Department for Environment Food & Rural Affairs

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Farm Energy Use: Results from the Farm Business Survey: England 2011/12

This release shows the final estimates of farm energy use from the 2011/12 Farm Business Survey. The key results are below and should only be seen as representative of the farms responding to this survey.

- Winter wheat received more in-field agrochemical applications than any other crops, with an average of 10.1 applications for the 2011 harvest.
- The number of agrochemical spray applications did not appear to influence average gross margin for the crop.
- For all farm types, either red diesel or electricity is the biggest contributor to energy use from fuel. Red diesel accounts for 67% of energy use from fuel on specialist cereal farms.
- Energy use from fuel on a per hectare basis is highest on specialist poultry farms (45.8 GJ/ha) and lowest on LFA grazing livestock farms (1.6 GJ/ha).
- When split by energy intensity (GJ per hectare for cereal farms, GJ per livestock unit for livestock farms), gross margin per hectare (cereal farms) or livestock unit (livestock farms) increases with energy intensity.

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Detailed results

This release gives the main results from the farm energy module of the FBS2011/12. This release focuses on two areas; fuel use by farms and agrochemical use. Results in this release should not be regarded as representative of the FBS population. Extreme care should be taken when drawing conclusions from this release. More information on using the results can be found in the Survey Details section.

The results presented in this release can be found at: https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs/series/farm-business-survey#publications

1 Agrochemicals

Farmers were asked to provide the number of applications of six categories of agrochemicals for each crop harvested in 2011. The results here relate only to a sample of around 200 farms. For the most comprehensive statistics on agrochemical use, please see the Pesticide Usage Survey.

Table 1a: Average number of agrochemical applications per hectare, split by crop, 2011 harvest

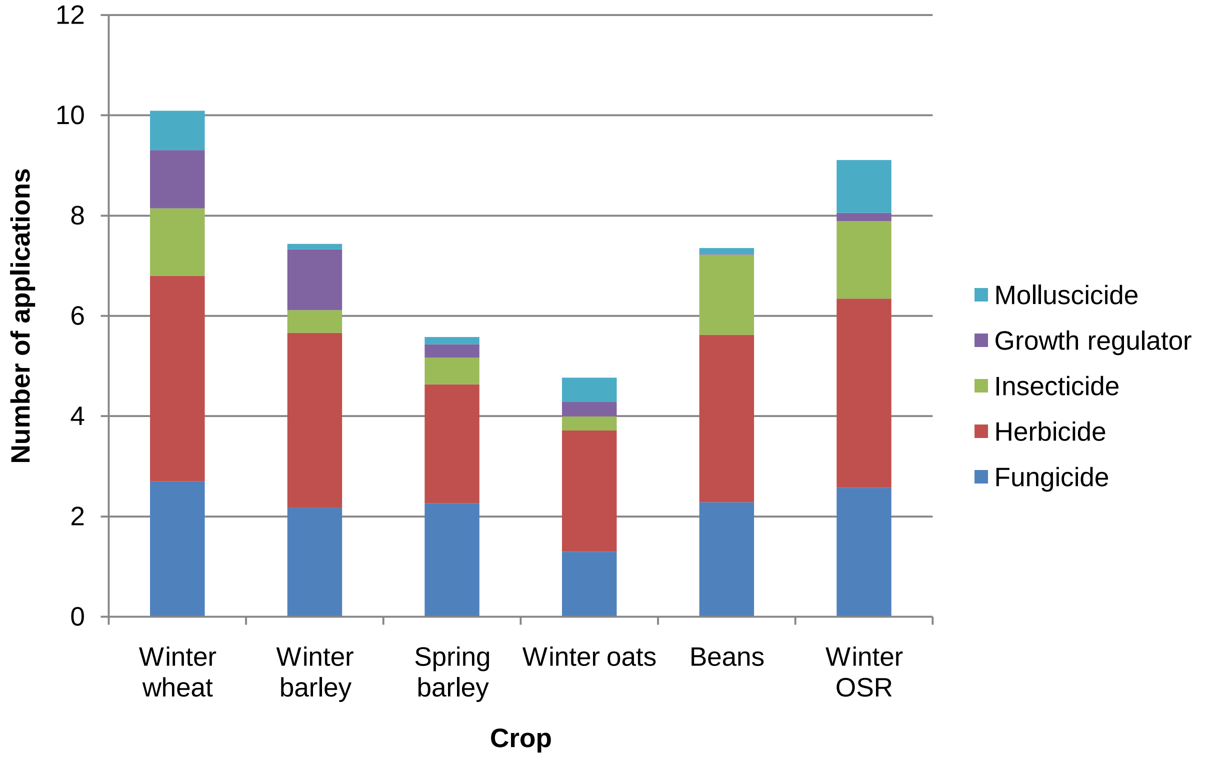
	Fungicide		**Herbicide**		**Insecticide**	
Crop	Mean	95% CI	Mean	95% CI	Mean	95% CI
Winter wheat	2.7	±0.4	4.1	±0.9	1.3	±0.3
Winter barley	2.2	±0.5	3.5	±1.6	0.5	±0.3
Spring barley	2.3	±1.2	2.4	±1.3	0.5	±0.3
Winter oats	*1.3*	*±0.5*	*2.4*	*±0.5*	*0.3*	*±0.3*
Beans	*2.3*	*±0.5*	*3.3*	*±2.1*	*1.6*	*±0.8*
Winter OSR	2.6	±0.5	3.8	±1.1	1.5	±0.6
Maize	0.5	±0.5	1.5	±0.4	0.3	±0.5
Other fodder crops	0.3	±0.4	0.6	±0.4	0.1	±0.1
Grassland	0.0	±0.0	0.1	±0.0	0.0	±0.0

