THE CONTROL OF GRASSY WEEDS BY MECHANICAL AIDS

A. H. FLAY, *Canterbury Agricultural College, Lincoln.*

My subject is the control of grassy weeds by mechanical aids. I think you will agree, gentlemen, that such a subject brings to mind that group of weeds commonly known as twitch. We all know that a weed is merely a plant out of place and that twitches are indeed very valuable plants under many conditions, such as in swamp consolidation, and as poor hill pastures; but they become weeds as soon as they interfere with or affect the maximum production of other more desirable cultivated species. In this respect their greatest interference is in arable farming and it is here that mechanical means of control have long been in use. In grasslands these grassy weeds usually blend in and sometimes form a valuable ingredient in the sward.

In addition to the twitches, of which there are some 6 that come to mind—old man, English, long twitch, or couch, creeping fog grass, onion-rooted twitch, browntop, *Poa prateensis* and Chewings fescue—we might add the annual weeds such as *Poa annua*, spurrey, wild oats and hair grass. It is recognised that spurrey is not a member of the grass family, but as it presents to the agriculturist problems similar to the annuals, *Poa annua* and hair grass, it was thought its inclusion here might be permitted. Yarrow might similarly be included with the twitches. These last five, together with creeping fog and browntop, are prolific seed producers. *Poa annua* and hair grass are less troublesome relatively. These grassy weeds and twitches are widespread over our New Zealand cropping lands, varying in intensity from farm to farm.

From time immemorial the mechanical approach has been the destruction of the existing plants by cultivation and the constant removal of the seedlings as they appear. Much of this work in growing crops has been done by hand, even to this day in many parts of the old world. In New Zealand up to the present time we have looked to our ploughs, grubbers and harrows, tractor-drawn nowadays, for cultivation work and weed control. Multi-inter-row cultivation with suitable crops is a modern development.

The twitches with their strong underground growing systems, not to mention the prolific seeding habits of these and other annual grassy weeds, are exceedingly difficult to eradicate. The underground systems can tolerate much abuse and some of the seeds remain viable in the soil for many years. Because of these facts eradication rather gives way to control-measures of cultivation, rotations and general farm management that aim at keeping these weeds in a recessive condition. True it is that every now and then, and here and there, they assume dominance, but control consists of altering farming policies and methods, the use of livestock for grazing between crops, and the adoption of cropping programmes and rotations that permit of the production of fodder and cash crops while at the same time giving the most effective mechanical treatment for control between crops simultaneously with seed bed preparation. Frequently fallow periods are employed, very largely for weed control but also to ensure high crop yields. Thus, old pastures containing twitch of any kind are skim-ploughed in November-December and fallowed through the summer and autumn, finally being sown to wheat or oats in late April or May. The mechanical treatment here is designed for twitch control and is carried out over the dry period of the year. It usually involves 3 ploughings, as many as 10 or a dozen grubblings and 4 or 5 harrowings spread over some 5 months

before the crop is sown. At present day contract rates this costs about £8 to £10 per acre. Such cultivation aims at killing the underground twitch system by exhaustion and drying out. It does not, and cannot, at the same time germinate seeds that may be present. This requires moisture and, except for wild oats, a firm seed bed. The wheat or oats is sown in a relatively open seed bed and here wild oats establishes as readily as does the sown grain crop. At this stage it must not be forgotten that the cultivation outlined here is designed to kill the twitch, raise the natural fertility by virtue of the lengthy fallow in order to ensure maximum crop yield and prepare a seed bed. Cultivation over a period does all three. The factor of importance from the weed angle is what extra cultivation did twitch control involve? If an old pasture were free of twitch and yarrow and was being prepared for wheat over the summer there could not be a saving in cultivation operations of more than one ploughing, 6 grubblings and 2 harrowings. At present-day contract rates this amounts to about £4 per acre. Thus for twitch control here the cost is £4 to £5 per acre.

To-day most farmers would endeavour to produce a preparatory crop prior to sowing a cereal—rape alone, or rape and lupins, and in some areas turnips and other roots as a fodder crop; or cash crops of peas, potatoes, or linseed as preparatory crops. Fodder crops, even in the absence of twitches, require at least one deep ploughing, 5 or 6 grubblings or discings, and 2 or 3 harrowings, spaced over a period from winter to sowing in November or December. This method of one deep ploughing, turning down flat old swards of browntop or Chewings fescue and top working, is an effective control for these twitches. Little more cultivation is required, but if the other twitches and yarrow are present a number of further grubblings or discings are required, primarily to hold these weeds in check and temporarily to weaken them sufficiently to ensure a successful establishment of the fodder crop. In the case of roots, winter grubbing of the turnip shells also brings the yarrow and twitch to the surface where the sheep readily eat the yarrow and even some of the twitch, and winter frosts severely damage the exposed underground system. Cultivation performs a dual purpose—making the turnips available to the stock and controlling the twitch.

These fodder crops allow wild oats to strike and then to be consumed along with the crop before seeding, but such grazing is too late for spurrey and *Poa annua* which establish, flower and seed before the fodder crop is eaten. With cash crops of peas, potatoes and linseed the above weeds establish, flower and seed all too quickly and before anything can be done other than the employment of inter-row cultivation and hand methods. Unless hand methods are employed in pea, potato, and linseed crops, any wild oats present will establish and seed before the cash crop is removed.

