Final Report
December 2008

Annex 54-UK

Project Dissemination – UK WAgriCo Non-technical Leaflet

[Deliverable 8.3]

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ANNEX 54-UK

Water Resources Management in Cooperation with Agriculture

Project Dissemination – UK WAgriCo Non-technical Leaflet

What is WAgriCo?

WAgriCo, or **W**ater Resources in **Co**operation with **Agri**culture, is a collaborative catchment-based project between partners in the UK (focused around Dorchester in Dorset), and Lower Saxony in Germany. Its aim was to work with and support the local farming community to protect groundwater quality.

WAgriCo, which ran from October 2005 to September 2008, demonstrated the use of practical water protection measures that farmers could adopt in order to contribute to the requirements of the EC Water Framework Directive.

It was supported and funded in the UK by:

- ADAS UK Ltd
- The Environment Agency
- The National Farmers' Union
- UK Water Industry Research Ltd
- Wessex Water Ltd

The project was also co-financed by the EU LIFE Programme and Defra.

Actions to protect drinking water

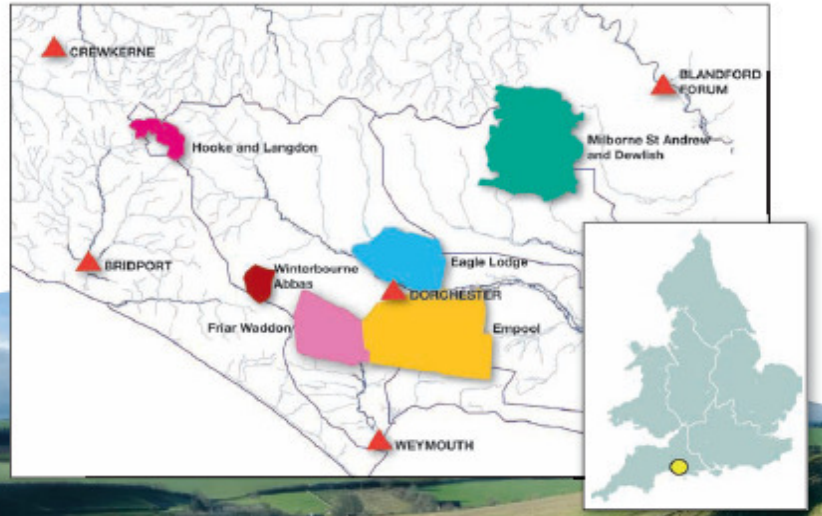
Wessex Water supplies 360 million litres per day of high quality water to 1.3 million customers in the south west of England with about 80% of this coming from groundwater sources.

Some of these sources have shown increasing concentrations of nitrate over the past few decades, which threatens their use for drinking water supply.

Concentrations in drinking water can be reduced by:

- construction of treatment plants – a very expensive option which has high long-term operational and maintenance costs;
- blending with water from lower nitrate sources, which requires sufficient supply of low nitrate water; or
- managing the surrounding land to decrease movement of nitrate from soil to water ('catchment management').

Figure 1: WAgriCo priority catchments



What did we do to help?

Work in the UK focused on eight pilot areas within the catchments of the Frome, Piddle and Wey – see Figure 1.

Four catchment advisers over the eight catchments were tasked with:

- meeting farmers to discuss the project and gain cooperation;
- identifying borehole or stream sampling points;
- undertaking an initial (qualitative) risk assessment of the farm;
- carrying out detailed audits to determine farm nutrient balance[1] (quantitative assessment) – see Figure 2
- working with farmers to identify potential methods for reducing nitrate losses; and
- gathering detailed farm data to determine the practicality and cost of mitigation measures.

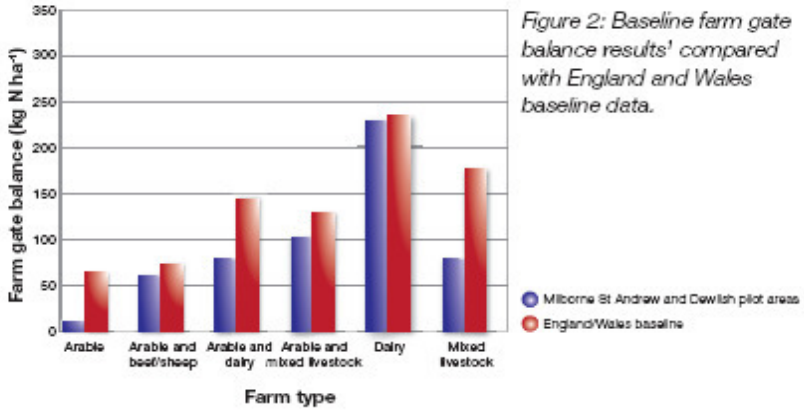


Figure 2: Baseline farm gate balance results[1] compared with England and Wales baseline data.

