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STATISTICS, DOCUMENT

Farm Business Survey in Wales: farm level Nitrogen, Phosphorous and Potassium application

Data from the Farm Business Survey (FBS) in Wales providing a general overview of the Farm Level Nitrogen, Phosphorous and Potassium Application, 2017-18 to 2022-23.

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Introduction

The farm fertiliser data used within this statistical article are derived from the annual Farm Business Survey (FBS) in Wales and provide further detail behind the [Farm Business Income results published on 23 January 2024](#). The following analysis explores the variation of fertiliser usage in farms in Wales via the FBS data. Data spans back to 2017-18 and looks at purchased, inorganic nitrogen (N), phosphorous (P) and potassium (K) usage on farms specifically. The term NPK will be used throughout this article when considering the data in relation to all three compounds together. The timepoints used within this article refer to financial years. A financial year is made up of 12 months but doesn't run from January to December. Instead, the financial year begins and ends each April. For example, the 2022-23 financial year considers data from April 2022 up until the end of March 2023.

Information on the quality and methodology for the Farm Business Survey are [provided in the Farm Incomes in Wales first release](#)

Background information

The use of inorganic NPK fertilisers to increase yield is part of farming practice for many grass and arable farmers. The application of NPK fertilisers aims to boost plant growth by providing more nutrients for improved growth and yield.

Nitrogen assists the production of amino acids, proteins, and nucleic acids which hold a role in chlorophyll production. Nitrogen therefore contributes to leafy growth and the green colour in plants and can enhance stem robustness and leaf size. Phosphorous ensures that roots and seeds develop adequately, whilst potassium helps to regulate water loss, improving plant ability to withstand drought by maintaining water within cells.

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Widespread use of NPK fertilisers has greatly improved agricultural productivity but overuse of NPK fertilisers can lead to several environmental repercussions including but not limited to; nutrient leaching, water eutrophication, and greenhouse gas emissions. Managing the environmental impacts of NPK usage is essential for sustainable farming practices in Wales.

Fertiliser applications

The figures in this report are built up from the farm accounts. Receipts show the cost and tonnage of products purchased. For each type of fertiliser an estimate is made of the weight of active ingredient (N, P or K as appropriate). Standard concentrations are used where no other information is available. In all cases in this report the weights refer to the active ingredient and not the total weight of product purchased.

Throughout this release, the amount purchased is used as an estimate of the amount used. Whilst this is considered a reasonable estimate, it should be noted that actual amounts of fertiliser applied may vary slightly. This is due to the possibility of not all fertiliser purchased being applied in the same financial year and instead being stored for the next year.

This report shows the amount of NPK both as a concentration (kilogrammes per hectare) and as a total weight. In agricultural and environmental terms the interest is usually on the concentration. The total weight is included to show the cumulative effect of many farms with relatively low concentrations compared to the few with high concentrations.

When calculating the concentration of fertiliser applied the whole farm area is used. The Farm Business Survey does not collect the detail to look at applications field by field.

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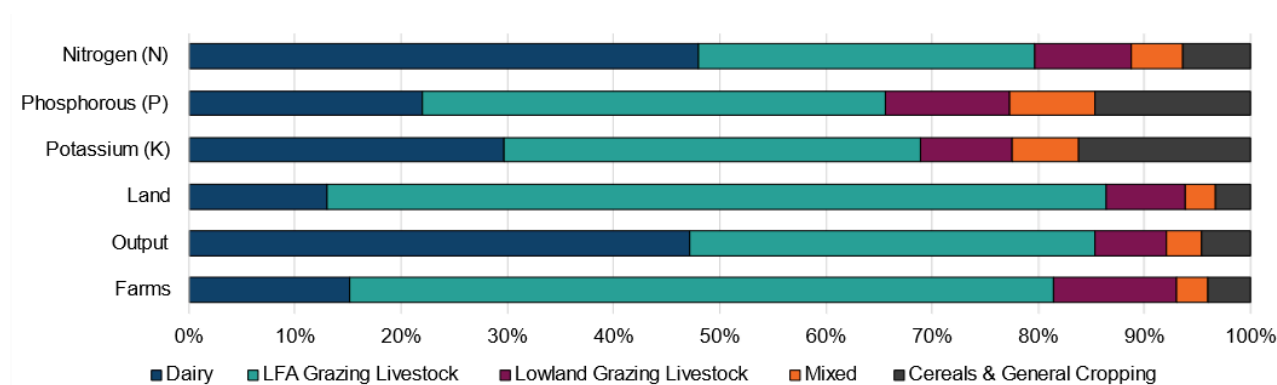
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Shares of farms, output, land and NPK usage

This section shows the share in the proportion of farms, output, land and NPK usage in Wales. Output is made up of individual crop and livestock output, diversified output, and subsidy payments. Land is based on the hectares of utilised agricultural area of the farm. The farm type classification is defined by the predominant activity on the farm. NPK usage refers to the total purchased inorganic NPK on farms as recorded in the FBS.

Figure 1: Share of farms by farm type: NPK, land, output and number of farms, 2022-23



Description of Figure 1: A stacked bar chart showing the share of farms by farm type in Wales for output, land, N, P and K application and number of farms for 2022-23. Dairy farms make up the largest proportion of nitrogen application and output in Wales whilst LFA grazing livestock farms make up the largest proportion of farms, phosphorous application and land in Wales. Lowland grazing livestock, mixed and cereals and general cropping farms make up the smallest proportions across each of the six categories.