Table 1b

	Growth regulator		**Molluscicide**		**Total in-field applications***		**Seed treatment**	
Crop	Mean	95% CI	Mean	95% CI	Mean	95% CI	%	95% CI
Winter wheat	1.2	±0.3	0.8	±0.2	10.1	±1.1	0.7	±0.2
Winter barley	1.2	±0.6	0.1	±0.1	7.4	±1.6	0.7	±0.2
Spring barley	0.3	±0.3	0.1	±0.2	5.6	±2.5	0.6	±0.3
Winter oats	*0.3*	*±0.3*	*0.5*	*±0.4*	*4.8*	*±1.2*	*0.5*	*±0.4*
Beans	*0.0*	*±0.0*	*0.1*	*±0.2*	*7.4*	*±2.0*	*0.4*	*±0.4*
Winter OSR	0.2	±0.2	1.1	±0.2	9.1	±1.1	0.7	±0.2
Maize	0.0	±0.0	0.0	±0.0	2.2	±0.6	0.3	±0.3
Other fodder crops	0.0	±0.1	0.0	±0.0	1.0	±0.8	0.1	±0.1
Grassland	0.0	±0.0	0.0	±0.0	0.1	±0.0	0.0	±0.0

Total in-field applications consist of fungicide, herbicide, growth regulators, insecticide and molluscicide.
% of seed treated is shown in the seed treatment column.
Multiple agrochemical applications may have been combined into fewer spray passes.

Figure 1: Average number of in-field agrochemical applications per hectare, split by crop, 2011 harvest



Multiple agrochemical applications may have been combined into fewer spray passes.

The total number of in-field agrochemical applications was highest for winter wheat, followed by winter oilseed rape. For all crops, herbicide is the agrochemical applied most times, with winter wheat crops receiving on average just over 4 applications during the season. Fungicide was the next most frequently applied agrochemical. Grassland received almost no agrochemical applications. Seeds were either treated or not, so Table 1 shows the proportion or all seeds that received a treatment. This practice was most common for winter wheat, winter barley and winter OSR.

