Barley Grass Control and Evasion
Chemical, Non-Chemical and Integrated Approaches

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Barley grass grows where it does because conditions are favourable for it. Its environment is determined partly by natural factors such as climate and soil type, over which man has little control, and partly by artificially induced factors such as soil fertility and grazing management.
To a limited extent barley grass creates its own environment because it can be an aggressive competitor during its growing season and the litter of dead plants or bare ground which it leaves creates conditions suitable for the establishment of seedlings of the next generation. Barley grass is one component in an ecological system and in order to reduce or eliminate barley grass this system must be changed. This can be done in two ways:

• Lift barley grass out of the system by physical or chemical means.

• Modify the environment to make it less suitable for barley grass.

Good control is most likely to be achieved by an integration of these two methods. Where control is difficult or impractical, consideration must be given to "living with the problem" and there are ways of reducing stock damage even on badly infested farms; these will be discussed later.

Herbicides
A range of commonly used herbicides will kill barley grass (Table 1): However, in most situations, selectivity is desirable and this creates problems because none of the currently available chemicals will control barley grass without affecting some desirable species. Even a perfectly selective chemical would, of course, reduce overall pasture production in the weeks or months following application because of the death of barley grass and the inevitable time lag before other species could occupy the vacant space. Damage done to favourable species by the herbicide increases this time lag and increases the likelihood of invasion by other weed species. If the damage persists so long that autumn regrowth is affected, then barley grass re-invasion could even be facilitated.
The more effective selective herbicides are applied in winter or early spring and control of barley grass at this time gives desirable species a good chance of replacing it. Unfortunately, barley grass can be difficult to recognise in the winter and actual eradication is rare so at least a few plants almost always manage to survive and set seed.

The use of herbicides to control barley grass has, in itself, relatively little effect on the ecological system. The causes which led to the original barley grass infestation will not have been changed and barley grass is likely to re-appear quickly, re-establishing from seed of surviving plants or from seeds brought in by stock, birds or the wind. In some instances removal of aggressive barley grass populations can lead to the

recovery of healthy perennial species which can resist re-invasion for some years. All too often, however, re-invasion is rapid and herbicide application needs to be repeated every 1 - 2 years.

Table 1: Herbicides known to give control of barley grass (see label, or latest Novachem Manual for rates and timing of application)*

Chemical	***Pasture tolerance***	***Lucerne tolerance***
atrazine	None	Good
clethodim	None	Good in mature, closely grazed stands when dormant in winter
cyanazine	None	Good
dalapon	Some depression	Temporary depression
dalapon/TCA	Some depression	Temporary depression
ethofumesate	Ryegrass good, clover none	None
glyphosate	None	None
paraquat	Clover recovers	Good in mature, closely grazed stands when dormant in winter
propyzamide	Clover good	Good
simazine	None	Good
terbuthylazine	None	Good in mature, closely grazed stands when dormant in winter

* Other herbicides used to control annual grasses in crops will usually give good control of barley grass.

Attempts at herbicidal control of barley grass commenced with the use of TCA in the mid 1950s and dalapon in the late 1950s. Although both materials give reasonable control of barley grass, results can be variable with TCA being rather more selective than dalapon. Optimum time of application is in winter or early spring. The introduction of paraquat in the early 1960s led to hopes of a treatment effective at the green seed head stage for stock camps and similar situations. Because of the damage to favourable species and the difficulty of eradicating all barley grass plants, paraquat alone did not prove very successful and residual soil sterilants were added to paraquat in the mid 1960s. These materials were also introduced, at about this time, for control

of barley grass in lucerne. Further advances were made in the late 1960s when propyzamide and Teedal (a commercial mixture of TCA plus dalapon) were first used. Later additions to the herbicide list were glyphosate and ethofumesate in the early 1970s.

Non-chemical control

Cultivation: Ploughing land badly infested with barley grass gives good control, especially if the land is cropped for 1—2 years before being returned to grass or lucerne.