Figure 1 demonstrates that the number of farms is not necessarily a good indicator of impact in terms of financial value, land or NPK application.

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Dairy farms account for just over half (47%) of total output in Welsh agriculture and for 48% of nitrogen application whilst accounting for a much smaller proportion of total land (13%) and farms (15%). This is important to consider in the context of average farm business income across Wales as dairy farms will have a substantial effect on this in driving up the average overall whilst accounting for only a small proportion of land and farms in Wales.

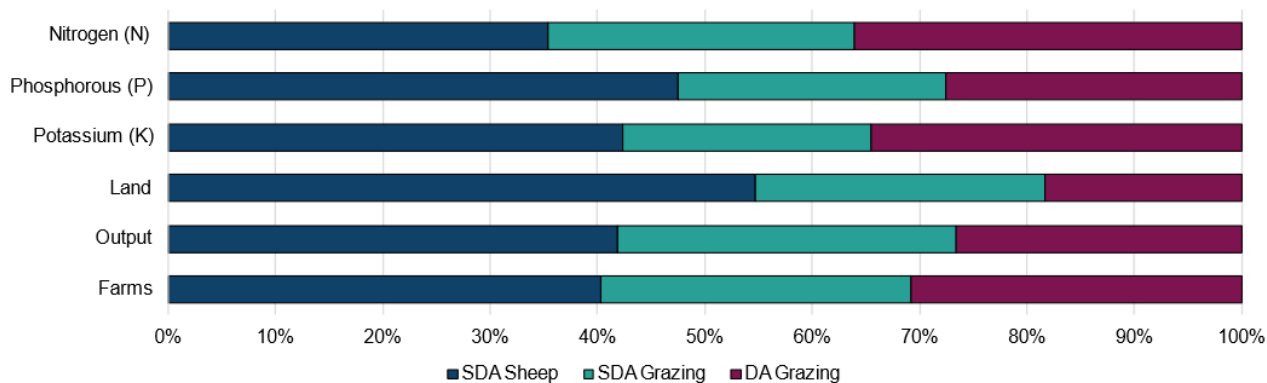
LFA grazing livestock make up the largest proportion of farms and land in Wales, accounting for two thirds (66%) of all farm types and almost three quarters (73%) of the land in Wales. LFA grazing livestock farms also account for a considerable portion of NPK application in Wales (32%, 44% and 39% respectively).

Lowland grazing livestock and other farm types account for much smaller proportions of Welsh agriculture with lowland grazing livestock accounting for 7% of output and land and 12% of all farms and a comparable portion of NPK application in Wales (9%, 12% and 9% respectively).

Cereals and general cropping farm types account for 8% of total output, 6% of total land and 7% of all farms and 16%, 15% and 6% of NPK application respectively.

Mixed farm types account for the smallest proportions of total output (3%), land (3%) and farms (4%) with a marginally higher proportion of NPK application (6%, 8% and 5% respectively).

Figure 2: Share of LFA farms by farm type: NPK, land, output and number of farms, 2022-23



Description of Figure 2: A stacked bar chart showing the share of LFA farms by farm type in Wales for NPK application, output, land, and number of farms for 2022-23.

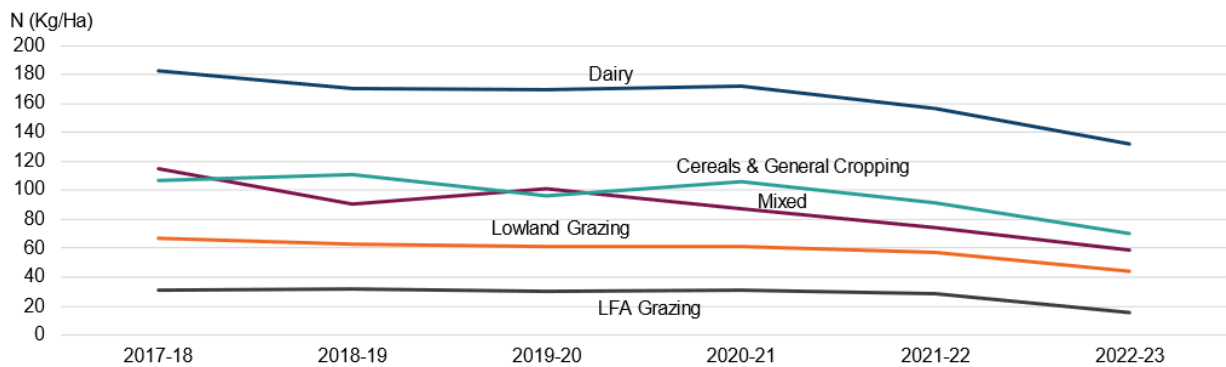
SDA Sheep farms make up the largest proportion of output (41%), land (55%) and farms (40%) out of all LFA farms in Wales. In addition, SDA Sheep farms make up the highest proportion of NPK application across the LFA farm types (11%, 21% and 17% respectively).

SDA Grazing livestock accounts for just under a third of all LFA output (31%), 27% of land and 29% of farms. Whilst making up a smaller proportion of NPK application (9%, 11% and 9% respectively). DA grazing livestock farms make up the smallest proportion of output (27%), land (18%) and just under a third (31%) of farms out of all LFA farms in Wales whilst NPK application is relatively lower (11%, 12% and 14% respectively).