[1] *Difference between N entering the farm from all sources (e.g. in fertiliser and feed) and N leaving the farm (produce).*

Monitoring and evaluating

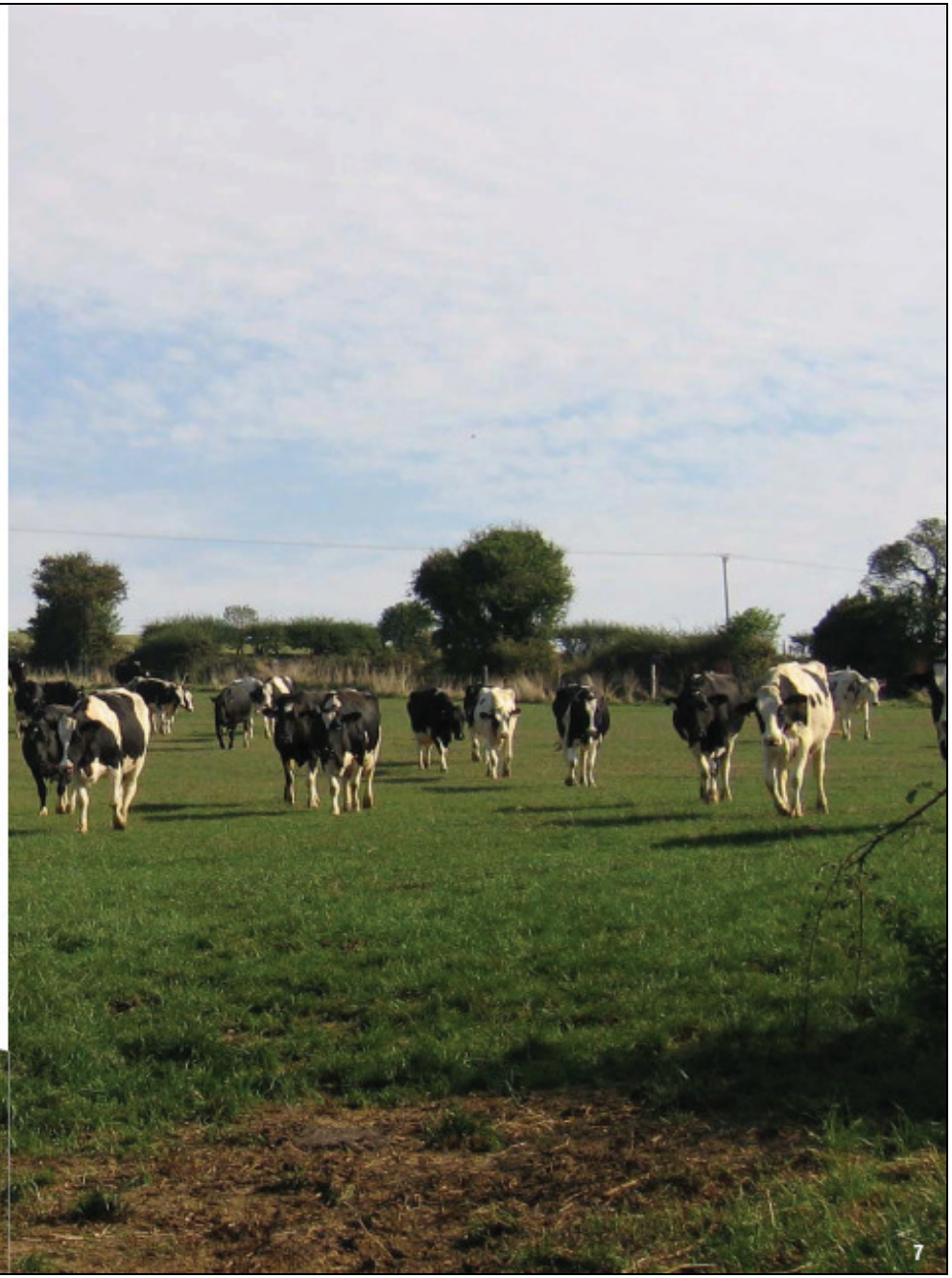
A range of measurements was undertaken throughout the project (see Table 1). The aim was to:

- provide information to the farmers;
- demonstrate the effects of the measures;
- identify any problems; and
- assess the effectiveness of the project.

Manure sampling and grain nitrogen sampling were also undertaken to guide fertiliser policy.

Table 1: Summary of catchment monitoring

Type of monitoring	Description
Soil nutrient status	Analysis of topsoil for P, K, Mg status and pH.
Soil mineral nitrogen (SMN) to 90 cm depth	Analysis of soil for SMN status (nitrate and ammonium content) can be used to estimate leaching risk (when taken in autumn at the return of the soil to field capacity) or for fertiliser nitrogen recommendations (when sampled in the spring).
Water sampling	Borehole and well sampling to allow groundwater quality and quantity to be determined.
Porous ceramic cups	To allow the monitoring of nitrate leaching losses from the soil.



