Control of bracken

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Mechanical methods of bracken control are now being replaced by the use of chemicals. Trials indicate the value of asulam and glyphosate in reducing frond numbers of bracken when sprayed in late July or early August in the west of Scotland. There is still a need to find a bracken eradicant chemical rather than a control chemical. Research is also required to investigate the results of removing the bracken cover on the ecology of the treated areas. The effects of sudden exposure of the hitherto protected grass to extremes of climate are not known.

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INTRODUCTION

Not too many years ago in its history, bracken was regarded as an invaluable plant, used for bedding, for the thatching of temporary shelter for stock and crops, as a source of potash for soap-making and, on occasions of scarcity of cereals, for the production of a bread-type food prepared from the rhizomes. It is reported that in modern times bracken fronds in the young stage are eaten as a delicacy in Japan.

In 1902 the Highland and Agricultural Society of Scotland offered a prize for the best design of a bracken-cutting machine; the prize was not awarded as too few entries were received, they were not considered to be of adequate efficiency and “while the growth of bracken on hill grazings had undoubtedly increased in recent years, there was no need for further investigations or experiments as to the most effectual means of combating the plague.” (Anon., 1903).

Since then, however, attitudes and opinions have changed and there has been a continuing, at times intensive, effort to find a method of bracken control.
METHODS OF CONTROL

There are at least three quite distinct and perfectly successful methods of bracken control. These are cutting (or bruising), dense stocking, and treatment with a herbicide. Any of these treatments, if persisted with, will control bracken. Why then do we continue to discuss the problem? Partly because of the greater persistence of the bracken plant than any current treatment can offer in terms of control, and partly in an attempt to improve on present methods. But overlying all of these methods is the economic background—the economic returns in the hill sheep and hill cattle industry and the economics of the treatments themselves. These economic features will always determine whether or not some particular method of bracken control is feasible at a particular point in time.

The history of bracken and of attempted control underlines the importance of economic influences. At one time bracken was a necessity to the extent that bracken rhizomes were deliberately planted in some inner Hebridean islands; later, due to changes in the system of stock-rearing on the hills as small farms and crofts with enclosed, intensive husbandry and numerous cattle were replaced by larger units raising sheep on the open hill, it became a weed.

Mechanical control

Early attempts at eradication on the open hill situation would be by scythe, followed later by more sophisticated and very efficient machines such as the Henderson Slasher. Extensive trials of bracken control machinery have been carried out; perhaps the best documented is that by the West of Scotland Agricultural College in the years 1952-1955 (McCreath & Forrest, 1958), conceived in the botanical sense by Professor Braid and continued by Professor Fletcher. The results showed that, given the 50% grant available at that time, mechanical systems of bracken control were effective and economic, but shortly thereafter the economic climate in hill farming changed as lamb prices fell, land prices rose, labour availability declined and machinery contractors found more lucrative sources of income than cutting bracken. As Table 1 (Martin, 1969) shows, there was a marked decline in the area of bracken land treated by machine and grant-aided in Scotland.

In most cases, of course, the bracken regenerated after a few years—but usually a six- to ten-year control period could be anticipated before re-treatment was considered necessary (McCreath & Martin, 1954). By the early
1950s selective herbicides had become commonplace in arable agriculture and the hope of the hill farmer was for chemical, rather than mechanical, control of bracken.

**Chemical control**

The history of chemical control of bracken is a fine example of exponential growth in numbers of different herbicides tried and found wanting. From sulphuric acid in 1915 (Gordon, 1916) to the present-day contender, asulam, almost every available herbicide has been tried in many differing formulations.

I think it fair to say that by 1974 the only herbicide that could be recommended was asulam. It was certainly the most effective in my experience since 1952, outclassing sodium chlorate, MCPA, 4-CPA, aminotriazole, dicamba and picloram. Table 2 (Anon., 1973 with additions) presents the results from the west of Scotland area of trials with asulam at 4.5 kg/ha; such results can be duplicated, indeed bettered, from many parts of the United Kingdom.

Table 2. Percentage reduction in frond numbers caused by spraying with asulam at different times of year

<table>
<thead>
<tr>
<th>Sprayed 1972</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oban</td>
<td>57 57</td>
<td>82 91</td>
<td>83 92</td>
<td>84 92</td>
</tr>
<tr>
<td>Callander</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Glespin</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Thornhill</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
</tbody>
</table>

-- not assessed.

The results indicate a narrow range of timing for effective control in the west of Scotland. Trial sites other than those above have shown regeneration rates of 10% per year or more (Martin, Williams & Raymond, 1972; Martin, 1974). Observations by McKelvie & Scragg (1973) indicate that regeneration rate may well be inversely proportional to the original level of control.

Asulam has been approved by the Government to the extent of being the only herbicide at present to attract a 50% grant towards the cost of bracken treatment coupled with fertilizer treatment, and to bring to the firm concerned the Queen's Award to Industry for innovation in its production methods. Of the other herbicides mentioned above, few are in use today as bracken herbicides, although they are all available, with the possible exception of picloram.

