

## WILD OATS IN WHEAT

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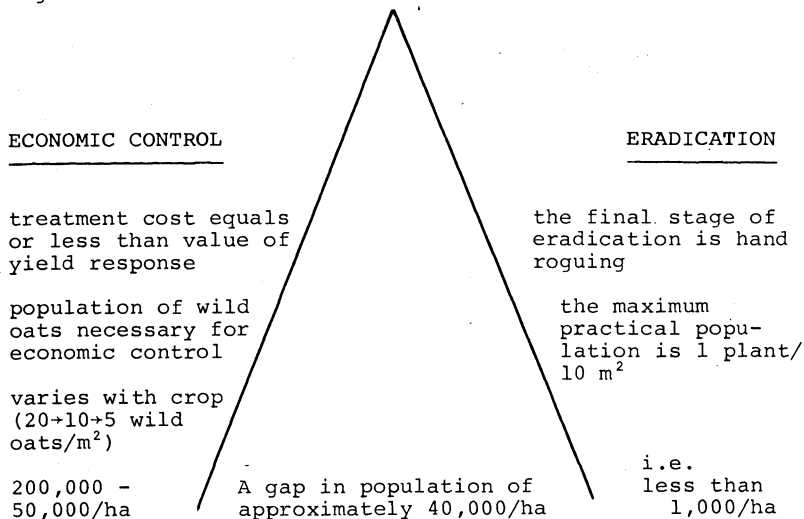
Wild oat (*Avena fatua* and *A. persica* syn. *A. ludoviciana*) is the weed of most concern to farmers in Canterbury and North Otago growing annual crops for grain and seed production. The area of wheat infested is estimated at 30,000 hectares of which less than 3,000 hectares would be economic to treat (Allen and Smallridge, 1972).

The basic concern has been of the potential effect on yield, crop harvesting and spread through contaminated seed, accentuated by difficulty of control and more recently by the imposition of penalties on infested crops and contaminated seed. There are two possible reasons for control of wild oats

- \* Economic control
- \* Eradication

These two approaches for control of wild oats has been termed the 'gap' by Mr. F.C. Allen (Fig. 1). Extra yield from treatment by herbicides in wheat is only profitable when wild oats are found in excess of about 200 plants per square metre. If penalties such as the rejection of seed lines showing the presence of wild

Fig. 1. THE WILD OAT GAP



oats are instituted the infestation level economic to treat would be very much reduced. However there is still a gap between the level of infestation giving economic returns, and those levels of wild oats that can be effectively rogued.

#### DISTRIBUTION OF WILD OATS

Wild oats occur in yield limiting quantities in Canterbury and North Otago and have recently appeared in Southland, Manawatu, Wairarapa, and Southern Hawkes Bay. However, the distribution is still patchy with some fields, farms or districts still apparently free of the weed.

A survey in 1977 (Saville et al. 1979) supported the belief that wild oat density is related to intensity of cropping, as ninety percent of intensively cropped fields were infested (Table 1). It also suggested that just

over half of the farms growing crops were free of wild oats. Some of the farms so identified in this survey were subsequently visited in 1979 (Allen and Butler, 1979) and it was found that all but fourteen percent of these did have wild oats but almost all (98%) could have been effectively hand rogued.

TABLE 1. WILD OATS IN ASHBURTON CCUNTY  
(AFTER SAVILLE et al.)

	<i>Farms with paddocks that were</i>			
	<i>1st year crop</i>	<i>3rd year crop</i>	<i>1 &amp; 3 crop</i>	<i>Continuous cropping</i>
Farms with wild oats (%)	14	22	64	95
Farms spraying for wild oats (%)	0	0	13	52

Thus the opportunity still exists on many properties in mid Canterbury and more certainly elsewhere to keep areas clean of wild oats and to make a concerted effort to eliminate the weed from lightly infested fields.

It was also clear from the 1979 survey that the weed is increasing its bounds and will do so more rapidly with increase in cropping unless action is taken now. Wild oats were found only in the drill row in 31 out of the 74 fields infested with wild oats, clearly indicating that wild oats are being sown with certified cereal seed. Furthermore, by inference it means that the numbers of 'clean' fields is being halved each season by this contaminated seed.

Seed certification procedures do not necessarily guarantee clean seed, although seven to ten percent of all cereal lines are rejected at field inspection, and a further one or two percent at laboratory examination. In ryegrass seed at field inspection, between 27 - 45% of all lines have wild oats present, but only two to six percent of lines other than Tama are rejected at laboratory examination for wild oats. Twentyfour percent of Tama seed was rejected in 1976 for wild oats (Scott, Seed Testing Station).

It can be concluded from these figures that 'clean' wheat growing areas can be infested not only from cereal seed but also from seed sown with other herbage seed lines sown between cash crops.

