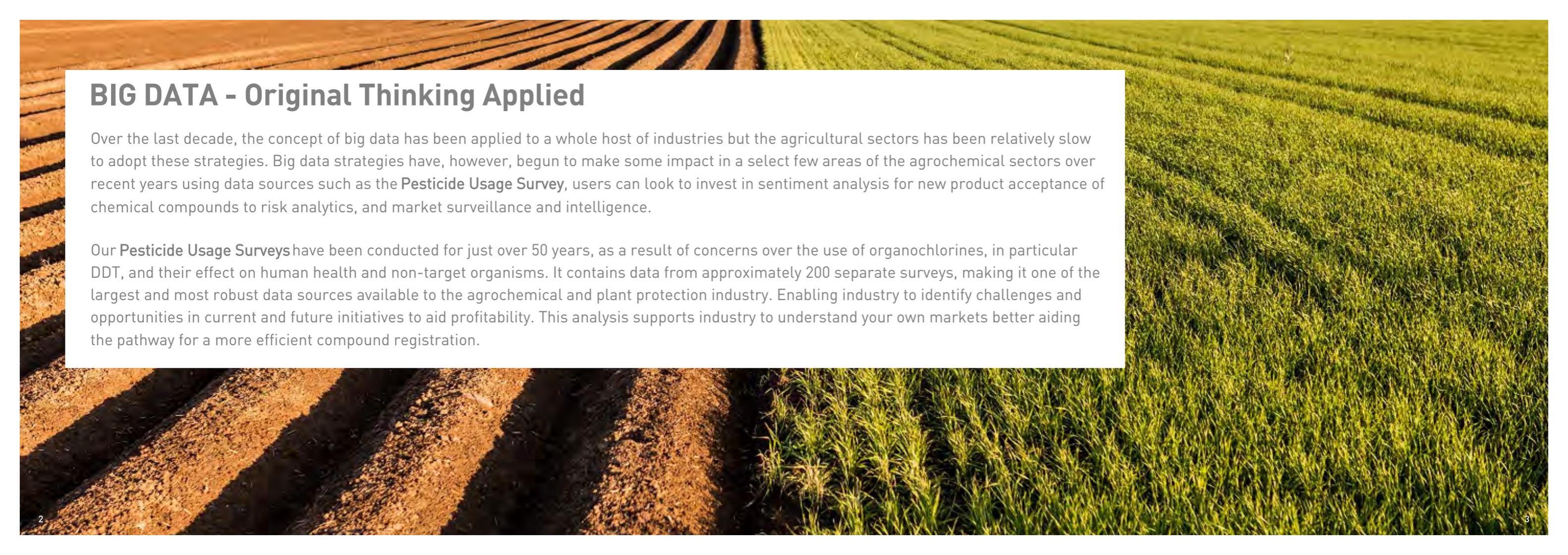




**50 Years of
Pesticide Usage
Surveys - Let
Predictive
Analytics Protect
your Business**



BIG DATA - Original Thinking Applied

Over the last decade, the concept of big data has been applied to a whole host of industries but the agricultural sectors has been relatively slow to adopt these strategies. Big data strategies have, however, begun to make some impact in a select few areas of the agrochemical sectors over recent years using data sources such as the **Pesticide Usage Survey**, users can look to invest in sentiment analysis for new product acceptance of chemical compounds to risk analytics, and market surveillance and intelligence.

Our **Pesticide Usage Surveys** have been conducted for just over 50 years, as a result of concerns over the use of organochlorines, in particular DDT, and their effect on human health and non-target organisms. It contains data from approximately 200 separate surveys, making it one of the largest and most robust data sources available to the agrochemical and plant protection industry. Enabling industry to identify challenges and opportunities in current and future initiatives to aid profitability. This analysis supports industry to understand your own markets better aiding the pathway for a more efficient compound registration.