The acreage treated by asulam, or mechanical methods, in Scotland and approved for grant aid has risen steadily from 447 acres in 1971, to 1172 acres in 1972 and to 2247 acres in 1973. Many more acres were actually treated, but due to late application for grant-aid or an unacceptable degree of after-treatment the total acreage is not recorded by DAFS. To sum up Scottish
experience with asulam, it is an effective control measure in the short term, it should be applied in the last two weeks of July or the first two weeks of August for maximum efficiency, it is tolerant of rainfall shortly after application and the results obtained are much less influenced by altitude and aspect of the treated site than has been the case with earlier herbicides.

Another herbicide currently under trial is glyphosate and results of its use are shown in Table 3 (Williams & Foley, 1974)

Table 3. Percentage reduction in frond numbers caused by spraying with glyphosate at different concentrations

<table>
<thead>
<tr>
<th>Concentration kg/ha ai.</th>
<th>Sprayed 3.8.72 Assessed</th>
<th>Sprayed 28.8.72 Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>79 63</td>
<td>79 41</td>
</tr>
<tr>
<td>2.2</td>
<td>75 77</td>
<td>95 97</td>
</tr>
<tr>
<td>4.5</td>
<td>95 97</td>
<td>97 98</td>
</tr>
<tr>
<td>6.7</td>
<td>96 97</td>
<td>97 98</td>
</tr>
</tbody>
</table>

Glyphosate appears to be marginally more effective than asulam in reducing frond numbers and there is indication of subsequent death of rhizome from which treated fronds arose which is associated with a reduction in rhizome carbohydrate.

Whether or not either of these herbicides is the final answer is a debatable question. Few, if any, alternative formulations are available at the moment. The prime question is that of the possibility of regeneration over an unknown period, coupled with current statutory requirement for a follow-up treatment and the economics of the complete programme.

FUTURE CONTROL

The term ‘control’ had deliberately been used rather than ‘kill’ or ‘eradication’. My own impression is that most farmers will be much more interested in a bracken eradicant chemical rather than a control chemical. Even if the former costs more initially, repeat treatments at intervals are obviated, and an interesting feature is that farmers tend to see the need for re-treatment when the bracken has regenerated to only about 50-60% of its original density. Some farmers indeed prefer a little bracken cover to give frost protection to grasses and thus extend the autumn grazing potential. In the past the use of the terminology ‘bracken kill’ has led to confusion and disappointment, and I would ask for accuracy in the description of trial results; if there is any frond regeneration or living rhizome within the treated area then one can only claim control of the bracken.

Another factor to aim at is a herbicide which really will translocate from the base of the treated fronds into and through the relatively inert mass of rhizome. We have had little evidence of such translocation with asulam, some evidence with glyphosate and more where asulam and ethrel have been applied together.
Retention of the herbicides used has been shown to be more effective with ultra-low-volume techniques than with low-volume, and the increasing use of U.L.V. equipment or helicopter spraying where the herbicide/water ratio may be as low as 1:1 will certainly improve retention percentages.

It is not necessarily all bracken-infested land which will benefit from the removal of the bracken canopy. There are three common types of cover and underflora important in hill land husbandry: bracken with good grass cover beneath (preferably Agrostis/Festuca in character), bracken with poor grass or mixed flora beneath, and bracken with no underflora. The first two are worth treating within the limits of economics; the third situation can present an immense reclamation and/or erosion problem and careful thought must be given before removing the bracken canopy. Treatment after spraying may vary in character from one area to another. There are undoubtedly areas where herbicidal removal of the bracken, with no further treatment, will bring into use areas of good grass, reduce the possibility of bracken poisoning and remove a favourite hiding-place of injured or diseased sheep.

It seems illogical that at one time cutting with no after-treatment attracted a 50% grant and yet today there is a minimum requirement for at least 4 cwt/acre phosphate application in order to attract the grant, despite the relatively great increase in fertilizer costs over the intervening years. Benefits undoubtedly accrue from such treatment, as a recent trial has shown. An area on the island of Seil (Argyll) was treated with asulam and later oversown with ground mineral phosphate. The yield of herbage of mixed upland grasses, was as follows:

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield (g/m²)</th>
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</thead>
<tbody>
<tr>
<td>Asulam alone</td>
<td>860</td>
</tr>
<tr>
<td>Asulam + 3 cwt/acre g.m.p.</td>
<td>971</td>
</tr>
<tr>
<td>Asulam + 6 cwt/acre g.m.p.</td>
<td>1528</td>
</tr>
</tbody>
</table>

It is doubtful if even the better fertilizer treatment goes far enough in many west of Scotland situations. There is a need, for full benefit to be obtained, for liming, phosphate, reseeding and fencing. This latter feature can be obviated by using a mosaic pattern of improvement rather than block treatment, but is technically more difficult to carry out. To a hill farmer the economics of acquiring full benefit are frightening. Where one is dealing with a situation where cattle and sheep are run together, and where fencing or other methods of controlled grazing, appears beneficial in preventing regeneration of bracken, complete treatment. Heavy stocking, by increasing stock numbers or by controlled grazing, appears beneficial in preventing regeneration of bracken although there is the anomaly that, since there are relatively few fronds appearing, there is much less chance of their being trodden on and killed.

What is to be the ecological future of treated areas? In the short term this may well mean a profusion of nettles, foxglove and thistles but these have, on our trial sites, quickly been eradicated—perhaps merely by exposure. But how does the hitherto protected grass respond to sudden exposure and to the extremes of climate? As yet we have not been presented with this problem over a long enough period to answer the question in relation to hill farm husbandry.
REFERENCES