Table 2: Gross margin per hectare of winter wheat, split by total number of in-field agrochemical applications, 2011 harvest

Number of agrochemicals*	% of farms in sample	Winter wheat area per farm (ha)	Gross margin per ha	GM 95% CI
<=6	27%	27	£971	±£190
>6-<=8	27%	80	£889	±£68
>8-<=10	22%	163	£872	±£192
>10	24%	188	£984	±£200
All	100%	110	£927	±£110

Total in-field applications consist of fungicide, herbicide, growth regulators, insecticide and molluscicide. Multiple agrochemical applications may have been combined into fewer spray passes.

Table 2 shows that there is no clear relationship between the gross margin for winter wheat and number of in-field agrochemical applications. This suggests that the optimal crop protection strategy is dependent on local conditions. Whether an application adds value will depend heavily on timing and cost, neither of which is available here. The likelihood is that there is a mixture of costs and benefits, so whilst some additional agrochemicals represent wasteful expenditure, others are critical to crop development and deliver benefits in excess of their cost. Most Farm Business Survey analysis highlights a strong link between costs saving and financial success, so it might be expected that fewer applications would deliver a gross margin benefit. The absence of this effect in this data suggests that agrochemicals are not being applied unnecessarily, although the best farmers may be spending less for each application. Analysis of other crops and individual agrochemical groups fail to show any obvious difference in gross margins between high and low application groups. Tables similar to Table 2 for winter barley, spring barley and winter OSR can be seen in the accompanying dataset.

What Table 2 does show is that the number of agrochemical applications was higher for larger areas of wheat, with farms applying more than ten doses to their wheat having an average wheat area almost 7 times that of farms applying less than or equal to six applications during the growing season. There could be various reasons for this including availability of resources (human or machinery) and crop rotations; however this does not appear to result in a gross margin penalty.

Table 3: Total number of in-field agrochemical applications on specialist cereal and other farm types for three key cereals, 2011 harvest

	Specialist cereals		Other farm types*	
Crop	Total in-field applications	95% CI	Total in-field applications	95% CI
Winter wheat	10.22	±1.14	9.23	±4.08
Winter barley	8.43	±1.76	5.85	±1.28
Spring barley	6.70	±4.75	4.63	±1.75

Other farm types include dairy, grazing livestock, pigs and poultry.
Total in-field applications consist of fungicide, herbicide, growth regulators, insecticide and molluscicide.
Total in-field applications are weighted by crop area.
Multiple agrochemical applications may have been combined into fewer spray passes.

Specialist cereals farms made a greater number of agrochemical applications to winter wheat, winter barley and spring barley than other farm types; however this result was not statistically significant. Greater application frequency might suggest increased attention to these crops on specialist cereals farms, whereas for other farm types alternative enterprises such as livestock receive most focus.

2 Fuel use

Farmers were asked to provide the volume of major fuels used on farm by them and by contractors in 2011/12.

Table 4a: Volume of fuel used per hectare (UAA), 2011/12

	Road fuel (l)*		**Red diesel (l)**		**Red diesel used by contractors (l)**		**LPG (kg)**	
Farm type	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Cereals	11.0	±6.1	106.9	±15.3	8.7	±4.4	2.0	±2.4
Dairy	13.7	±3.9	121.6	±29.6	26.3	±8.9	0.7	±1.1
LFA Grazing Livestock	10.4	±3.5	15.3	±5.4	2.2	±1.1	0.1	±0.1
Lowland Grazing Livestock	11.1	±2.8	46.3	±10.3	8.2	±2.2	0.5	±0.5
Pigs	24.2	±14.1	139.5	±33.6	15.1	±7.1	0.0	±0.0
Poultry	103.4	±115.8	81.6	±36.2	13.2	±6.2	78.7	±95.3

Road fuel consists of derv and petrol.
Includes fuel used by contractors.

