Aquatic Weed Research in Britain

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INTRODUCTION

The main aquatic weed problems in Britain have traditionally been associated with land drainage and for centuries it has been essential to remove excessive plant growth in ditches to maintain crop production on some of the most valuable of our agricultural land. In Britain approximately 3 million acres in England and Wales have to be drained. In addition rivers have to be kept free of weeds over much of the year to prevent flooding and to carry the excess water from the drained land to the sea. In 1972 local authorities paid approximately £6 million to maintain the land drainage system (Newbold, 1976). This sum must have grown considerably since then but even so it cannot be considered enormous. In many of the other countries in Europe, notably the Netherlands, Belgium, Northern Germany, Denmark and parts of France, land drainage is also an essential part of agriculture. Nonetheless, in terms of area and length of channel, the problems in most European countries are small compared with irrigation areas in the United States, although the importance of aquatic weed control to crop production is probably equally great.

The difference in physical size between aquatic weed problems in Europe and the United States is again clearly seen in water transport and recreation. Apart from major river systems such as the Rhine and Danube, commercial transportation by water is very limited. Rivers and canal systems in Britain are now used almost exclusively for pleasure boating.

Much of the water in Britain at one time or another enters a river system, and almost every river is used for domestic supplies. In some cases the demand for potable water is so great that before it reaches the sea, water is passed through the human population a number of times. It is also reused over and over again for industrial purposes. The provision of good wholesome water for both these purposes requires a very high standard of control over the quality of sewage effluent and the purification of domestic supplies. Naturally, the addition of any other substance such as a herbicide is not encouraged. This is the case with potable supplies in other countries as well.

In Britain and some other parts of Europe, fishing is a very popular leisure pursuit and all lakes and rivers and even land drainage channels are in great demand. Although the fishermen do want a certain amount of weed control so they can catch fish, plants usually form an essential part of the fish habitat and so must not be eradicated. In very few instances is total weed control justified, and management has normally to be aimed at a compromise to meet the needs of conflicting objectives. It is here, in the develop-

ment of new systems of management, that the main aquatic plant problems now exist. Although there are some exceptions, Britain's problems are not so much to do with weed killing as with ecosystem management.

Britain is extremely fortunate that, except for *Elodea canadensis* which has caused some problems, we have so far escaped the invasion of rapidly multiplying exotic species like those that have spread through the waters of so many other countries and whose control has created such immense biological and economic problems. In recent years however, the marine alga *Sargassum muticum* has established itself along part of the southern coasts of Britain and European biologists watch with some apprehension the gradual spread of *Hydrilla verticillata* northwards towards the more temperate parts of North America. Presently, the main difficulties are caused by indigenous plants, and the need to find new techniques to replace the labour-intensive methods of yesteryear.

MECHANICAL CONTROL

The traditional method of weed control was to cut the plants three or four times during the summer and pull them onto the bank. Before the second world war, this was primarily done by hand with occasional dredging with a drag line. Some useful weed cutting machinery has been developed since then and it is likely that weed cutting will remain the option to be considered first in a maintenance plan. It is right that it should because most of the ecosystems which exist today have been developed under a cutting regime. However high costs, capital and operational, together with difficulties of access on intensively farmed land, are likely to limit their usefulness. Efforts to produce new machinery designed specifically to remove vegetation from narrow ditches are being made in the Netherlands, Britain and perhaps other countries and the next few years may see some fruitful advances. Undoubtedly there will always be a place for some mechanical removal, especially where an ecosystem of scientific or aesthetic interest, created and maintained by similar operations in the past, has to be preserved, or where some use of the aquatic plants has been developed.

BIOLOGICAL CONTROL

Classic biocontrol with insects seems unlikely to be of value in temperate regions except where exotic species have invaded, e.g. *Myriophyllum spicatum* in the United States and Canada, and in Europe the only prospect on the horizon is the herbivorous fish, the grass carp (Robson 1978). This fish has definite possibilities although it also has some limitations and has to be managed carefully to prevent it from eradicating all plants and creating results similar to total chemical control. There is still a long way to go to determine the best way to use grass carp, but experiments to study their grazing behaviour and their effect on other fish species are being carried out. There is little doubt that eventually they will provide us with a very valuable tool.

Considering biocontrol in its widest sense, there are other possibilities of which perhaps plant competition is the most promising. Yeo's work with *Eleocharis* in California is well known, but there are also other attempts being made elsewhere. In Holland, van Zon and his colleagues are looking at plants with floating leaves such as water lilies. These studies are designed to find a plant which will not be eaten by grass carp, will not seriously impede water flow, and may also serve to reduce growth of the submersed weeds. Dawson (1978) in England has also been studying the effect of shade, this time produced by trees growing on the banks of rivers and streams. Some research in Denmark and West Germany has the same objectives and some success is reported although the method does not always meet with the river engineer's approval because it impedes access to the river bank.

CHEMICAL CONTROL

The third option is the use of herbicides and it seems clear that there is a place for them in the intensive management of water as well as for weed eradication in the more extensive aquatic weed situations. Chemicals are frequently the only option available to contain the explosive spread of an invading weed which has no natural enemies or other factors limiting its growth. Under these conditions, eradication has to be the goal, even though it may never be achieved, to prevent the weed destroying the original ecosystem. Eradication is also the objective in irrigation channels where movement of the water is of paramount importance. Total weed killers are again an obvious option. But in the water courses of much of Europe and in particular those of Britain, total eradication of plant growth is rarely desired and research is now aimed primarily at selectively removing only part of the plant community. The main reasons for this are to avoid side effects such as the reduction in oxygen levels which frequently follow herbicide treatments and destruction of aquatic habitats. Selective control of aquatic plants is enhanced by using sodium alginate as a carrier for herbicides and enables the chemical to be placed onto the target species. Localised control has other advantages too. It reduces the amount of herbicide used, making the treatment more acceptable to the authorities responsible for water quality and it enables certain products to be applied to plants in swiftly flowing water. In addition the "all or nothing" approach previously needed against submersed weeds is avoided and consequently treatments are more economical.

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