CHAPTER 6

Objectives and Systems of Control

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The effects of wild oats on crop husbandry are expressed primarily in reduced crop yield. However, different husbandry systems affect the incidence of wild oats and are themselves affected in turn by the needs for wild oat control. This interaction between wild oats and farming systems must inevitably reflect the circumstances of individual growers. Different growers, while still primarily concerned with the maintenance of crop yield, may define the objective of control in different ways. Similarly, growers committed to different husbandry practices—dictated perhaps by soil or economic considerations—may adopt markedly different systems of control. Objectives of control and systems of control are obviously interrelated. While some advances have been made in defining objectives and in the development of systems of control, few critical analyses and appraisals have appeared in the literature.

OBJECTIVES OF CONTROL

The annotated bibliography of the world literature on wild oats (up to August 1972) surprisingly contained only five references to the objectives of control of wild oat and none of these proved relevant to modern cereal farming in Britain. However, an up-to-date contribution to knowledge on this subject has come from papers given at the 11th British Weed Control Conference in 1972. