Indicator 8: Cereals and other crops – manufactured fertiliser application

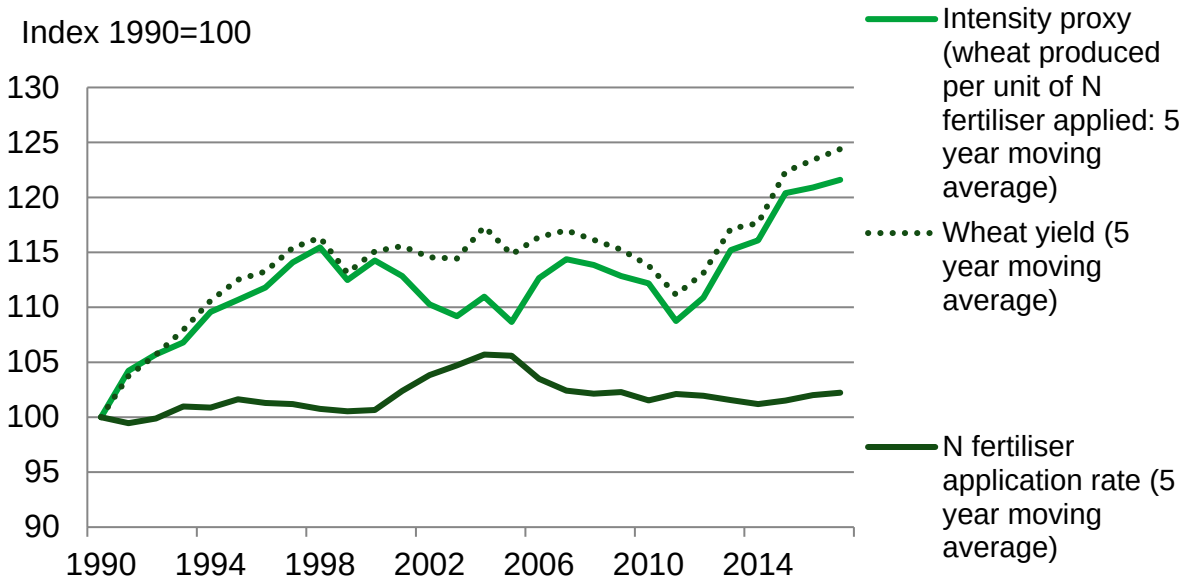
Rationale: more efficient use of nitrogen fertilisers has the potential to increase productivity whilst reducing the environmental risk. The ratio of the weight of crops produced to the weight of manufactured nitrogen fertiliser applied provides a proxy measure for the intensity of greenhouse gas (GHG) emissions. Trends in crop yields provide a related headline measure of productivity.

Indicator: 5 year moving average[1] (including 2019 data) of crop production per unit of manufactured N applied (wheat, winter and spring barley, winter oilseed rape and sugar beet, England).

Desired outcome: improved manufactured fertiliser efficiency will lead to increasing levels of crop production per unit of N applied.

Current status	Long term: (last 10 years)	Short term: (2 years)
Wheat	✓	✓
Winter barley	✓	✓
Spring barley	✓	✓
Winter oilseed rape	✓	≈
Sugar beet	✓	≈

Wheat produced per unit of manufactured N fertiliser applied, England



Source: British Survey of Fertiliser Practice, Defra Cereal and Oilseed Rape Production Survey

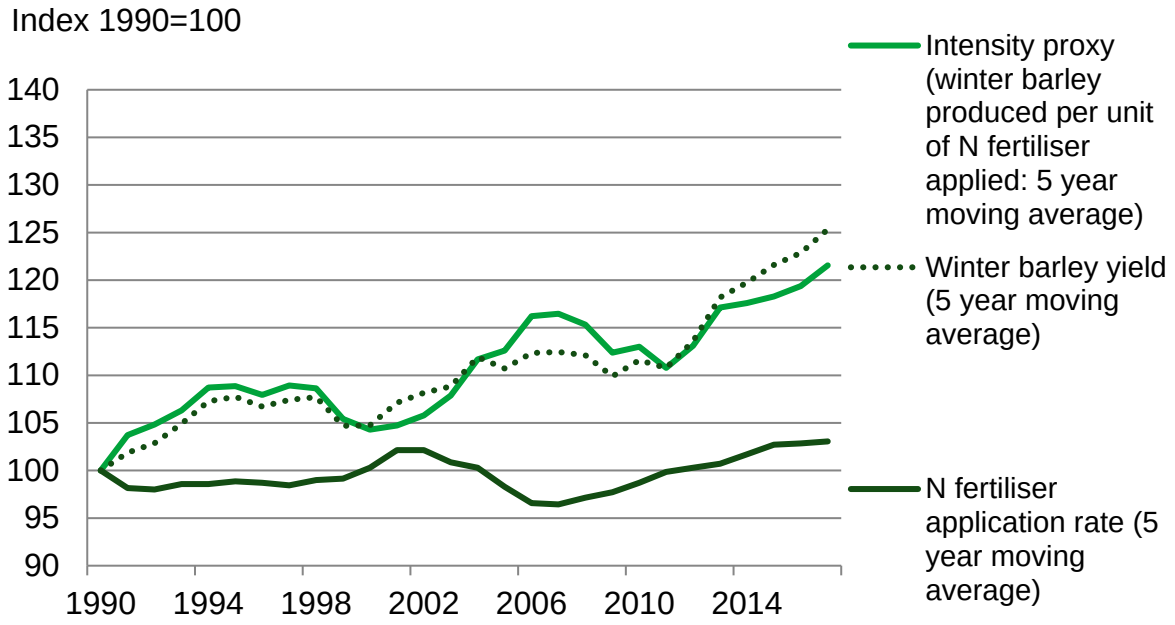
Since 1990 there has been an overall increase in the quantity of wheat produced per unit of manufactured nitrogen applied. Much of the increase took place during the 1990s as wheat yields increased whilst application rates remained relatively constant.