#### SEED VIABILITY, SURVIVAL AND GERMINATION

A brief description of some of the biology of the plant is essential if control measures are to be properly integrated.

- \* Wild oat seed is potentially viable once it reaches the milk stage. Seeds ripen progressively from the top of the panicle. They fall when ripe thus ensuring, in direct-headed crops, that most of the seed reaches the ground before the crop is harvested. The addition of 3,000 seeds per square metre is not uncommon in a moderately infested wheat crop.
  
- \* The seeds are capable of burying themselves in soil cracks or under clods. Movement is brought about by twisting of the awn in response to humidity and the direction of travel is controlled by the ratchet-like action of the backward-pointing

seed hairs.

\* Ripe seed may germinate within a few weeks if given favourable conditions, or it may enter a period of dormancy. Dormancy, associated with the seed hull, is induced by a number of factors including hot weather during ripening, repeated dampening and drying of the seed, and exclusion of oxygen by deep burial. It breaks down progressively, resulting in prolonged strikes of wild oats in any one season. It may be present for more than ten years, though in most circumstances few seeds remain viable for more than eight or nine years. Under cultivation the largest strike is usually in the season after ripening and most seeds in the cultivated layer have germinated after three or four years.

\* Germination takes place during the cooler months with peaks following cultivations during spring. Seedlings can establish from depths up to 20 cm but the majority come from the top 5 - 8 cm.

#### SYSTEMS OF CONTROL

Despite considerable numbers of publications dealing with wild oats, few have related to systems of controlling the weed. Until recently, the few references were either general or invalidated by the passage of time. Recent reports have principally concerned spring barley but there are some references to control in winter and spring wheat in the United Kingdom.

In barley, herbicides such as tri-allate and barban give sufficient control of wild oat seeding to allow hand-roguing after four years, while the increased barley yield

covered the cost of treatment. (Roebuck, 1972). However, Roebuck and Trenner reported in 1970 that with winter wheat, herbicides as above were unable to prevent wild oat population increases and that the most effective method of preventing return of seed to the soil was hand roguing.

Wilson (1978) stated that this return of seed to the soil was the most important aspect of long term decline of a wild oat population rather than the persistence of seeds in the soil.

Cussans (1976) and others have attempted to define population dynamics of wild oats (Fig. 2). The control or mortality factor is dependent on a number of variables and if there is a 15% mortality of seeds shed each autumn then the resultant effect on soil seed reserves is shown in Figure 3.

Fig. 2. POPULATION CYCLE - WILD OATS

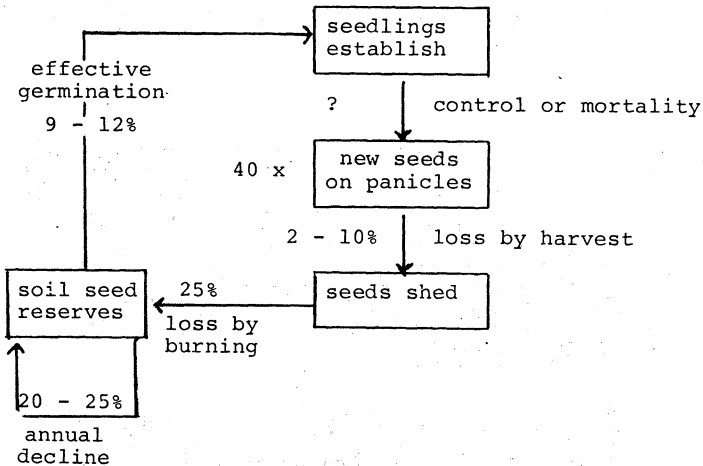
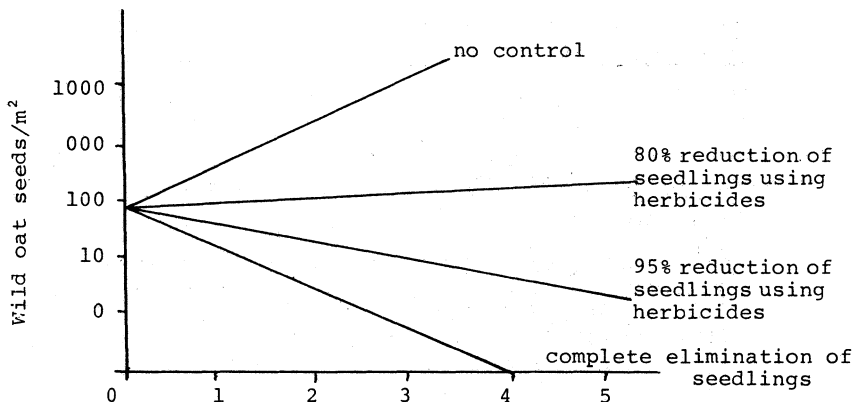


Fig. 3. EFFECT OF FOUR SYSTEMS WITH A 15% MORTALITY OF RECENTLY SHED SEED EACH AUTUMN

(after Cussans, 1976)



Wilson also suggests that seed stocks of wild oat in an arable soil are likely to have originated from infestations in only two or three seasons. This is not true in all instances in New Zealand, for in one of the trials reported by Allen and Butler (1980) the paddock had been in pasture for eight years, yet a wild oat population of 135 plants per square metre was present in the first crop. Observations a year after wild oat trials were carried out by the Research Division of MAF clearly showed that the varying control of wild oats achieved in one year is reflected in the infestation in the subsequent crop. Thus prevention of wild oat seeding is a necessary step in any eradication plan.