Trends on the average and total NPK usage and fertiliser costs

This section shows the trends on NPK usage over time in Wales. It is important to consider the differences between the average NPK application per farm and the total level of NPK application per farm type. The average NPK application is portrayed as kilograms per hectare (Kg/Ha) and NPK usage refers to the total purchased inorganic NPK on farms as recorded in the FBS.

Figure 3: Average nitrogen application (kg per hectare) by farm type, 2017-18 to 2022-23



Description of Figure 3: A line chart showing average nitrogen application by farm type between 2017-18 and 2022-23.

All farm types have demonstrated a gradual decline between 2020-21 and 2022-23. There are a multitude of factors that this decline could be attributed to, one of which is the increase in the cost of fertiliser in recent years which will be explored in further detail later in this article.

Dairy farms have a considerably larger average application of nitrogen Kg/Ha and sits higher than other all other farm types in the chart across the timeseries

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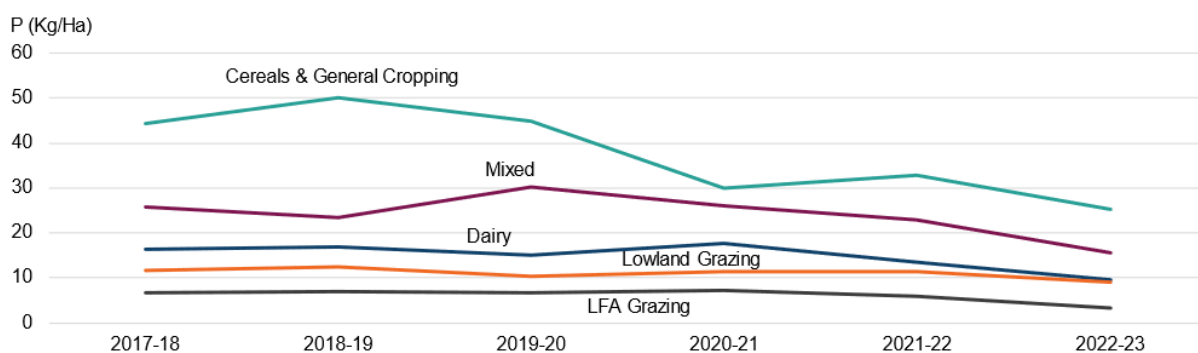
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(132 Kg/Ha in 2022-23). This is because nitrogen is a key component of protein which contributes to animal milk.

Dairy farms are followed by cereals and general cropping (70 Kg/Ha in 2022-23), mixed (59 Kg/Ha in 2022-23), lowland grazing (44 Kg/Ha in 2022-23) and LFA grazing (16 Kg/Ha in 2022-23). The order remains consistent across the timeseries with the exception of 2019-20 where mixed farms marginally held a higher application rate (101 Kg/Ha) than cereals and general cropping (96 Kg/Ha) but this dropped down to 87 Kg/Ha in the following year whilst cereals and general cropping increased to 106 Kg/Ha.

Figure 4: Average phosphorous application (kg per hectare) by farm type, 2017-18 to 2022-23

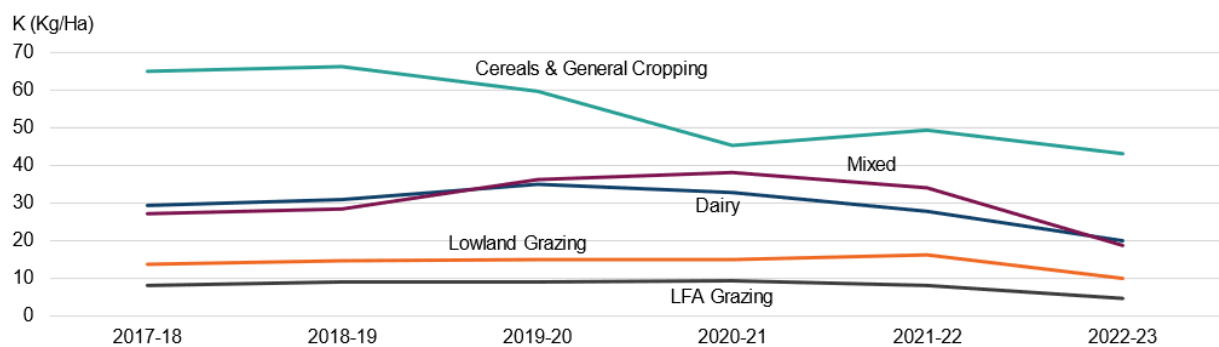


Description of Figure 4: A line chart showing average phosphorous application by farm type between 2017-18 and 2022-23. All farm types have demonstrated a decline between 2021-22 and 2022-23.

Cereals and General Cropping farms have a considerably larger average application of phosphorous Kg/Ha and sits higher than other all other farm types in the chart across the timeseries (25 Kg/Ha in 2022-23). This is because an application of phosphate helps to stimulate the growth of the roots and shoots of crops.

This is followed by mixed farms (16 Kg/Ha in 2022-23), dairy (10 Kg/Ha in 2022-23), lowland grazing (9 Kg/Ha in 2022-23) and LFA grazing (3 Kg/Ha in 2022-23). The order remains consistent across the timeseries with the exception of 2019-20 where mixed farms marginally held a higher application rate (101 Kg/Ha) than cereals and general cropping (96 Kg/Ha) but this dropped down to 87 Kg/Ha in the following year whilst cereals and general cropping increased to 106 Kg/Ha.