We can quickly dispose of the problem of control of wild oats by acknowledging that there is no mechanical method of control. The seeds in the land have to be germinated and then destroyed. As wild oats seeds do not all germinate in one year the only feasible method is by the successive production of fodder crops—rape, lupins as greenfeed, greenfeed oats or ryecorn, short rotation ryegrass and the sowing of the area to pasture. Such restriction on the freedom of choice of cropping programme on the arable farm can be an exceedingly important limiting factor in management and a charge on profits.

On the arable farm *Poa annua* is only important in spring-sown crops in some districts and the only mechanical control is inter-row cultivation. This may cost £2 or £3 per acre. To reduce the effectiveness of a smother from *Poa annua* and spurrey, roots are often grown on ridges. The formation of ridges not only facilitates inter-row cultivation but

also ensures a sufficiently dry ridge that is a little less favourable to the germination of spurrey and *Poa annua* without affecting the germination too much of the cruciferous crop. Where root or other crops, including grain, and even new pasture are sown on the flat in 7in. drills, or broadcast, spurrey smother can be exceedingly severe. Mechanical treatment here is out of the question except prior to sowing. It is possible under some circumstances where wind "blowing" or erosion is not a problem, to obtain 1 or 2 strikes of spurrey and *Poa annua* by sowing a fine, firm seed bed some weeks before crop sowing date. Harrowing or light grubbing will destroy most of the seedlings, but cultivation must be very shallow in order to avoid bringing fresh seed up to the germinating layer. Even after several successive strikes there is nearly always an abundance of seed in the soil, it seems, to strike in the sown crop, so that one sometimes questions the effectiveness of this method for spurrey. The cost of extra mechanical treatment here is not great—3 or 4 harrowings, say 15/- per acre, but the delay in sowing of the crop, the ineffectiveness in wet districts and seasons and the wind erosion danger in some districts places limits on its application. Direct mechanical means—shall it be admitted—are unable to control this plant which might be classed along with grassy weeds.

We come back now to our old friends, the twitches. We have treated them mechanically before sowing grain crops direct from pasture after a fallow and before sowing fodder preparatory crops. Let us look for a moment at the twitch position as it affects cash preparatory crops of peas, potatoes, and linseed.

Linseed may be sown and a successful crop obtained on browntop or Chewings fescue where a deep flat furrow has been turned down and followed by adequate, timely and well-spread top work. Potatoes, provided there is adequate cultivation may be grown with reasonable success following the ploughing up of any class of twitch, but the term "adequate cultivation" implies not only several ploughings, many grubbing and heavy harrowings but also proper attention to inter-cultivation of the growing crop at a total cost for cultivation of £8 to £12 per acre. Land free of twitch and yarrow could be prepared for potatoes for about one half this cultivation cost. Where old man twitch, creeping fog grass, onion rooted twitch and yarrow are present in strength they preclude the growing of cash crops of peas and linseed.

After a fodder or other preparatory crop, and before sowing a grain crop there is no time to work the land for twitch control except—let it be mentioned—that during the production of the potato crop and immediately after it is lifted some work is done, but it amounts to little more than that necessary for a maximum potato crop and for clearing of the land for drilling grain.

After the removal of the grain crop and the clearing of the stubble by burning or by mowing and sweeping off, the land may be sown to greenfeed oats and lupins. The mechanical treatment of the re-establishing twitch is nil. The land is ploughed, harrowed once or twice, and drilled at once. It is only after the greenfeed is ploughed in late October or November that further cultivation is possible, and here it is usual to employ a short summer fallow. In the absence of twitch, cultivation could be restricted to ploughing, 2 or 3 grubbing and 2 harrowings, but because of twitch it frequently amounts to much more, sometimes 3 times this quantity, at an extra cost—at contract prices—of £4 to £6 per acre.

If a second wheat crop is to be grown there will be extra cultivation if twitch is present, and likewise when successive barley crops are grown. The extra cultivations may cost £3 to £6 per acre

and rarely is there a complete kill; even if there is a complete kill of all living plants there is still the constant slow, but certain, reinfestation from seed, from hedge and fence lines and stack bottoms.

It is true that farm management has now become so organised on mixed cropping farms that twitch control is being taken "in stride" so to speak. It is being accepted. Some farmers set out to clean thoroughly a field a year by a complete summer fallow, at no time allowing a green shoot to appear, and then following up with fodder and cash crops that automatically permit of the germination and destruction of the seeds in the soil. Records kept for 11 such treated fields show that on average each acre received $6\frac{1}{2}$ ploughings, 3.3 grubblings, 4.2 Drummond harrowings, 2.5 rollings and 2.2 harrowings, which at to-day's contract rates cost about £11 per acre. After allowing, say, £2½ to £3 per acre for normal cultivation and seed bed preparation the cost of twitch control is about £8 per acre—and this is not to mention a full season's loss of production. Such treatment, however, reduces to insignificance twitch control for some 7 or 8 years.

Enough has been said to show that whether twitch control be carried out between and along with the normal seed bed preparation or as a complete fallow, there is a considerable direct annual charge together with some loss of production. Whatever way we look at it, twitch control is a serious hindrance to the arable farmer.

In conclusion, it can be said that on arable farms the grassy weeds as here listed are being controlled in full or in part by mechanical means aided by carefully planned crop rotations, choice of crops and livestock production. This control is not only costly, amounting annually to probably £1 per acre over the entire area of the better class mixed farm, but also restricts somewhat the freedom of choice of crop to be grown and the fullest profitable use of the land.