#### HAND ROGUING

The effectiveness of roguing wild oats with a patented

herbicide glove compared with hand pulling was carried out in the United Kingdom (Holroyd and Strickland, 1978). They found that over a wide range of wild oat populations, time spent searching for wild oats remained relatively constant at 1.25 - 1.5 hours per ha. Time actually spent treating the wild oat panicle with the glove was three times faster than hand pulling - 1,450 per hour as against 540 per hour. Although treatment of panicles by the glove prevented formation of viable seed, some unviable wild oat seed appeared in the harvested grain. Roguing was possible with populations in excess of 15,000 per ha but not recommended except for patches. A swathe width of about three metres was the most convenient to use. Glove roguing has not been adopted in New Zealand, but it may assist roguing denser infestations presently attempted by hand pulling, thus bridging the gap between economic yield responses and eradication capabilities.

Hand roguing is carried out on Canterbury farms, and on farms with low levels of wild oats in the Ashburton County (Allen and Butler, 1979). 14 out of the 23 farmers interviewed did carry out this form of roguing. Unfortunately some farmers were not able to identify wild oats correctly but more disturbing, most wheat and barley paddocks had cultivated oat plants as impurities, thus making the job of roguing more difficult even though some cultivated oat variety panicles are reasonably easy to distinguish from wild oats.

#### CULTURAL CONTROL

A number of reports and articles have emphasised the partial control achieved by good management. Such programmes include:

\* utilisation of break crops to encourage seedling



growth but not seed production.

- \* preventing reinfestation from such sources as hay, grain and stock.
- \* burning stubble immediately after harvest.
- \* shallow cultivation rather than deep ploughing.
- \* use of direct drilling.
- \* encouragement of wild oat germination in the spring before the crop is sown.
- \* avoidance of crops that allow wild oats to seed prolifically.

#### CHEMICAL CONTROL

A number of herbicides have been tested in New Zealand and are registered for use. These herbicides, their rates of application and correct growth stage for application and notes are presented in Table 2.

Tri-allate is expected to give 80 - 95% control of seedlings (Scherp, 1972). Seedlings not killed grow on normally and are easily rogued. Other herbicides, when not successful, tend to make wild oats re-grow from basal nodes, or continue growing leaving plants not visible above the crop (Allen and Smallridge, 1972; McDowell, 1978; Butler et al., 1980) thus being more difficult to rogue.

In the 1979 cereal growers survey conducted by the Economic Division, MAF, farmers were asked the area of cereals they sprayed. The data for wheat was that in North Canterbury 1% of wheat was sprayed for wild oats (compared with 20%

TABLE 2. HERBICIDES FOR WILD OAT CONTROL IN WHEAT

<i>Common name</i>	<i>Rate a.i. kg/ha</i>	<i>Product name</i>	<i>Product/ha</i>	<i>Growth stage of wild oats</i>	<i>Notes</i>
barban	0.25-0.31	Neoban	1-1½ litres	1-2½ leaf	Apply in 90-100 litres water/ha at 350-400 KPa. Not recommended for undersown crops.
diclofop-methyl	0.9 -1.1	Hoegrass	2½-3 litres	2½-4½ leaf	Apply in 200 litres/ha.
difenzoquat	1.0	Avenge	5 litres	3 - 6 leaf	Add wetting agent, can be tank mixed with emulsifiable concentrate broad-leaved weed herbicide.
benzoylprop-ethyl	1.6-2.0	Suffix	8-10 litres	fully tilled - 2 node	If application is delayed to boot stage the wild oat panicle may emerge and set viable seed.
flamprop-methyl	0.8 -1.0	Mataven	4-6 litres	5 leaf - 2 node	Comments as for benzoylprop-ethyl.
L-flamprop-isopropyl	0.8 -1.0	Suffix BW	8-10 litres	5 leaf - fully tilled	Tentative recommendation only. Not yet fully registered.
tri-allate	1.4	Avadex BW	3.5 litres	pre plant	Soil incorporate either shortly before or after drilling. Fine clod seedbed is better, therefore better for spring sown crops. Crop seed should be placed below the treated zone.

for broad-leaved weeds); in Central Canterbury 18% (54%); in Mid Canterbury 17% (33%) and in South Canterbury 12% (64%).