Figure 5: Average potassium application (kg per hectare) by farm type, 2017-18 to 2022-23



Description of Figure 5: A line chart showing average potassium application by farm type between 2017-18 and 2022-23. Similarly to phosphorous and nitrogen application, all farm types have demonstrated a decline between 2021-22 and 2022-23.

Similarly to phosphorous application, Cereals and General Cropping farms have a considerably larger average application of potassium Kg/Ha and sits higher than other all other farm types in the chart across the timeseries (43 Kg/Ha in 2022-23). This is because potassium can influence factors such as size, shape and colour of the grain. Potassium can also increase crop yields by increasing root growth and improving drought tolerance.

Depending on the year, this is either followed by dairy (20 Kg/Ha in 2022-23) or

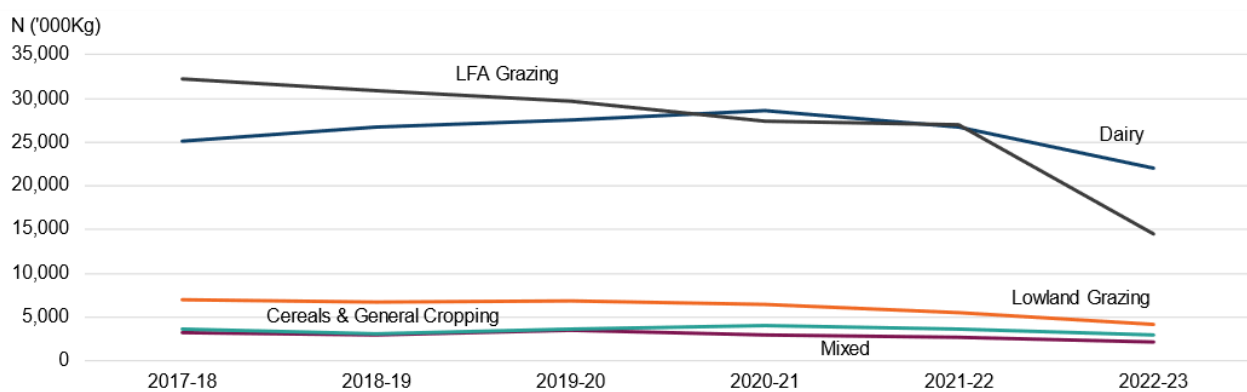
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mixed (19 Kg/Ha in 2022-23) but both farm types share similar trends over the timeseries. Lowland grazing farms hold the next highest application rate (10 Kg/Ha in 2022-23), followed by LFA grazing (5 Kg/Ha in 2022-23). The order remains consistent across the timeseries with the exception of the dairy and mixed farm types.

Figure 6: Total nitrogen application (1,000 Kg) by farm type, 2017-18 to 2022-23



Description of Figure 6: A line chart showing total nitrogen application by farm type between 2017-18 and 2022-23.

An important point to consider in Figure 6 is that LFA grazing shows the highest total overall application of nitrogen for the years 2017-18 through to 2019-20 and for 2021-22. In comparison, dairy farms had held the highest average rate of application in terms of (Kg/Ha) for nitrogen across the timeseries as demonstrated in Figure 3.

This can be attributed to the large number of LFA grazing farms in Wales compared to dairy farms and demonstrates that a low application rate in terms of (Kg/Ha) does not necessarily mean that the overall application at the aggregate level will also be low.

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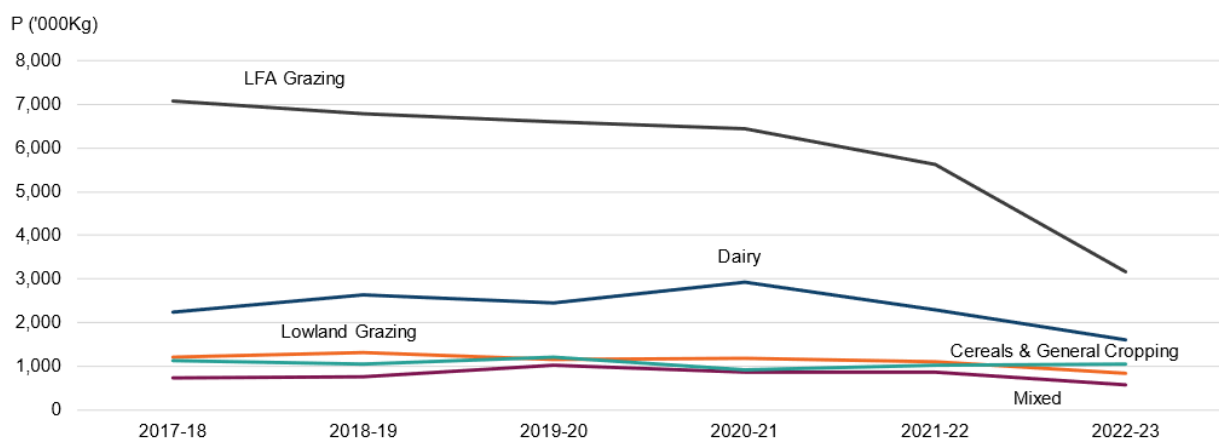
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Both dairy and LFA grazing farms saw reductions in overall nitrogen application in 2022-23, with dairy farms reporting a total application of just under 22 million kgs of nitrogen and LFA grazing farms reporting a total application of 14.5 million kgs in 2022-23.