The trend in wheat yields has remained relatively stable from 2000 with changes in the intensity measure driven by overall application rates. This indicates that since 1990, the overall GHG intensity of wheat production improved. More recently, higher yields have driven an increase in the intensity proxy signalling an improvement in the indicator overall.

The following charts show the equivalent measures for winter barley, spring barley, winter oilseed rape and sugar beet.

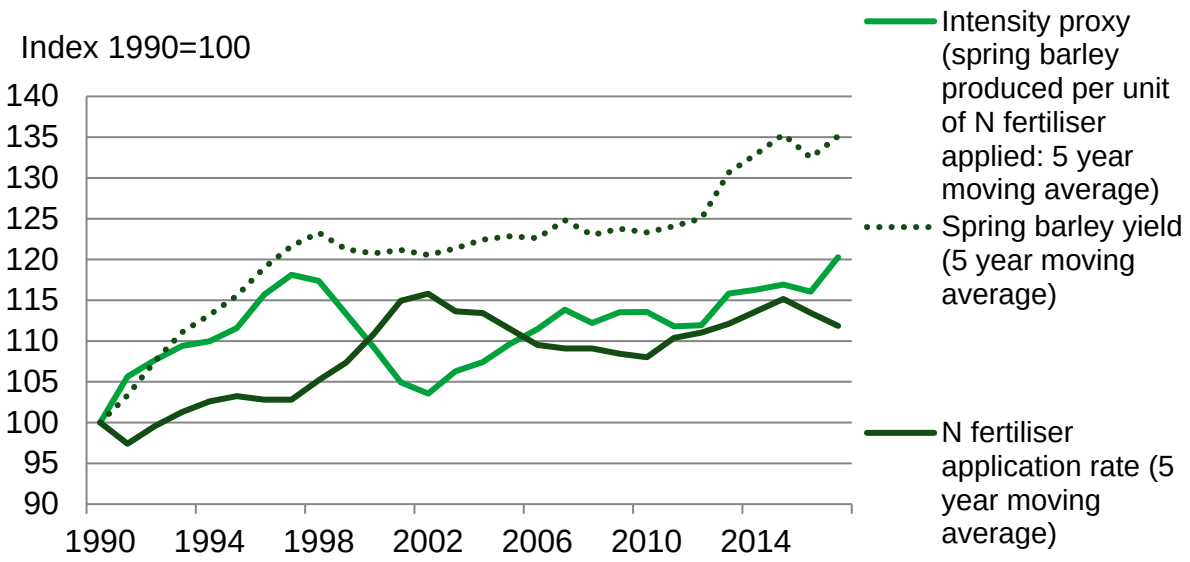
Trends for the intensity measures for winter and spring barley are similar to those for wheat with an increase in yields in 2019 leading to an increase in the moving average for 2017.