Table 4b

	Kerosene (l)		**Electricity (units)**		**Heating oil (l)**	
Farm type	Mean	95% CI	Mean	95% CI	Mean	95% CI
Cereals	11.8	±12.9	115.5	±52.8	0.1	±0.2
Dairy	2.0	±1.7	511.8	±135.2	0.9	±0.8
LFA Grazing Livestock	2.5	±1.2	28.7	±12.3	-	-
Lowland Grazing Livestock	6.3	±3.2	67.2	±25.7	0.4	±0.4
Pigs	0.6	±0.8	821.7	±643.6	-	-
Poultry	180.8	±299.2	2,194.4	±2,035.5	7.1	±11.7

Expressing fuel consumption on a per hectare basis aids comparison between farm types and benchmarking for individual farms. Within farm types there will still be a variety of systems with a range of intensity. Fuel used by contractors was almost exclusively red diesel.

Table 5: Total volume of red diesel used, split by user

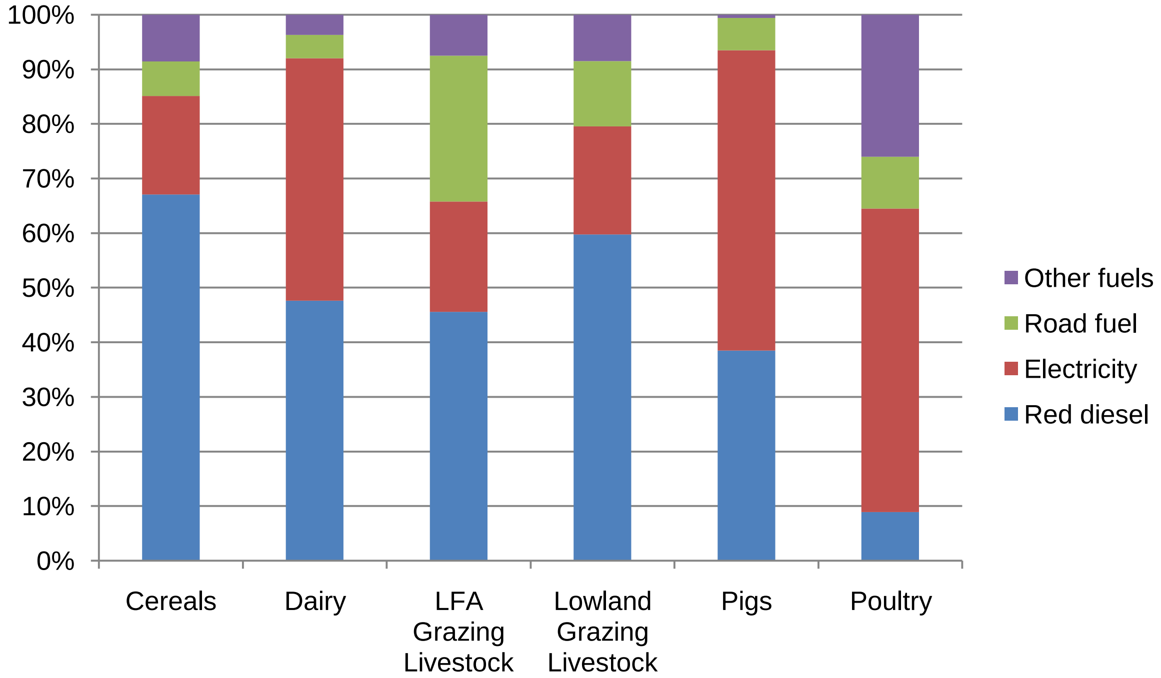
Farm type	By farm	95% CI	By contractors	95% CI
Cereals	92%	±4%	8%	±4%
Dairy	82%	±7%	18%	±7%
LFA Grazing Livestock	88%	±5%	12%	±5%
Lowland Grazing Livestock	85%	±4%	15%	±4%
Pigs	90%	±4%	10%	±4%
Poultry	86%	±7%	14%	±7%

Includes farms that did not use contractors.

The proportion of red diesel used on surveyed farms by contractors is similar for all farm types, ranging from 18% on dairy farms to 8% on cereal farms. Operations will be contracted out when they cannot easily be done by the farmer, often due to lack of specialist machinery. This is less likely to be the case on large farms where a greater range of kit is economically viable. The relatively low use of red diesel by contractors on cereal farms in this survey may well be influenced by the presence of a far greater proportion of large cereal farms than in the overall FBS population (see Appendix A).