The remaining farm types including lowland, cereals and general cropping all report much lower overall applications of nitrogen which can primarily be attributed to the number of these farms in Wales. Lowland grazing reported a total application of 4.2 million kgs of nitrogen, cereals and general cropping reported just below 3 million kgs and mixed farms reported a total application of 2.2 million kgs of nitrogen in 2022-23. Similarly to LFA grazing and dairy farms, all three showed a reduction in overall application for 2022-23.

Figure 7: Total phosphorous application (1,000 Kg) by farm type, 2017-18 to 2022-23



Description of Figure 7: A line chart showing total phosphorous application by farm type between 2017-18 and 2022-23.

Figure 7 shows that LFA grazing report the highest total overall application of phosphorous across the timeseries. In comparison, cereal and general cropping farms had held the highest average rate of application in terms of (Kg/Ha) for

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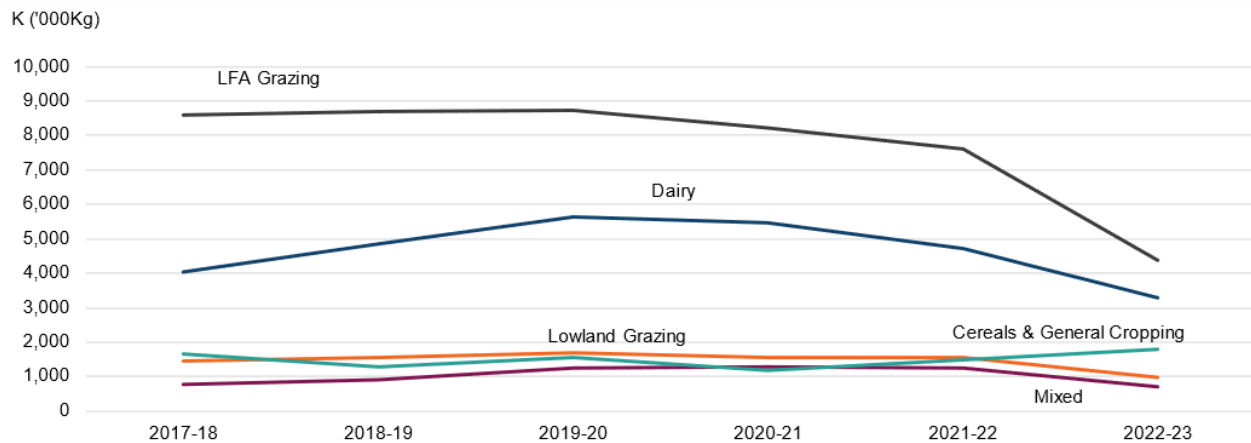
phosphorous across the timeseries as demonstrated in Figure 4.

As previous, this can be attributed to the large number of LFA grazing farms in Wales compared to cereal and general cropping farms. A similar effect can be seen in the total phosphorous application of dairy farms where, at an aggregate level, the level of phosphorous application is now greater than cereals and general cropping. This further shows that a high or low application rate in terms of (Kg/Ha) does not equate to the overall application in Wales being the same.

LFA grazing farms reported considerable reductions in overall phosphorous application in 2022-23, reporting a total application of 3.2 million kgs in 2022-23. Phosphorous application on dairy farms has been dropping since 2020-21 to a total application of 1.6 million kgs of phosphorous in 2022-23.

The remaining farm types including lowland grazing, mixed, cereals and general cropping all report much lower overall applications of phosphorous due to the lower number of these farms in Wales. Lowland grazing reported a total application of just below 850,000 kgs of phosphorous, cereals and general cropping reported 1 million kgs and mixed farms reported a total application of 580,000 kgs of phosphorous in 2022-23. All farms showed a reduction in overall application for 2022-23 with the exception of cereals and general cropping farms.

Figure 8: Total potassium application (1,000 Kg) by farm type, 2017-18 to 2022-23



Description of Figure 8: A line chart showing total potassium application by farm type between 2017-18 and 2022-23.

Figure 8 shows that LFA grazing report the highest total overall application of potassium across the timeseries. In comparison, cereal and general cropping farms had held the highest average rate of application in terms of (Kg/Ha) for potassium across the timeseries as demonstrated in Figure 5.

Again, this is due to the large number of LFA grazing farms in Wales compared to cereal and general cropping farms and, once again, a similar effect can be seen in the total potassium application of dairy farms where, at an aggregate level, the level of potassium application is greater than cereals and general cropping. As with nitrogen and phosphorous application, this demonstrates that a high or low application rate in terms of (Kg/Ha) does not result in the same high or low levels in overall application at the Wales level.