Applying Big Data

Range of Crops covered by Pesticide Usage Survey in the UK

Surveyed Crops	Number of Farms	% Area Grown
Arable	1,201	6
Grassland & Fodder	688	8
Edible Protected	272	52
Outdoor Vegetables	640	36
Soft Fruit	336	39
Orchards	283	35

- The table is representative of the survey with 6% of the total arable area (4.2 million hectares in 2014) and between 33%-50% of all horticultural crops being sampled. Vital information when building a submission for the registration of substances.
- The registration process requires manufacturers and importers to collect or generate data on the substances they manufacture or import, to use this data to assess the risks and to develop and recommend appropriate risk management to control with a 'worse case' scenario always being considered.
- The Pesticide Usage Survey (PUS) data can be used to provide a more accurate, 'real-life' chemical compound benchmark to support registration. For instance, looking at the maximum number of days a product is used a year by a single operator.



Quantifying Pesticide Usage aids Application of Active Ingredients across UK farmland

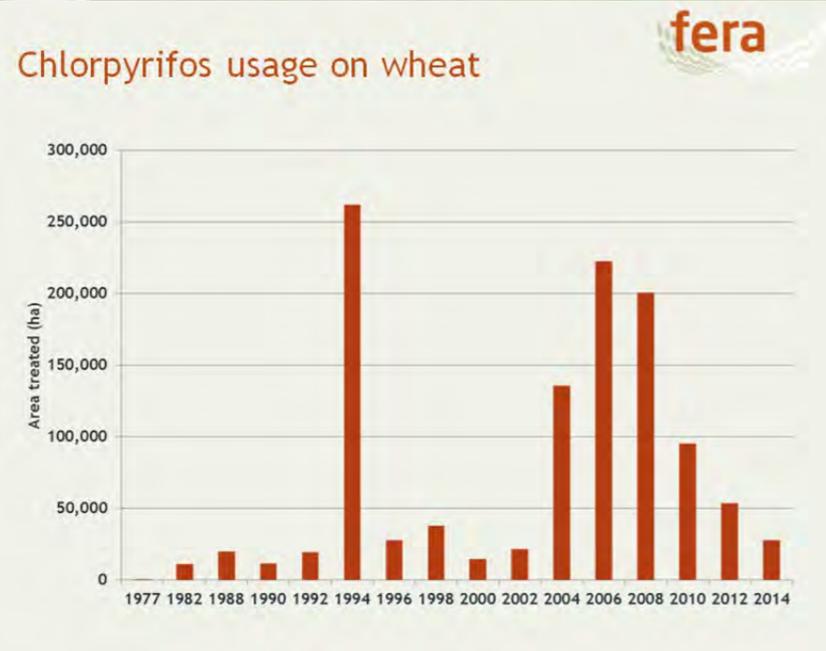
For example, recent data shows a relative decline in UK oilseed rape (OSR) planted area which could be attributed to the withdrawal of neonicotinoid seed treatments available to farmers, particularly affecting southern England.

Take a look through the following pages as the data highlights examples of recent use. For instance, the main organophosphate insecticide used on orchards has been Chlorpyrifos. However, its approval was lost in 2016, further surveys will determine whether this will result in an increase in the use of pyrethroids or neonicotinoids across UK orchards - such insight will enable industry to plan for this potential eventuality.

Pesticide Usage Surveys (PUS) collect usage data usually on a two-year cycle, ensuring that the main crops grown in the UK are covered at least once every four years. Arable, soft fruit, vegetable and protected edible crops are surveyed biennially with grassland and fodder crops surveyed every four years. The datasets contain details of pesticide usage on each crop in terms of weight, area and the percentage treated with specific active substances including conventional pesticides, biopesticides, and living biocontrol organisms.

Chlorpyrifos Usage on Wheat

Wheat accounts for approximately 40% of the total arable area.



The peak of Chlorpyrifos usage in 1994 was due to heavy infestations of Orange Wheat Blossom Midge (OWBM) during this year. A similar infestation also occurred in 1993. This pest can both reduce yields and the quality of the harvested wheat crop.