To reduce the chances of re-infestation with barley grass after cultivation, uncultivated head-lands and fence-lines must be sprayed with a suitable herbicide to eliminate any barley grass there.

Replacement and alternative species: The use of oversowing or other methods of introducing favourable grass species has often been advocated as an aid to barley grass control. Oversowing any grass species into an established barley grass sward is virtually useless because of aggressive competition and, similarly, perennial pasture species sown into barley grass sites in summer or autumn are likely to be swamped by the germinating barley grass. Under conditions conducive to their rapid germination and establishment, large seeded annual grasses, such as Italian ryegrass. (*Lolium multiflorum*)**,** or cereals, can effectively compete with barley grass. However, in comparison with barley grass, their seeds are not so well adapted to germination and establishment on the soil surface, and they are probably less efficiently self-sown, are not so resistant to grazing and do not, at first, grow as well as barley grass on the saline soils of stock camps (Popay and Sanders 1976).

In view of this, the best use of oversowing would be to improve a sward after barley grass had been removed or weakened by herbicide application. The aim of this would be both to reduce the loss of pasture production caused by the disappearance of barley grass and, hopefully, to reduce the chance of barley grass returning to the sward the following year. Henderson and Grant (1974) oversowed barley grass-infested pasture after paraquat treatment in the autumn with prairie grass (*Bromus wildenowii*) cocks foot, (*Dactylis glomerata*), phalaris (*Phalaris aquatica)*, tall fescue (*Schenodorus arundinacea*) or perennial ryegrass (*Lolium perenne*)**.** Only prairie grass at a very high sowing rate (230 kg/ha) substantially affected the proportion of barley grass in the sward, but even this did not significantly reduce the numbers of barley grass seed heads produced. Henderson and Popay (1976) tested combinations of oversown pasture species and herbicides, but only herbicide treatments reduced barley grass levels below those in untreated plots. In the second year barley grass levels in all plots were approximately the same as in untreated plots. Experimental evidence of the success of oversowing is thus very limited.

It is possible that some pasture species or cultivars may offer more resistance to barley grass invasion than the ones traditionally used. George (1972), in Australia, observed that *Phalaris aquatica* pastures contained less barley grass than those of tall fescue. As already explained, one of the reasons for barley grass invasion of pastures is the failure of pasture grasses over the summer and their slow recovery in the autumn. The pasture grasses needed, therefore, are those which will not suffer too

seriously from summer drought and which will regrow rapidly in the autumn. Potentially suitable ones are ryegrasses containing ‘safe’ endophytes that do not affect animal production. Including AR542 endophyte in tall fescue has reduced barley grass cover and seed head production and sowing subterranean clover with tall fescue has also reduced barley grass presence (Tozer *et al.* 2007).

Mowing: Removal of flowering tillers, just before the seed begins to fill, by mowing (or by grazing - see next section) removes the primary seed crop. This both weakens the plants and delays the production of reproductive tillers. However, unless all the flower heads are immature at the time of mowing some seeds may be viable and will survive to establish a new generation.

Barley grass seeds do not survive in silage (Hartley and Lancaster 1974) so that making silage of grass or lucerne before the first ripe barley grass seeds are shed is likely to reduce barley grass the following year. Making hay from barley grass infested pasture is not to be recommended because seed can remain viable in the hay for several years and this is one way in which barley grass is spread from site to site.

Grazing management: Under-grazing in spring, which allows barley grass to flower, and over-grazing in the summer which helps to weaken perennial pasture species both favour barley grass. Such conditions are inherent under traditional stock management, especially in summer-dry, east coast areas.

Observations made in New Zealand suggest that hard grazing between October and February can reduce the incidence of barley grass. Trial work has shown that continuous set stocking with sheep to maintain pasture at 2 - 3 cm can virtually eradicate barley grass within 2 years (Hartley 1977). Hard rotational grazing achieved similar results.