Similarly to phosphorous application, LFA grazing farms reported considerable reductions in overall potassium application in 2022-23, reporting a total application of just under 4.4 million kgs in 2022-23. Potassium application on

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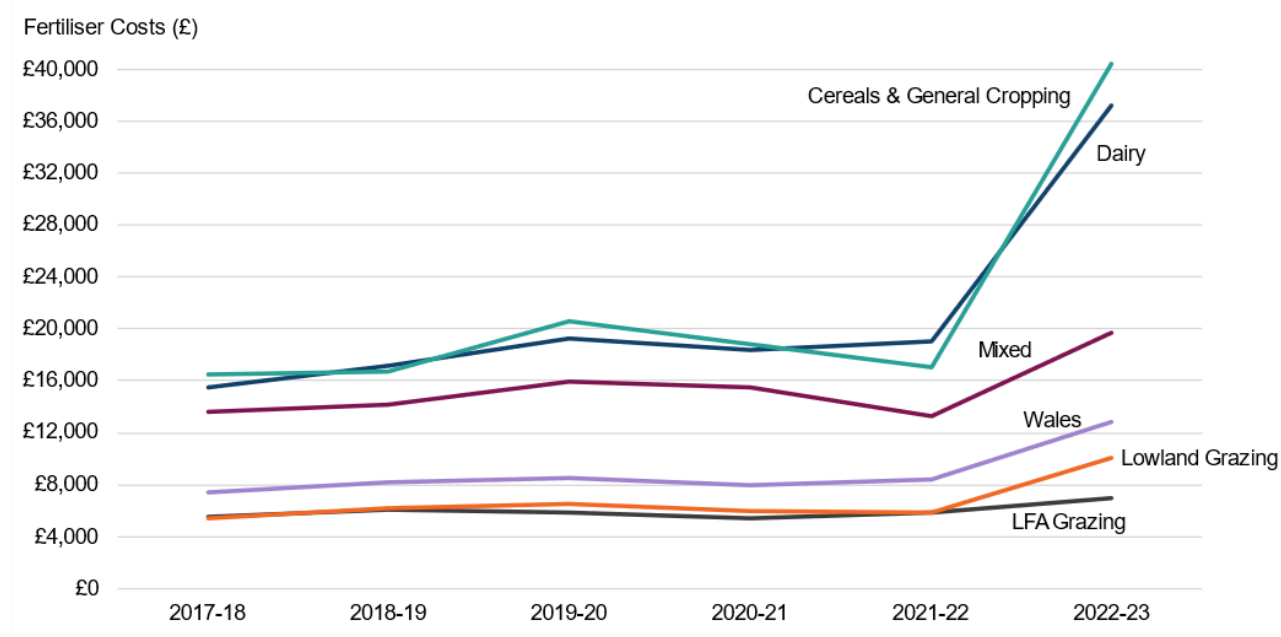
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dairy farms has been dropping since 2019-20 to a total application of 3.3 million kgs of potassium in 2022-23.

The remaining farm types including cereals and general cropping, lowland and mixed all report much lower overall applications of potassium due to the lower number of these farms in Wales. Cereals and general cropping reported a total application of 1.8 million kgs of potassium, lowland grazing reported just under 1 million kgs and mixed farms reported a total application of almost 700,000 kgs of potassium in 2022-23. All farms showed a reduction in overall application for 2022-23 with the exception of cereals and general cropping farms.

Figure 9: Average fertiliser costs (£) by farm type, 2017-18 to 2022-23



Description of Figure 9: A line chart showing the average fertiliser costs by farm type between 2017-18 and 2022-23. The chart shows that fertiliser costs have increased for all farm types in 2022-23 but particularly for dairy and cereals and general cropping farms where the highest fertiliser costs were reported.

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Overall, average fertiliser costs increased by 53% to £12,580 for farms in Wales in 2022-23 but this varied considerably across the different farm types. Fertiliser costs increased the most for cereals and general cropping farms by 137% to an average of £40,400 in 2022-23. This was closely followed by dairy farms who reported an average increase of 96% to £37,200.

Mixed farms reported an increase of 48% to £19,700, lowland grazing an increase of 72% to £10,100 and LFA grazing an increase of 18% to £7,000 in 2022-23.

In the UK, inorganic fertilisers are frequently imported and both Russia and Ukraine had previously accounted for a considerable portion of UK fertiliser imports. These imports were reduced over the 2022-23 financial year due to the war in Ukraine and resulting sanctions which has led to a substantial increase in the price of fertilisers.

This increase in price is just one factor that could be attributed to the reduction in the application of NPK by farms in Wales for 2022-23. Other factors include the possible anticipatory changes in farming practices in preparation for the sustainable farming scheme or to accomplish more efficient fertiliser application practices in general.

Variation in NPK application within farm types

This section shows the variation in NPK usage within farm types in Wales. As with previous sections, the average NPK application is portrayed as kilograms per hectare (Kg/Ha) and NPK usage refers to the total purchased inorganic NPK on farms as recorded in the FBS.