Programme of measures

The farm audits showed there were very few examples of poor farm practice. Six actions ('mitigation measures') were identified as a focus for farm advice.

1 Fertiliser recommendations

Farms were reviewed and fertiliser recommendations provided that aimed to keep within optimum rates. Timed fertiliser applications to minimise the risk of loss of nutrients were developed and took full account of manure inputs.

2 Manure management plans and farm waste audits

A manure management plan and manure handling risk audit were undertaken to help manage manures on the farm and to improve fertiliser value and reduce nitrate losses.

3 Cover crops

Depending on crop rotation, some farmers were able to establish a cover crop immediately post-harvest or, at the latest, by mid-September. They were able to retain the cover crop area uncultivated until at least 15 February the following year and follow with a spring crop.

4 Fertiliser spreader calibration

There was opportunity for each fertiliser spreader on a farm to be calibrated and a report on performance provided to the farmer.

5 Moving application of slurries and poultry manure

The possibility of moving from autumn to spring application to make best use of manure N was explored with farmers, i.e. moving from application after 15 October to applications after 31 January.

6 Calculation of N efficiency

Basic farm data on feed, fertiliser inputs, animal numbers and crop yields were used to calculate a nutrient balance for a farm. This could potentially be used to 'benchmark' the farm's performance and provide incentives to increase efficiency. Farmers were invited to a workshop on how to increase N efficiency but were able to try and maximise their efficiencies in any way they wished.

Co-operation with farmers

Support for developing changed practices was needed at the local level and so WAgriCo used four catchment advisers from Wessex Water and ADAS to offer on-farm assistance and advice on farm management issues.

Farm advice was delivered through one-to-one farm visits, technical newsletters, training workshops and informal meetings. Recommendations mainly concentrated on improving nutrient and manure management on the farms.

This guidance was supported by evidence and data from monitoring, allowing advice to be tailored to the farm and adding greater value to the farm business.

Of the 74 farms targeted by the project, 52 (70%) agreed to participate.

The uptake of the measures was in uenced by the individual farming systems, for example the predominant use of winter crop rotations made the use of cover crops inappropriate for many.

Table 2: Farmer co-operation

Measure	% uptake by farmers
Fertiliser recommendations	81
Manure management plans and farm waste audits	46
Cover crops	31
Fertiliser spreader calibration	37
Moving from autumn to spring application for slurries and poultry manures	10
Use of on-farm N-efficiency	62

Some results

- **Fertiliser recommendations and manure management**
  In general there is no large scale over-supply of nitrogen (as fertiliser plus manure) to crops in the catchments. Some farmers applied more N than recommended to a few of their arable crops. The main problem centred around a relatively few maize fields - where the nitrogen content of the large manure applications were not taken into account when deciding on fertiliser N dressings. Where manures were applied to other arable crops, there was recognition of their nitrogen value. Grass fields generally received less N than would be recommended in Defra's current version of RB209.

- **Cover crops**
  Cover crops were established by farmers over the 2007/08 winter period. Figure 3 shows the SMN results by crop for those fields with cover crops compared to those without.

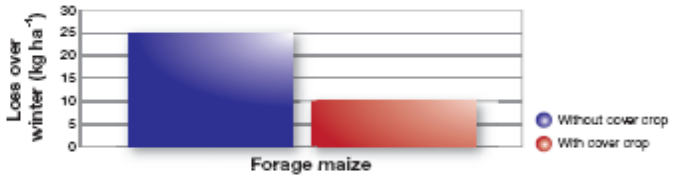


Figure 3: Nitrate losses under forage maize and spring barley with and without cover crops

The SMN results suggest that the use of a cover crop within the WAgriCo pilot areas can reduce the amount of N lost over the winter period by approximately 15 – 30 kg ha^{-1} (note - based on data from one winter).

- **Fertiliser spreader calibration**
  Results showed that one in five machines tested required calibration for application rates to be correct. The average coefficient of variation (CV) before calibration was 22%, and, following calibration, 3%. The theoretical effects of poor spreading suggest that, for cereal crops, a relative low CV of 15% will increase nitrate leaching by 8%. This increases to approximately 13% (11kg ha^{-1}) at a CV of 30%. These results indicate that fertiliser spreader calibration is effective in reducing nitrate leaching as well as being beneficial to the farmer, providing £12 – 24 ha^{-1} in yield improvements (based on February 2008 prices).

