CONTROL OF ALGAE WITH STRAW

IACR INFORMATION SHEET 3

IACR - *Centre for Aquatic Plant Management*

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INTRODUCTION

Algae cause a number of problems in water. They impede flow in drainage systems, block pumps and sluices, interfere with navigation, fishing and other forms of recreation, cause taint and odour problems in potable waters, block filters and, in some instances, create a health hazard to humans, livestock and wildlife. These problems seem to be increasing, probably because nutrient levels in water are rising as a result of human activity and natural processes. At the same time there is a growing worldwide demand for improvement in water quality. Thus, the need to control algae is increasing for environmental, recreational and public health reasons.

Because of their small size and rapid growth rates, algae are difficult to control by methods used for other aquatic plants. Cutting and other forms of mechanical control can help to reduce problems with filamentous algae but are of very limited use. Many algae are susceptible to appropriate herbicides but this approach is unpopular in some waters on environmental and public health grounds. Furthermore, herbicides which control algae also kill higher plants so that, although the water is cleared temporarily of all plants, once the herbicide has gone from the water, the regrowth of algae is not restricted by competition from the higher plants and the problem can get worse in subsequent years.

A new method of controlling algae has been developed by the Centre for Aquatic Plant Management which overcomes many of these problems. This involves the application of barley straw to water and has been tested in a wide range of situations and in many countries throughout the world and has proved to be very successful in most situations with no known undesirable side-effects. It offers a cheap and environmentally acceptable way of controlling algae in water bodies ranging from garden ponds to large reservoirs, streams, rivers and lakes.

Despite the simplicity of the idea, experience has shown that there are a number of basic rules which must be followed to ensure that the straw works successfully. The purpose of this leaflet is to provide practical advice on the optimum ways of using straw.

HOW STRAW WORKS

In order to use straw effectively, it is necessary to understand something of how the process works. When barley straw is put into water, it starts to rot and during this process a chemical is released which inhibits the growth of algae. Rotting is a microbial process and is temperature dependent, being faster in summer than in winter. As a rough guide, it may take 6-8 weeks for straw to become active when water temperatures are below 10 degrees C but only 1-2 weeks when the water is above 20 degrees C. During this period, algal growth will continue unchecked. Once the straw has started to release the chemical it will remain active until it has almost completely decomposed. The duration of this period varies with the temperature and the form in which the straw is applied and this will be discussed in more detail later. However, as a generalisation, straw is likely to remain active for approximately six months, after which its activity gradually decreases.

Although the exact mechanism by which straw controls algae has not been fully proven we believe that the process may occur as follows. When straw rots, chemicals in the cell walls decompose at different rates. Lignins are very persistent and are likely to remain and be released into the water as the other components decay. If there is plenty of oxygen available in the water, lignins can be oxidised to humic acids and other humic substances. These humic substances occur naturally in many waters and it has been shown that, when sunlight shines onto water which contains dissolved oxygen, in the presence of humic substances, hydrogen peroxide is formed. Low levels of peroxide are known to inhibit the growth of algae and experiments have shown that sustained low concentrations of hydrogen peroxide can have a very similar effect on algae to that of straw. Peroxides are very reactive molecules and will only last in water for a short time. However, when humic substances are present, peroxides will be continuously generated whenever there is sufficient sunlight. The slow decomposition of the straw ensures that humic substances are always present to catalyse this reaction.

There are various factors which affect the performance of straw and which support this hypothesis. It is important to take these factors into account to ensure successful treatment of algal problems with straw.

1. Type of Straw

Barley straw works more effectively and for longer periods than wheat or other straws and should always be used in preference to other straws. If barley is unavailable, other straws, including wheat, linseed, oil seed rape, lavender stalks and maize can be used as a substitute. The information in this leaflet describes the use of barley straw. If other straws are used, it is likely that the quantities applied and frequency of application may have to be increased.

We have tested a range of barley straw varieties, including some grown organically; all these were activeat the same level. Hay and green plant materials should not be used because they can release nutrients which may increase algal growth. Also they rot very rapidly and may cause deoxygenation of the water.

2. The anti-algal chemical

The chemical released by the straw does not kill algal cells already present but it prevents the growth of new algal cells. Thus algae which die will not be replaced when the straw is present and so the algal problem is controlled.

3. Speed of effect

Once the straw has become active, the time taken for control to become effective varies with the type of alga. Small, unicellular species which make the water appear green and turbid, usually disappear within 6-8 weeks of straw application. The larger filamentous algae, often known as blanket weeds, can survive for longer periods and may not be controlled adequately in the first season if the straw is added too late in the growing season when algal growth is dense. It is, therefore, preferable to add the straw very early in the spring before algal growth starts.

4. Production of the anti-algal activity

Activity is only produced if the straw is rotting under well oxygenated conditions. Usually, there is adequate dissolved oxygen in water to ensure that the chemical is produced by the straw. However, if the straw is applied in large compact masses such as bales, or to very sheltered and isolated areas of water, there will be insufficient water movement through the straw, which will progressively become anaerobic (without oxygen). Under these conditions, only the surface layers of the straw will produce the chemical and so the majority of the straw will have no useful effect.

5. **Absorption and inactivation of the chemical**

   The chemical is very quickly absorbed by algae and is inactivated by mud. Therefore, in waters which have high algal populations and are turbid with suspended mud, it is necessary to add more straw than in clear waters.

6. **Selective effect on algae**

   The chemical does not appear to have any effect on higher plants. In our experiments, we have seen that the suppression of dense algal growth has allowed flowering plants (macrophytes) to recolonise waters which were previously dominated by algae. In several shallow lakes where straw was used, algae were replaced by higher plants which suppressed the subsequent growth of algae, so eliminating the need for further straw treatments.

7. **Effects on invertebrate animals and fish**

   There are no reports of harmful effects on invertebrates or fish except in a few instances where excessive amounts of straw were applied to small ponds and the water became deoxygenated. These excessive doses were at least 100 times the doses recommended in this leaflet. In most instances, invertebrate populations increase substantially around the straw so providing a useful food source for fish. There is anecdotal evidence that, in fish farms and fisheries, straw treatments may be associated with improved gill function and fish health and vigour.

SUMMARY

1. When algal problems occur in water bodies ranging from garden ponds to large reservoirs, lakes and rivers, barley straw offers an environmentally acceptable and cost-effective form of control.

2. It should be applied twice each year, preferably in early spring before algal growth starts and in autumn.

3. Particularly in static waters, the straw should be in a loose form through which water can pass easily and should be held in nets, cages or bags.

4. The minimum effective quantity of barley straw in still or very slow flowing water is about 2.5 g m-2 but higher doses of up to 50 g m-2 should be used in densely infested waters and muddy waters.

5. In rivers, masses of straw (bales or nets) should be spaced along the sides at intervals not more than 100m apart.

6. Straw should be supported by floats so that it does not sink to more than one metre below the surface, even when waterlogged.

7. If the straw starts to smell then it is not working and should be removed. This is caused by too much straw in too little water.