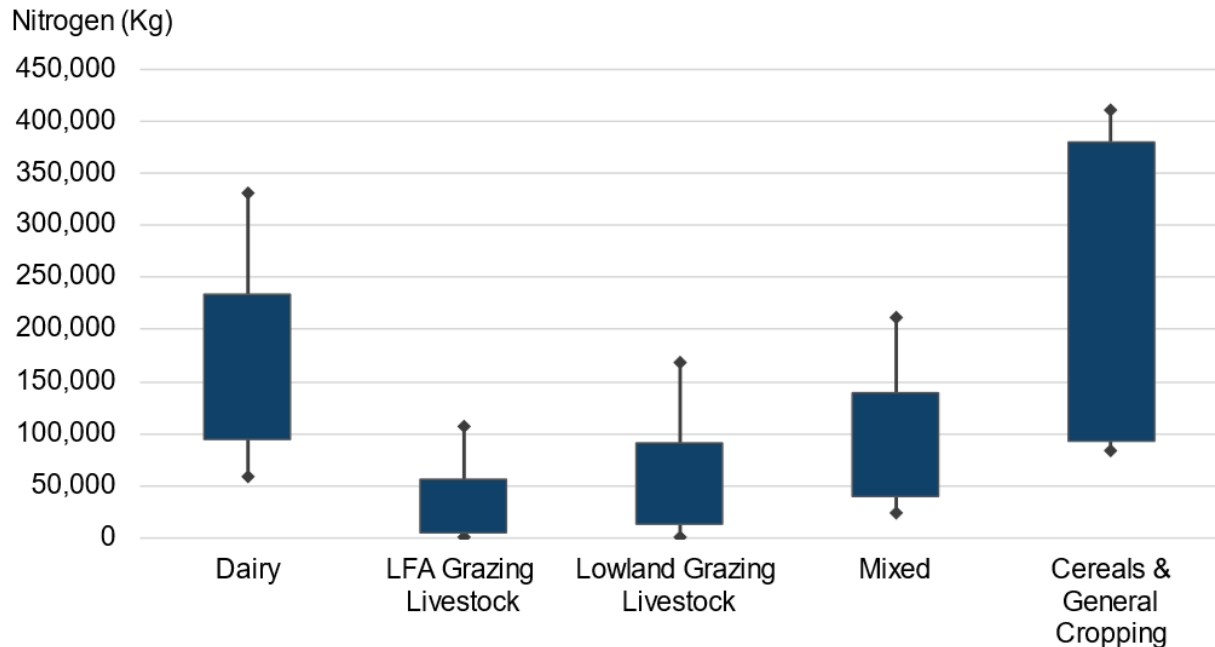
Figure 10: Variation of total nitrogen application (Kg) by

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farm type, 2022-23



Description of Figure 10: A box and whisker chart showing the variation of nitrogen application within each farm type for the 2022-23 financial year. The top and bottom sides of each box are the upper and lower quartiles (25% and 75%) for the given farm type. Cereals and general cropping farms show the greatest variation whilst LFA grazing shows the least.

The box itself covers where 50% of the data is found (known as the interquartile interval). The 'whiskers' represent where the bottom 10% and top 10% of the data is found (otherwise known as the 10th and 90th percentiles). Please note that the above refers to the Farm Business Survey weighted sample estimates and not the actual farming population within Wales.

Cereal and general cropping farms have shown the greatest range in nitrogen application and whilst the average nitrogen application for 2022-23 was a total of 2.95 million kgs, many farms within that population are applying much more or

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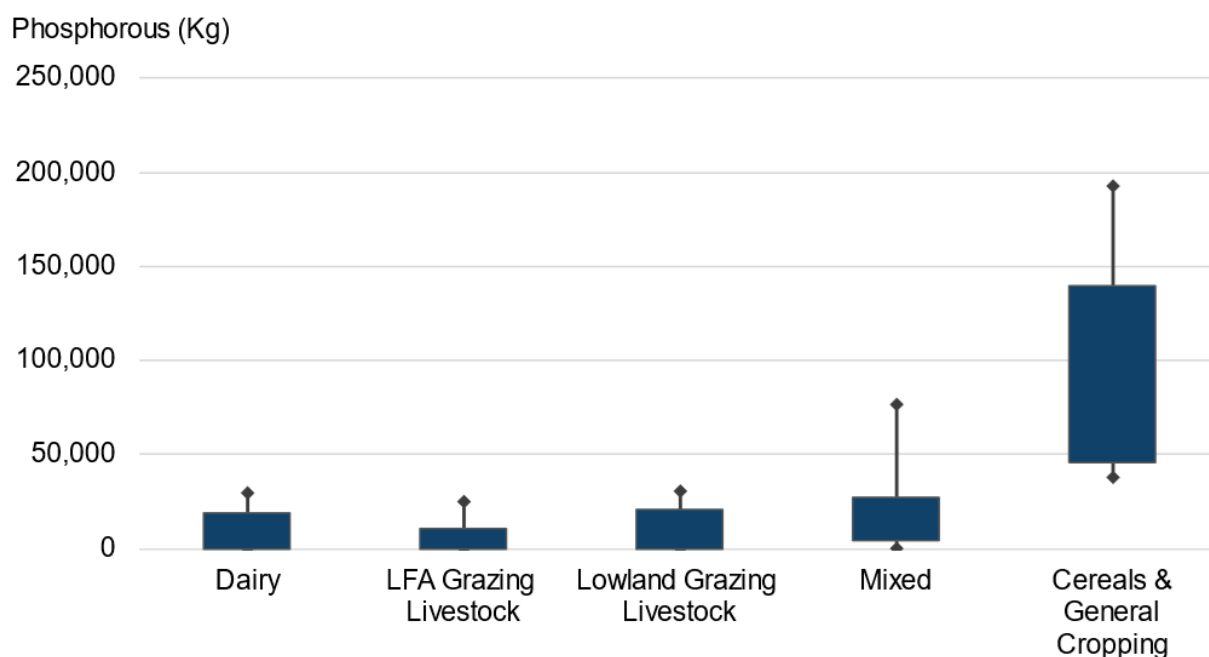
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less than this.