Fuel volumes were converted into energy values (GJ) using factors extracted from the European Reference Life Cycle Database (ELCD), in line with those used by Cranfield University in their study of the previous data on this topic. This allows total energy use from fuels to be compared, which is particularly useful for comparing farm types which have different fuel use profiles.

Figure 2: Energy use (GJ/ha UAA) split by fuel type and farm type, 2011/12



Includes fuel used by contractors

Table 6: Energy use (GJ/ha UAA) split by fuel type and farm type, 2011/12

Farm type	Red diesel	Electricity	Road fuel	Other fuels	All fuel
Cereals	67%	18%	6%	9%	100%
Dairy	48%	44%	4%	4%	100%
LFA Grazing Livestock	46%	20%	27%	8%	100%
Lowland Grazing Livestock	60%	20%	12%	8%	100%
Pigs	38%	55%	6%	1%	100%
Poultry	9%	56%	9%	26%	100%

Include fuel used by contractors.
A more details split of fuels is shown in the accompanying dataset.

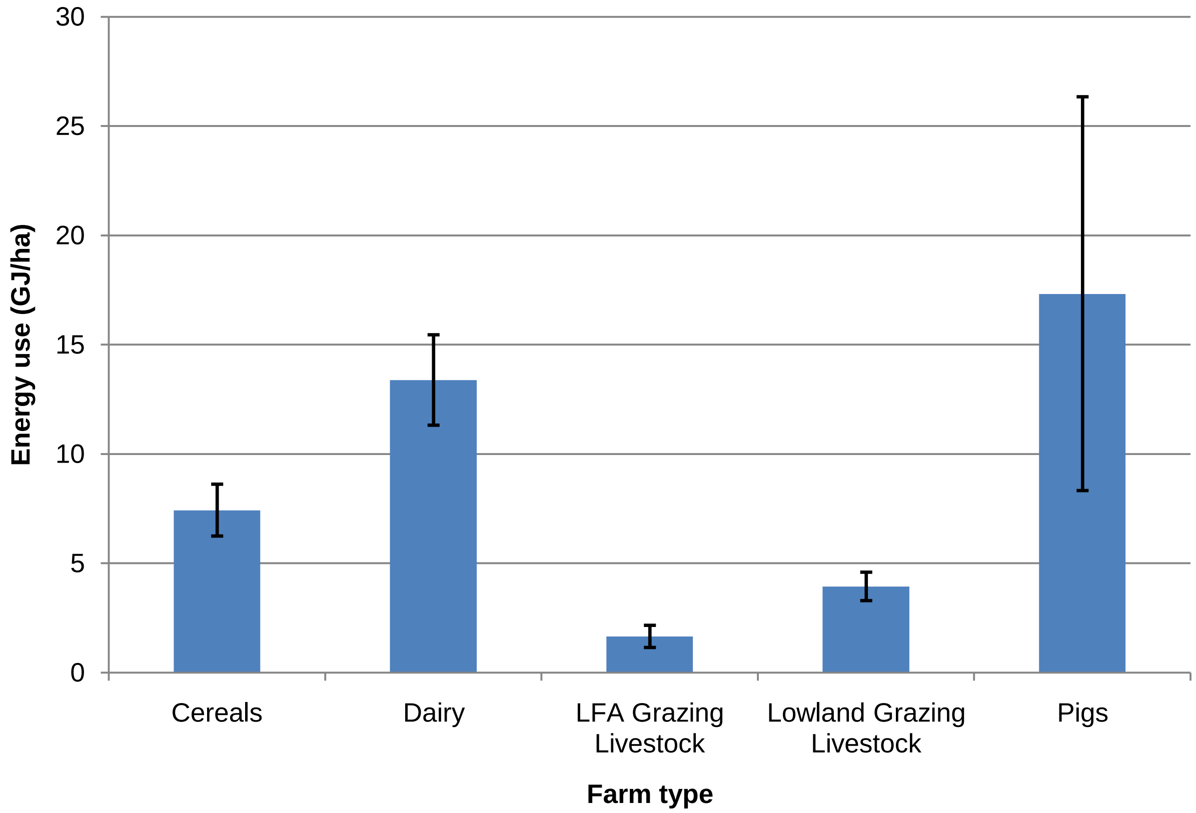
The majority of energy used by farms comes from a combination of red diesel and electricity, with these accounting for between 64 and 93% on all farm types included in this survey. For some poultry farms, kerosene (included in ‘other fuels’) is an important fuel, used for heating sheds. Road fuel is relatively important for grazing livestock farms, particularly those in the LFA reflecting the movement of livestock by road and less frequent field based operations.

