

Evidence

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Low-cost testing kits for measuring phosphate in water

Project summary SC120043/S2

An evaluation of low-cost testing kits for measuring phosphate in water samples was undertaken as a collaborative MSc project between the Environment Agency and Cranfield University.

Phosphate pollution of water is one of the biggest challenges facing the Environment Agency at the moment. Low-cost testing kits could be used by Environment Agency Officers, Catchment Sensitive Farming Officers or those carrying out catchment walkovers to make decisions in the field based on immediate results. They also allow farmers and farm advisors to see for themselves the levels of phosphate in water draining from their land, rather than having to accept the word of a scientist or regulatory body. Farmer-led monitoring, also known as participatory monitoring, should improve the farmers' understanding of where on a farm phosphate is lost and enable them to modify current farm practices to reduce their contribution to pollution.

Ten phosphate testing kits were identified through internet searches and visits to aquatic shops. Using product information sheets, their suitability was assessed against two criteria: (i) low range of phosphate concentrations required (<5 mg/litre); and (ii) low-cost (less than £100). From the ten, four suitable kits were identified: Hanna Instruments' HI-713 and HI-736, the Natural Chemistry Phos-Test strips and the Salifert Profi-Test. More specialised kits (such as those available from scientific suppliers like Hanna Instruments) are more expensive than those available from aquatic suppliers. The cheapest kit of the four was the Salifert Profi-Test, at £6.25 and the most expensive the HI-713/HI-736 at around £100.

Farmers were interviewed at two farm events to assess ease of use of the kits. The four kits were displayed on the table, and farmers were asked to choose which kit(s) they wished to try, to fill in the appropriate consent form, and then to answer a short questionnaire at the end.

To assess accuracy and precision, all kits were tested under laboratory conditions against a range of known phosphate standards (no suspended solids) and then with suspended solids (to replicate the influence of natural sediment under laboratory conditions).

Fieldwork was conducted in the Blackwater subcatchment of the River Wensum in Norfolk. Water samples were taken at a number of sites, including in low-flow ditches, high and medium-flow rivers and from field drains. Both turbid and clear conditions were sampled to ascertain how robust the kits are under extreme field conditions. At each site, each kit was tested 3 times. Water samples were also taken back to the laboratory so that results from the field and laboratory analysis could be compared.

From the three stages of assessment in the laboratory, in the field and by farmers, conclusions were drawn about the kits:

- From laboratory testing, the kits were ranked from best to worst: HI-713, Natural Chemistry, Salifert, HI-736.
- From field testing, the kits were ranked from best to worst: HI-736, Natural Chemistry, Salifert and HI-713.
- From farmer assessment, the kits were ranked from best to worst: HI-713/HI-736, Natural Chemistry and Salifert (although the HI kits were thought to take too long – 5 minutes versus 30 seconds).

Overall, the Natural Chemistry Phos-Test strips gave the most consistent test results and provided the best value for money, working out at 8p per test. The more expensive HI-713/736 kits are also suitable for further participatory monitoring work. However, it is recommended that sampling does not take place (with any of these kits) in very turbid watercourses, or during heavily sediment-mobilising storms as results will be less accurate.

The recommendations are made with a note of caution – the results from these kits are not an adequate replacement for laboratory testing and they should not be used as an absolute measure of a water body's quality. As a method of engaging farmers they suffice, but they should not be used for any other purpose due to the lower levels of accuracy and precision compared to laboratory results.



Hanna Instruments 713
(Handheld Colorimeter Phosphate Low Range)



Hanna Instruments 736
(Handheld Colorimeter Phosphorus Ultra Low Range)



Natural Chemistry Phos-Test strips



Salifert Profi-test

This summary relates to information from an MSc project, reported in detail in the following output:

Evaluating the accuracy and usability of low-cost phosphorus home testing kits. MSc Thesis. Emma Bird, Cranfield University, School of Applied Sciences.

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