An important feature shown in Figure 10 is that there is a degree of overlap across all farm types. This means that despite cereals and general cropping farms holding the highest aggregate application rate for nitrogen and LFA grazing the lowest aggregate application rate, there are still a small proportion of LFA grazing farms applying more nitrogen than cereals and general cropping farms and vice versa. This is true across all comparisons of the farm types for 2022-23.

Figure 11: Variation of total phosphorous application (Kg) by farm type, 2022-23



Description of Figure 11: A box and whisker chart showing the variation of phosphorous application within each farm type for the 2022-23 financial year. The top and bottom sides of each box are the upper and lower quartiles (25% and 75%) for the given farm type. Similarly to nitrogen application, cereals and

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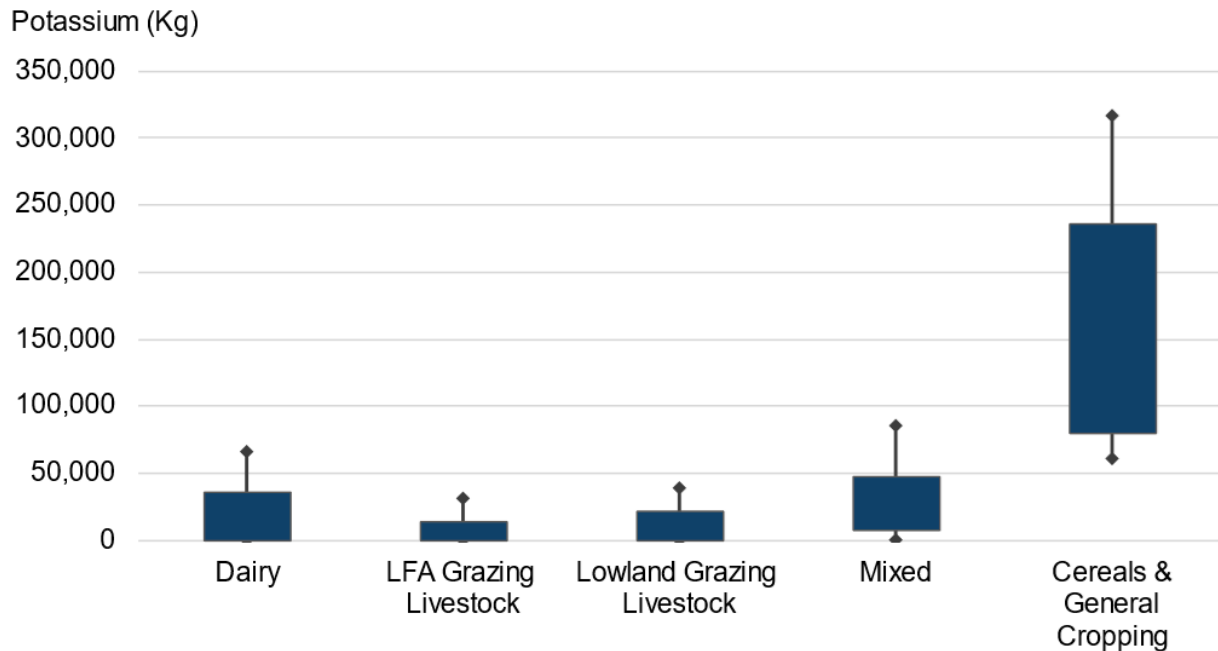
general cropping farms show the greatest variation whilst LFA grazing shows the least.

As with nitrogen application, cereal and general cropping farms have shown the greatest range in phosphorous application and whilst the average phosphorous application for 2022-23 was a total of 1.06 million kgs, many cereal and general cropping farms are applying much more or less than this.

Mixed farms show the second greatest degree of variation whilst the bottom 50% of the population estimates for dairy, LFA grazing and lowland grazing farms reported no application of phosphorous at all.

Unlike nitrogen application, Figure 11 does not show overlap across all the farm types. The top 10% (or 90th percentile) of phosphorous application in dairy farms is still less than the bottom 10% (or 10th percentile) of cereals and general cropping farms.

Figure 12: Variation of total potassium application (Kg) by farm type, 2022-23



Description of Figure 12: A box and whisker chart showing the variation of potassium application within each farm type for the 2022-23 financial year. The top and bottom sides of each box are the upper and lower quartiles (25% and 75%) for the given farm type. Like nitrogen and phosphorous application, cereals and general cropping farms show the greatest variation whilst LFA grazing shows the least.

As with nitrogen and phosphorous, cereals and general cropping farms have shown the greatest range in potassium application and whilst the average potassium application for 2022-23 was a total of 1.8 million kgs, many cereal and general cropping farms are applying much more or less than this.

As with phosphorous application, the bottom 50% of the population estimates for dairy, LFA grazing and lowland grazing farms reported no application of

potassium at all.

Figure 12 does not show overlap across all the farm types. The top 10% (or 90th percentile) of potassium application in both LFA grazing and lowland grazing farms is still less than the bottom 10% (or 10th percentile) of cereals and general cropping farms.

We want your feedback

We are very interested in hearing from you regarding this analysis and would welcome feedback on the style and content of this release in addition to suggestions for future analysis. At the time of publication, there are no future updates planned for this release unless we are aware of a specific user need for this.

Please email stats.agric@gov.wales to discuss further.

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