around 56,700 farms in the population.

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).

[25] Farmed area = UAA + 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.

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

Where possible we have provided comparisons with other data sources, particularly the British Survey of Fertiliser Practice. Appendix C provides a comparison of overall application rates for nitrogen, phosphate and potash by farm type.

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#documents

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.

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)[27]. 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.

[27] 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 in previous years

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.

2014/15 (2014 harvest)

Autumn 2013 saw temperatures slightly above average. Favourable weather conditions enabled good establishment of winter crops for the 2014 harvest. The winter months, although featuring above average temperatures were exceptionally stormy and were the wettest since 1910, with major flooding occurring. The severe flooding in some regions resulted in sizeable areas of cereal crops being lost. Spring 2014 saw above average temperatures. The warm spring resulted in good grass growth with livestock being turned out earlier than usual in some regions. Summer 2014 was warmer than average, although August was the coldest since 1993. June and July were dry months for most of England, whilst August was wet.

2013/14 (2013 harvest)

Wet weather in the autumn of 2012 meant that some farmers struggled to drill crops, particularly on heavy land. The late 2012 harvest also delayed seed availability. The balance between winter and spring crops was atypical and will have had a major impact on fertiliser use as lower yielding spring crops generally require less fertiliser. Spring 2013 was the coldest recorded since 1962 and hampered the establishment of spring sown crops and the recovery of poorly established winter sown crops. The summer months saw an improvement in growing conditions and a subsequent recovery in yields compared to the previous year.

2012/13 (2012 harvest)

Favourable conditions in the autumn of 2011 meant that drilling for 2012 crops progressed well and crop establishment was generally good. The relatively mild and dry winter resulted in continued good winter crop establishment but in April the weather changed and was the wettest on record. This was followed by a wet and cool summer which had a significant effect on crop yields and the quality of harvest.

Appendix B: Characteristics of responders to the FBS (eligible farms) and the fertiliser module

	2016/17	
Farm Type	Farms in the FBS	Fertiliser module subset
Dairy	20%	20%
LFA Grazing Livestock	9%	9%
Lowland Grazing Livestock	14%	14%
Cereals	12%	13%
General cropping	16%	18%
Pigs	4%	3%
Poultry	5%	5%
Mixed	10%	9%
Horticulture	11%	9%
All farms	**100%**	**100%**

	2016/17	
Region	Farms in the FBS	Fertiliser module subset
North East, Yorkshire & Humber	14%	15%
North West	21%	23%
East Midlands	19%	20%
West Midlands	20%	20%
East of England	26%	23%
South East	14%	15%
South West	21%	23%
All farms	**100%**	**100%**

	2016/17	
Farm Size	Farms in the FBS	Fertiliser module subset
Spare & part-time	16%	17%
Small	12%	12%
Medium	12%	11%
Large	12%	12%
Very large	16%	16%
All farms	**100%**	**100%**

Appendix C: Overall application rates for nitrogen, phosphate and potash by farm type in the British Survey of Fertiliser Practice, England 2012/13 to 2016/17