Applications of Chlorpyrifos would mainly have been made in May and June of 1994 when this pest is most active.

Similar, but less severe infestations also occurred in 2004, 2006 and 2008. The introduction of OWBM resistant varieties of wheat have meant that the impact of this pest is likely to be significantly less for future crops.

Increase in Insecticide Usage on Arable Crops

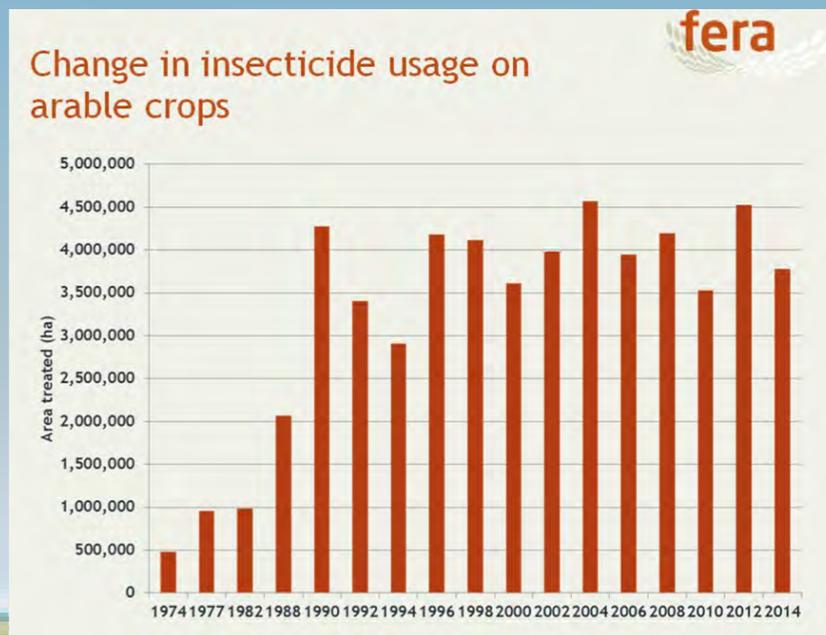
The Pesticide Usage Survey gets to the real reason as to why - looking behind the numbers

Insecticide usage on arable crops increased dramatically between 1982 and 1988, and again between 1988 and 1990. However, the area of arable crops grown remained relatively unchanged over the same period and therefore the increase in insecticide usage was not linked to an increase in the cropping area.

The real reason for the increase in the use of insecticides is due to the introduction of pyrethroids in 1982, with rapid increases in the area treated with Cypermethrin. The use of Cypermethrin continued to increase until the late 1990's where its usage started to be replaced by the pyrethroid Lambda-cyhalothrin.

Most of the Cypermethrin applications would have been made in the Autumn for the control of aphids in cereals. The dip in insecticide usage in 1994 is largely due to heavy rainfall in the autumn of 1993 which prevented sprayer movement during this period.

Where a year of use is specified this relates to the harvest year and applications which relate to the harvest year may also have been made in the previous Autumn.



Anyone for Strawberries?

The data shows the principal five fungicides used on UK strawberries

Myclobutanil is the principal fungicide used on UK strawberries and it accounts for 14% of the total fungicide treated area, more importantly it is used on 80% of the area of strawberries grown, with an average of 3 applications at 90% of full label rate.

Those fungicides, myclobutanil and iprodione, marked with * are potential endocrine disruptors. The PUS data have been used to help Defra and CRD understand the implications of the loss of individual active substances used on specific crops.

'In this case the loss of these two very important active substances could have a significant effect on strawberry production in the UK. The alternatives, if available, are likely to be more expensive and therefore affect the gross margins for the production of the crop'.