Table 7: Energy use from fuels (GJ/ha UAA), split by farm type, 2011/12

Farm type	Energy use per ha (GJ)	95% CI
Cereals	7.4	±1.2
Dairy	13.4	±2.1
LFA Grazing Livestock	1.6	±0.5
Lowland Grazing Livestock	3.9	±0.7
Pigs	17.3	±9.0
Poultry	45.8	±37.2

Includes fuel used by contractors.

Figure 3: Energy use from fuels (GJ/ha), split by farm type, 2011/12



Poultry farms have been excluded from the chart to enable an easier visual comparison between other farm types.
Includes fuel used by contractors.

Energy use from fuel on a per hectare basis varies considerably between farm types. Poultry farms have by far the highest energy use on a per hectare basis at 46GJ, two and a half times higher than the next highest which is pigs. This reflects the intensive nature of the poultry sector and to a lesser extent pigs, where livestock are often kept at high stocking densities in sheds requiring constant temperature regulation and ventilation. UAA is also much lower for these farm types as they are not so reliant on land area. Dairy use considerably more energy than grazing livestock farms due to parlour operations and housed animals. LFA grazing livestock farms use just over 1.5GJ per hectare with less reliance on housing and fewer land operations.

Table 8: Gross margin of cereal farms per hectare UAA, split by energy use from fuel per hectare UAA

Energy use (GJ/ha UAA)	% of farms	GM per ha	GM 95% CI
<=5,000	32%	£1,136	±£191
>5,000-<=6,000	21%	£1,106	±£183
>6,000-<=9,000	26%	£1,303	±£153
>9,000	21%	£1,538	±£254
All farms	100%	£1,283	±£105

Table 9: Gross margin of Dairy farms per Livestock Unit, split by energy use from fuel per Livestock Unit

Energy use (GJ/LU)	% of farms	GM per LU	GM 95% CI
<=6,000	45%	£969	±£120
>6,000-<=8,000	29%	£1,015	±£103
>8,000	26%	£1,371	±£249
All farms	100%	£1,102	±£123

Includes fuel used by contractors

Table 10: Gross margin of LFA grazing livestock farms per Livestock Unit, split by energy use from fuel per Livestock Unit

Energy use (GJ/LU)	% of farms	GM per LU	GM 95% CI
<=2,500	18%	£601	±£222
>2,500-<=3,000	20%	£754	±£126
>3,000-<=4,500	32%	£893	±£168
>4,500	30%	£1,100	±£445
All farms	100%	£836	±£127

Includes fuel used by contractors

Table 11: Gross margin of Lowland grazing livestock farms per Livestock Unit, split by energy use from fuel per Livestock Unit

Energy use (GJ/LU)	% of farms	GM per LU	GM 95% CI
<=2,500	20%	£745	±£313
>2,500-<=3,500	23%	£702	±£129
>3,500-<=4,500	33%	£803	±£175
>4,500	25%	£1,158	±£283
All farms	100%	£854	±£125

Includes fuel used by contractors

When split by energy intensity (GJ per hectare for cereal farms, GJ per livestock unit for livestock farms), gross margin per hectare (cereal farms) or livestock unit (livestock farms) increases with energy intensity. This suggests that even within farm types there are systems with varying intensity with a higher energy input required to make a higher gross margin. Regardless of system, we would expect a range of energy efficiencies to be present, with more energy efficient (lower use) farms being rewarded by higher gross margins. However this data suggests that the impact of the farming system rather than energy efficiency dominates.