Hard grazing from October to January, either set-stocked or rotational, seems to give good control of barley grass while lax stocking in summer also reduces barley grass (Hartley 1977).

Integrated control

It is unlikely that barley grass could be eradicated by any single method and a combination of spraying and stock and pasture management will probably be required.

A planned approach to farm-scale control is worthwhile, but details must depend on the layout and available facilities of individual farms. Control will be best achieved piecemeal and great care should be taken to limit re-infestation of cleared areas. For this reason the use of appropriate herbicides along fence lines and in races and gateways is recommended. Where possible, care should be taken to ensure that stock do not carry seed into cleared areas: judicious use of rotational grazing, ensilage of grass from badly infested pastures and carefully planned pasture renovation can all help.

Stock camps, characterised by regular heavy animal disturbance, are the typical sites of barley grass infestations and control or eradication of barley grass from these areas would reduce the chances of infestation in neighbouring pastures.

As long as stock camps are formed it is difficult to prevent barley grass from occurring on them. However, if the causes of a stock camp, such as shade trees, are removed so that stock no longer congregate, then barley grass will often, given time, disappear. Rotational grazing, with large mobs of stock present for short periods, prevents the persistent congregation of stock in one spot. This helps to reduce the localised trampling effect and ensures a more even distribution of returned dung and urine. Another alternative is to fence off badly infested areas, thus preventing seed damage to stock and reducing seed dispersal. This also makes the barley grass more conspicuous, which assists destruction and enables other pasture species to grow up and smother the barley grass. (Taylor 1971, 1976).

Once stock are excluded other plant species can be established on stock camps although the barley grass may first have to be sprayed out. Prairie grass appears to be one of the best species to use in higher rainfall areas.

In some warmer areas summer active grasses such as Kikuyu grass, *Pennisetum clandestinum,* can persist on dry knobs and could perhaps be useful in keeping barley grass out.

Removal of barley grass from stock camps by the use of herbicides does not change the ecological system very much and re-invasion is usually rapid. If stock camp areas are relatively small and unproductive, then bare ground might be considered preferable to barley grass and non-selective herbicides can be used.

The material most commonly used for this purpose is glyphosate, but this creates an ideal seedbed for any surviving or introduced seeds and often makes the barley grass problem worse. Residual material such as simazine can be added to glyphosate to reduce re-invasion though high rates of dalapon alone may he better. However use of such materials results in bare ground which will eventually be re-colonised by barley grass unless regular applications of chemicals are made or barley grass eradicated from the property.

Ryeqrass is almost invariably present on stock camps and the use of appropriate selective materials for barley grass removal will allow some spread of ryegrass. Ethofumesate is ideal for this purpose and, since ryegress is highly tolerant, it can be sprayed outside the margins of the stock camp without doing too much damage. Ethofurnesate kills clovers, but these are rarely important in the vicinity of a camp. The other ‘selective’ materials such as propyzamide or TCA/dalapon are better tolerated by clovers but tend to damage ryegrass. As ryegrass is a desirable species on stock camps these materials are not very satisfactory.

Pastures: Where barley grass has become a major component of pastures, ploughing, spraying or grazing management are the available alternatives for eliminating or reducing it.

As already mentioned, herbicidal removal of barley grass reduces pasture production, However, initially, stock productivity may not be as severely affected as pasture production (Hartley *et al*, 1974). Over summer, stock may benefit greatly from winter herbicide treatment of the pasture (Hartley and Atkinson 1972), because seed damage can seriously reduce stock health and growth (Atkinson and Hartley 1972: Hartley and Bimler 1975). Treatments resulting in clover dominance may lead to higher summer production than that from untreated pasture. Before herbicides are used to control barley grass in pasture, the likely benefits of improved pasture composition, improved summer pasture production and improved stock growth and health must be weighed against the cost of treatment, loss of spring production and possible invasion by other weeds.