Strawberries - fungicide usage - 2014

Active substance	Area Treated (Ha)	Weight Applied (Kg)	Prop Treated area	Prop Area grown	Number app	Prop RR
Myclobutanil*	9,993	806	0.14	0.80	3.12	0.90
Potassium hydrogen carbonate	8,094	47,442	0.11	0.44	4.61	0.57
Fenhexamid	7,130	4,637	0.10	0.76	2.36	0.87
Iprodione*	4,912	3,573	0.07	0.58	2.11	0.97
Bupirimate	4,908	1,660	0.07	0.60	2.04	0.97

'A Field for Growing' - PUS Insights Go Overseas

Country	Crops Surveyed	Number of farms
Belgium	Arable crops	37
Greece	Citrus, Vegetables, Vines	72
Italy	Apples, Maize, Vegetables & Vines	81
Lithuania	Arable crops	31
Netherlands	Arable crops, Vegetables	29
Poland	Arable crops, Orchards & Vegetables	61
Spain	Citrus, Vegetables, Vines	60
UK	Arable crops, Orchards	45

The Pesticide Usage Surveys have also been used for European Studies. In particular, work for EFSA has looked at the cumulative annual exposures of operators to agricultural and horticultural pesticide usage, grain storage, homes & gardens use and also vertebrate control. This is also underpinned with additional data on IPM, environmental management of fields, use of personal protective equipment (PPE), mixing & loading of pesticides, spraying equipment (including tank volumes, forward speed, boom widths, filling methods & nozzle use), all vital intelligence to feed your business insights and market understanding.

Just some of the insights to obtain;

- The length of time (in hours) an operator sprays a crop each year
- The length of time (in hours) spent spraying with each sprayer type each year
- The annual exposure to each active substance in terms of hours of use
- The annual exposure to each active substance in terms of weight applied

'Turning the Tap' on the Regulatory Water Landscape

Under EU law (Council Directive 91/271/EEC), towns and cities are required to collect and treat their urban wastewater, as untreated wastewater can put human health at risk and pollute lakes, rivers, soil, coastal and groundwater.

EU member states had until the end of 2000 to ensure appropriate treatment of wastewater from large agglomerations (population equivalent of more than 15,000), and until the end of 2005 for discharges from medium-sized agglomerations and discharges to freshwater and estuaries from small agglomerations.

Recent news showcases the severity of this regulation with The European Commission (EC) announcing it is taking Ireland to the Court of Justice of the EU for failing to ensure that urban wastewater in 38 towns and cities across the country is adequately collected and treated to prevent serious risks to human health and the environment.

Case Study - We work with the Water Industry

Working with Regional Water and Sewage Companies - 'BIG Data' Provides Clarity

- We understand well that the challenges faced by the water sector of population growth, climate change, tightening environmental standards and changing customer expectations are likely to require further significant investment in future
- The water industry is one of the most highly regulated sectors in the UK with three main regulators: **The Drinking Water Inspectorate, The Environment Agency and Ofwat** (the independent economic regulator) as well as working closely with **The Consumer Council for Water & DEFRA**
- By accessing the pesticide usage database to look at pesticides **by county** this provides an important opportunity for the water industry to demonstrate and understand what active substances are being used (by weight of active substance) by farmers/growers by frequency/seasonality when undertaking groundwater extraction.
- This information is invaluable as it assists the Water Company in identifying the likely pesticides that will be encountered, the likely levels, which can then be factored in, ensuring their decision making is far more informed.

Work With Us & Put Big Data to Work

BIG DATA gives you the competitive edge to yield more

Working with some of the most recognised agrochemical market leaders, Pesticide Usage Data has been extracted to enable these companies to analyse data relating to their products, market share and the market sector in which they operate.

'So for instance we can inform you of your market share across the surveyed crops, broken down by product and crops'

This data source contains a wealth of information concerning the crops surveyed, products and market share which can help companies to make better informed decisions of current future registrations. With over 90% participation rate, this data source is one of the largest and most robust available to the agrochemical and plant protection industry

Using this data intelligence can drive innovation and to make the best possible decisions. It also provides you with insight into how customers use your products and is of particular relevance to product stewardship. Ad hoc studies have included farmer and grower use of individual active substances. For example, Fera was heavily involved in the evolution of the chlorpyrifos 'Say No to Drift' campaign.



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