- **N efficiency**

Calculating a farm's nitrogen use efficiency is potentially a way of gauging the farm's effectiveness in managing the N inputs. Being aware of this efficiency value and how it can be increased by changed practices may provide a tool for farmers to monitor improvements in their N management. N efficiency is the proportion of imported N that is exported as 'useful products' (see Figure 4).

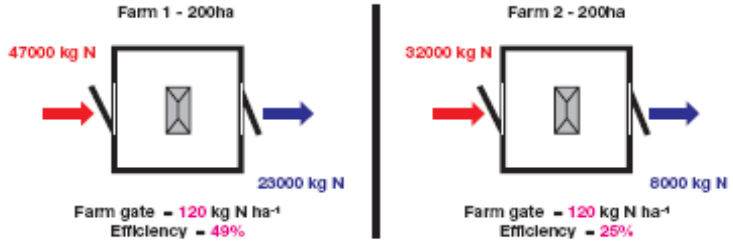


Figure 4: Comparison between N efficiencies and farm gate nutrient budget results

Baseline N efficiencies were calculated for 26 farms within the Milborne St Andrew and Dewlish catchments based on farm data from 2001-2005 and are shown in Table 3.

Table 3: Baseline N surpluses compared to baseline N efficiency figures

Farm type	Baseline surplus (kg N ha^{-1})	Baseline efficiency (%)
Arable	26	67
Arable and beef/sheep	73	74
Arable and dairy	81	47
Arable and mixed livestock	100	74
Dairy	272	38
Mixed livestock	96	19

This approach assumes surplus nutrients are available for loss, and a reduction in this surplus and consequent improvement in N efficiency translates into a reduction in the nutrient load received into the local water body.

Mathematical modelling of the nitrate transport was also undertaken to estimate the effectiveness of the measures taken in terms of lower levels of nitrate in the groundwater.

The economic picture

An economic assessment was undertaken to calculate the likely real costs of implementing the six measures promoted within the WAgriCo project. Nineteen farms cooperating with the project were randomly selected and interviewed face-to-face to assess the costs to them of the measures. For each measure, the farmers were asked to estimate the additional costs and benefits of adoption. Table 4 illustrates the results.

Table 4: Costs and benefit of the six mitigation measures

Measure	Average cost	Range	No. of farms relevant	Modelled typical N loss reduction
Fertiliser recommendations	-£3.72 ha^{-1} (benefit)	-£7.40 to £18.70	19	4.5%
Manure management	-£9.30 ha^{-1} (benefit)	-£6.70 to £69.40	17	8.4%
Cover crops	£68.80 ha^{-1}	£20.00 to £150.00	18	28.0%
Fertiliser spreader calibration	-£14.20/ ha^{-1} (benefit)	-£0.02 to £48.80	17	Varies
N efficiency calculation	£600.00 per farm (£2.00 ha^{-1})	-	19	Varies

Whilst it is not possible to assess the cost-effectiveness of different measures without detailed information on the extent to which they reduce pollution, it is clear that:

- farmers should be strongly encouraged to adopt mitigation methods which can be introduced at no net cost; and
- a facilitation approach is a relatively low-cost way of informing farmers about reducing diffuse pollution.

Lessons learnt

Farmers involved in the project drew out their key messages from the project as follows:

1) **Working together is key.** The project has been successful as it developed a very strong sense of partnership with genuine openness between all partners. Farmers were happy to provide data to the project as they knew it would help them and they would not be criticised.

2) **Continuity.** The WAgriCo project was a three year initiative, but farmers felt that such projects need to have continuity beyond these short timescales to be successful.

3) **Advisers are vital.** Ideally, these advisers should be agronomists, or have a good agricultural knowledge first and foremost. This should mean that any changes suggested or needed on farm to help water quality will also fit within the farm business, practically and economically.

4) **Evidence, both in terms of problems and solutions, is vital.** If a farmer can understand his part in the problem he will more likely want to be part of the solution. The project used soil, grain and water testing. All the results were available to the farmers for use in their businesses and for interest.

5) **Incentives are necessary.** Two approaches can be used: direct payments for changes to behaviour; or an adviser providing agronomic and environmental advice to the farmer for free, with clear economic and environmental benefit.

6) **The value of 50 mg l^{-1} nitrate may not be achievable everywhere.** Actions, therefore, have to be targeted to where a difference can be made.

Good liaison is essential

An essential part of the WAgriCo project was good liaison between the different groups within the catchment and, importantly, the farmers. The majority of this liaison was two-way with groups sharing information and aiming to understand the constraints, problems and opportunities of each other.

Quotes from farmers who took part:

"This year WAgriCo is just ***beginning to get started.****"*

"When WAgriCo finishes, ***there will be a vacuum*** *as the issues that it raised will all get forgotten."*

"WAgriCo has ***made us think*** *and take a careful look at what we are doing and why."*

"WAgriCo has ***created an awareness*** *that will remain in place for the future."*