It is clear that spraying for wild oats is not as widely practised as for broad-leaved weeds. Some reasons for lack of spraying have been discussed earlier; such as the low incidence of wild oats on low intensity cropping farms.

#### COMPARISON OF HERBICIDES

Baldwin (1979) in the United Kingdom reviewed some 200 trials on wild oats and blackgrass Agricultural Development and Advisory Service (ADAS), of the Ministry of Agriculture, Fisheries and Food. It should be noted that these comparisons often involved both blackgrass (*Alopecurus myosuroides*) and wild oats, but the conclusions as regards wild oats were:

- \* the fundamental aim must be total removal at the earliest possible stage to eliminate the possibility of competition.
- \* where wild oats emerge in autumn or early winter, early or split applications of herbicides may be necessary.
- \* post emergence treatments for wild oats can give high levels of control and good yield responses, but not in all cases.

Data presented by Baldwin shows that when applied at the growth stage recommended for each herbicide, all chemicals, in 40 - 45% of the trial comparisons, gave 94% control of wild oat seeding or better. In 20% of the trial comparisons less than 75% control of wild oat seeding was achieved.

This level of wild oat control is similar to that reported by Allen and Butler (1980) and Allen and Smallridge (1972) in Canterbury; but it is probably higher than the level reached in field use. Application methods and the later than recommended application of herbicides all contribute to a slight reduction in efficiency achieved by many farmers.

#### SUMMARY

Wild oats are a serious weed in intensively cropped arable areas, but not in less intensively cropped areas where there are longer intervals between cropping phases.

Wild oat seeding is the most important phase in a control programme, and prevention of seeding should be the principal aim in any eradication programme. Sources of contamination such as forage and herbage seeds are also important, and care must be taken to prevent import of wild oat seeds from these sources.

The use of an effective herbicide in high infestations of wild oats is economic but in low infestations thought should be given to the eradication of wild oats. A herbicide (tri-allylate) can be used to reduce wild oat levels to hand-roguable levels. Alternatively post-emergence herbicides may give sufficient control to prevent seeding. Evidence to suggest that this second alternative will be effective is not available in New Zealand. Given the reliability of herbicides in the United Kingdom it seems unlikely that eradication by this method will be successful, unless used in conjunction with other control measures.

REFERENCES

- ALLEN, F.C. and SMALLRIDGE, T.J. 1972. Chemical control of wild oats alone and with broad-leaved weeds in wheat and barley. Proc. 25th N.Z. Weed & Pest Control Conf.: 192-198.
- ALLEN, F.C. and BUTLER, J.H.B. 1979. Survey to locate wild oat free areas in mid Canterbury. Proc. 32nd N.Z. Weed & Pest Control Conf.: 149-152.
- ALLEN, F.C. and BUTLER, J.H.B. 1980. Comparison of some post-emergence chemicals for wild oat control in cereals. Proc. 33rd N.Z. Weed & Pest Control Conf.: 237-240
- BALDWIN, J.H. 1979. The chemical control of wild oats and blackgrass. A review based from ADAS agronomy trials. ADAS Quat. Rev., 69-101.
- BUTLER, J.H.B.; ALLEN, F.C.; LISTER A.J. 1980. Comparison of some wild oat herbicides for use in barley. Proc. 33rd N.Z. Weed & Pest Control Conf.: 241-244
- CUSSANS, G.W. 1976. Population dynamics of wild oats in relation to systematic control. Weed Res. Org. 6th Report: 47.
- HOLROYD, J. and STRICKLAND, A.G. 1978. Roguing wild oats. Weed Research 18: 175-180.
- MCDOWELL, A.B. 1977. Hoe 23408 - a new herbicide for control of wild oats and summer germinating grasses. Proc. 30th N.Z. Weed & Pest Control Conf.: 15-18.
- ROEBUCK, J.F. 1972. Systems of control of *Avena fatua* in spring barley. Proc. 11th British Weed Control Conf.: 731-735.
- ROEBUCK, J.F. and TRENNERY, J. 1978. System control of wild oats (*Avena ludoviciana*) in arable rotations. Weed Abstracts 27: 2108.
- SAVILLE, D.J.; ALLEN, F.C. and HOCKEY, P.R. 1979. A wild oat survey in Ashburton County. Proc. 32nd N.Z. Weed & Pest Control Conf.: 144-148.

- SCHEPP, L.A. 1972. The tolerance of winter wheat to tri-alleate. Proc. 25th N.Z. Weed & Pest Control Conf.: 203-206.
- WILSON, B.J. 1978. The long term decline of a population of *Avena fatua* L. with different cultivations associated with spring barley cropping. Weed Res. 18: 25-31.