Ethofurnesate effectively controls barley grass in pasture, but clovers are severely suppressed. However, these can be introduced after 3 months if ryegrass competition is reduced (O'Connor *et al*, 1975). The temporary loss of clovers may be unacceptable in some situations. Ethofumesate must be applied in May, June or July for best effect and removal of barley grass at this time gives ryegrass the opportunity to tiller and fill in the spaces left by barley grass.

Propyzamide affects all grasses. It kills barley grass but leaves clover-dominant swards in areas of adequate summer rainfall. This may be useful in some instances, but may not be acceptable in others, It is most effective when applied in winter or early spring.

A commercially available mixture of TCA and dalapon is probably the least damaging of commonly used barley grass herbicides. Applied in late winter or early spring, it leaves a reasonably balanced award, although barley grass is sometimes partially replaced by other weeds.

All herbicidal treatment of pasture-wide infestation of barley press results initially in reduced pasture production, though subsequent growth may be increased. Pasture-wide infestations may be controlled more economically and equally effectively by appropriate stock manipulations though these may disrupt normal stock management. As control by grazing management requires hard grazing in spring when feed is plentiful, and lax grazing in summer, when feed is short, it cannot be practiced on a whole property at once, but should be concentrated on problem areas. An integration of herbicide control and grazing management may be desirable and a systematic approach made to clear the property, taking care to avoid reinfestation of areas already cleared.

Where infestation is too widespread for overall control, priority should be given to protection of vulnerable stock, primarily lambs. During the summer, lambs should be restricted to paddocks free of barley grass. Treatment with herbicide during the winter is useful to prepare paddocks for lambs during the summer, Topping also helps protect lambs by removing the first seed crop and delaying further seed till more lambs are drafted oft.

Lucerne: Barley grass is one of the common annual weeds which invade lucerne and is not adequately controlled by the commonly used management practices,

particularly in very dry areas. Rotational mob stocking and long spelling allow lucerne to smother most weeds but stock will not graze barley grass well if it becomes too rank. Lucerne contaminated with barley grass can safely be made into silage, thus removing a substantial portion of the barley grass seed, It should not be made into hay. Where lucerne is grown as a monoculture the grass killer propyzamide can be used safely (Meeklah 1969: Miles 1969: Honore *et al*, 1973). The addition of simazine to winter applied paraquat will improve the period and efficiency of control (Meeklah 1964; Cassels 1966; Forgie 1973).

When winter-active grasses are sown into lucerne, herbicidal control of barley grass is almost impossible though these sown grasses will help to displace barley grass.

Avoiding barley grass damage to stock

Were it not for the obnoxious seed, barley grass would not be considered any more of a problem than many other volunteer annual grasses. Providing, therefore, that seed heads and animals can be kept apart, some farmers may not think there is any great need to actually reduce the barley grass content of pasture. There are methods of "living with barley grass".

Lambs are the class of stock most at risk from ripe barley grass seeds and should be kept away from them. One way of doing this would be to move lambs on to less-affected areas at the time when seeds are being shed. Other methods are early lambing, or delaying ripe seed shed by hard spring grazing, mowing for silage, topping when flower spikes emerge or by light application of selective herbicides such as TCA/dalapon during the winter.

Shorn sheep and lambs are less likely to suffer from barley grass damage than unshorn ones (Hartley and Atkinson 1973). To be effective, shearing should be carried out immediately before the first seeds ripen.

Different breeds of sheep differ in their susceptibility to barley grass seed damage. George (1972) found that Merinos were more susceptible to damage than Dorset Horns. Hartley and Atkinson (1973) found that woolly-faced sheep were most likely to suffer eye damage and that wool type could have a considerable effect on the amount of pelt damage. They observed that Border Leicester sheep suffered least damage and Merinos and Down types most, with Romneys being intermediate. Therefore, in serious barley grass areas, some consideration should be given to changing to other breeds of sheep.

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