Winter barley produced per unit of manufactured N fertiliser applied, England



Source: British Survey of Fertiliser Practice, Defra Cereal and Oilseed Rape Production Survey

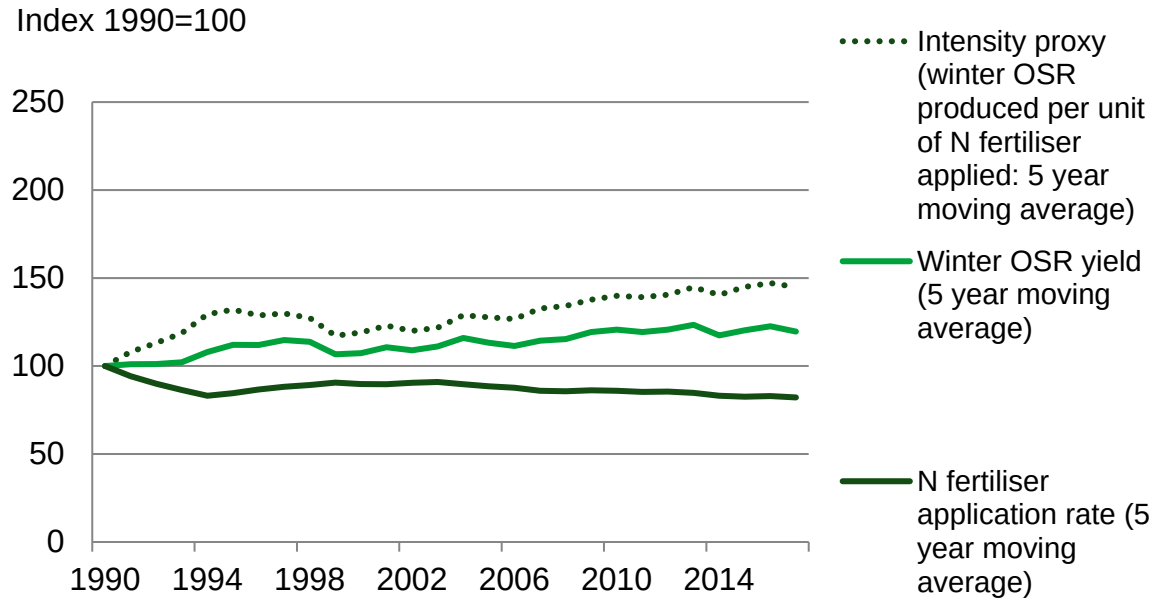
Spring barley produced per unit of manufactured N fertiliser applied, England



Source: British Survey of Fertiliser Practice, Defra Cereal and Oilseed Rape Production Survey

Over the last 10 years the intensity measure for winter oilseed rape has seen a slight upward trend peaking in 2015 (the moving average for 2013 to 2017).

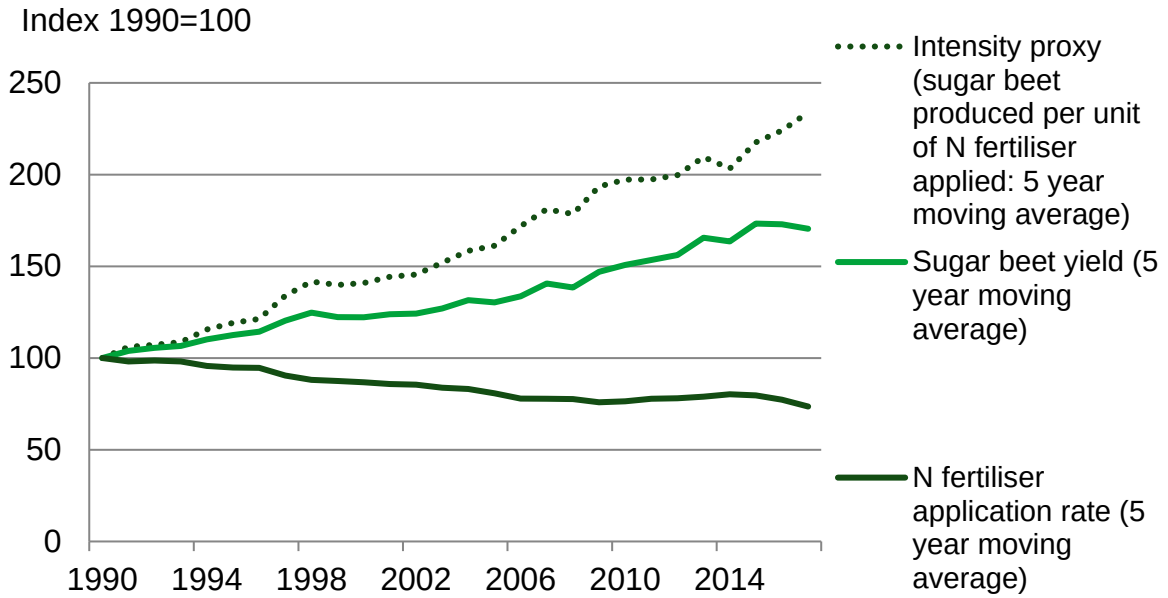
Winter oilseed rape produced per unit of manufactured N fertiliser applied, England



Source: British Survey of Fertiliser Practice, Defra Cereal and Oilseed Rape Production Survey

For sugar beet, until 2015, the trend had been consistently upward since 1990. Historically bonuses were offered by British Sugar for low amino-nitrogen levels, which may have influenced this trend. However the sugar industry in England has undergone considerable restructuring following reform of the EU sugar regime in 2006. Most recently a decrease in nitrogen fertiliser application rate has led to an improvement in the indicator.