Survey details

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 1,900 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. To be eligible for the FBS, farm businesses must have a standard output of at least 25 thousand Euros.

In 2011/12 a sub-sample of around 200 farms in the FBS took part in an additional module to collect information on energy use. The survey was designed to collect data for greenhouse gas calculations which will be reported on in late 2013. Specific farm types were selected with a focus on those types which tend to have very dominant enterprises. For this reason, horticulture, general cropping and mixed farm types were not surveyed. It was also critical that full financial data was available for all responses, so the sample was restricted to those that completed that part of the FBS, although these represent over 90% of the full FBS sample. The sample for cereals, dairy and grazing livestock farms was stratified into three strata, based on Standard Output. This was not done for pigs and poultry farms. The size breakdown of responses is close to the FBS population breakdown for some farm types but not for others.

Full details of the characteristic of responding farms can be found at Appendix A.

Fuel volumes were converted into energy values (GJ) using factors extracted from the European Reference Life Cycle Database (ELCD) by Cranfield University. These factors use a Life Cycle Assessment (LCA) perspective which include energy used in the extraction, refinement and delivery of fuels, on top of the calorific value of the fuel itself.

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

Data analysis

The omission of some farm types from this survey means that the results are not representative of the farming industry as a whole and no results are reported on this basis. Due largely to the low number of observations, no attempt has been made to weight up results. As such, results in this release should not be regarded as representative of the FBS population. Extreme care should be taken when drawing conclusions from this release.

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. Confidence intervals have been adjusted to take into account the size of the total population from which they were sampled.

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

For the FBS, where figures are based on less than 5 observations these have been suppressed to prevent disclosure and where they are based on less than 15 observations these have been highlighted in the tables.

Availability of results

An in depth report based on the same data as this release is expected to be published in late 2013. This report will attempt to capture all areas of on farm energy consumption including areas such as purchased animal feed and fertiliser. The report will also focus on emissions from energy and consider the relationship between financial and environmental performance.

The data collected in this survey is not part of the core Farm Business Survey and is therefore not collected on an annual basis. No further collections of energy data as part of the Farm Business Survey are currently scheduled.

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.

Definitions

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

Road fuel
Petrol plus derv.

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.

UAA
Utilisable Agricultural Area (UAA) comprises the area of crops, grass and rough grazing, fallow and any uncropped land that could be returned to agricultural production.

Livestock Units
Based on estimated energy requirements. Standard ratios are used for converting animals of different species and ages into *Livestock Units* with one unit representing a mature 'black and white' dairy cow.

Appendix A: Characteristics of responders to the FBS energy module and the FBS population.

Appendix A1: Characteristics of responders to energy module 2011/12

Farm Type	Small	Medium	Large	Total
Cereals	18%	61%	21%	100%
Dairy	0%	74%	26%	100%
General cropping				
Horticulture				
LFA Grazing Livestock	73%	27%	0%	100%
Lowland Grazing Livestock	58%	43%	0%	100%
Mixed				
Pigs	5%	53%	42%	100%
Poultry	29%	57%	14%	100%

Small: Standard Output >=€25,000-€100,000
Medium: Standard Output >€100,000-€500,000
Large: Standard Output >€500,000

Appendix A2: Characteristics of FBS population 2011/12

Farm Type	Small	Medium	Large	Total
Cereals	45%	51%	4%	100%
Dairy	3%	66%	31%	100%
General cropping	22%	62%	16%	100%
Horticulture	44%	41%	14%	100%
LFA Grazing Livestock	81%	19%	0%	100%
Lowland Grazing Livestock	80%	20%	0%	100%
Mixed	47%	44%	9%	100%
Pigs	19%	56%	25%	100%
Poultry	14%	57%	29%	100%

Small: Standard Output >=€25,000-€100,000
Medium: Standard Output >€100,000-€500,000
Large: Standard Output >€500,000