Sugar beet produced per unit of manufactured N fertiliser applied, England



Source: British Survey of Fertiliser Practice, Defra Cereal and Oilseed Rape Production Survey

Data sources

Overall manufactured nitrogen application rates are sourced from the British Survey of Fertiliser Practice. Cereal and oilseed rape yields are sourced from the Cereal and Oilseed Rape Production Survey[2]. Sugar beet yields are derived from industry production data and areas from the June Survey of Agriculture.

Indicator methodology

The intensity proxy is calculated as a centred 5 year moving average of the ratio of annual crop production to the manufactured fertiliser application rate. For example, the 2017 estimate is the average of data from 2015 to 2019. The intensity proxy is presented as an index (1990=100) to allow comparison with trends in the component series.

Statistical background
The latest year for which an estimate is available using the 5 year moving average method is 2017 (the average of data from 2015 to 2019). Any later estimates of the trend are less certain, since for year on year changes, the random component in the data series is more significant than the trend component.

Nitrogen application rates for England and Wales combined have been used in the in the calculations as data for England are only available from 2004. However, a comparison between the England and Wales total and the England only application rates (where available more recently) showed no significant differences.

The British Survey of Fertiliser Practice
The British Survey of Fertiliser Practice (BSFP) is a voluntary annual survey. Respondents are selected from the population of agricultural holdings compiled using the June Agricultural Survey. Holdings of less than 20 hectares are not included in the sample. While these smaller holdings account for a significant proportion of all holdings in terms of numbers, they cover a much smaller proportion of the total area of crops and grass. The target sample size is 1,500 farms which is designed to achieve a nationally representative sample. In 2019 responses were received from 991 respondents from the main sample (66%); this was increased to 1,327 (88% of the target) by contacting 'reserves'. The overall response rate from all those contacted was 48%. The survey year for 2019 corresponded to the 2019 season or harvest year.

BSFP data collection is undertaken mainly through face to face interviews with individual farmers. At data entry, any omitted responses, figures outside pre-agreed limits or other discrepancies are flagged for checking and followed up, often by contacting the survey respondent. Additionally, 10% of the interviews undertaken are subject to a call back by an independent reviewer to check responses as part of data quality assurance arrangements. The aggregated figures are checked for consistency and trend analysis against historic data and are subject to independent expert peer review.

The BSFP sample responses are raised to be representative of the national population by using the inverse of the achieved sampling fraction (i.e. the number of holdings in the population divided by the achieved sample size in each stratum) as the weight.

The validity of the derived weights are assessed by calculating a weighted crop area for the most extensively grown crops by this method and comparing this to the latest available crop area estimates from the June Agricultural Survey. Standard errors are calculated for key results (major crops) using standard survey statistical methodology.

The sampling variation/standard errors associated with the application rates reported for the main arable crops, all tillage and grass and further methodological details can be found on the fertiliser usage website.

The BSFP has National Statistics status. These are official statistics which have been assessed and comply with the National Statistics code of practice.

Cereal and Oilseed Rape Production Survey [3]
Defra's Cereal and Oilseed Rape Production Survey is an annual voluntary survey which gathers data on production tonnages and moisture content for various cereal and oilseed crops. It also verifies data gathered from the June Survey of Agriculture on planted areas for these crops. These data are then used to calculate national and regional yield estimates for each crop type. The 2017 results were based on a representative sample of 2,477 growers across English regions and farm sizes. The response rate was 71%.

Further methodological details can be found on the cereal and oilseed rape production website.

The Cereal and Oilseed Rape Production Survey has National Statistics status. These are official statistics which have been assessed and comply with the National Statistics code of practice.

Sugar beet
The annual sugar beet yield figures published in Agriculture in the United Kingdom are calculated using area data from the June Agricultural Survey and industry production data.

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[1] Centred 5 year moving averages have been used to smooth out the effect of random factors in crop production (such as the weather). The latest year for which an estimate is available using this method is 2015 (the average of data from 2013 to 2017). These averages provide a good means of interpreting longer rather than short term trends. More details of this can be found in the methodology section of this indicator.
[2] In 2012, to save the time and costs of running two separate surveys, the Cereal Production Survey and Oilseed Rape Production Survey were brought together on the same survey form.
[3] In 2012, the Cereal Production Survey and Oilseed Rape Production Survey were brought together.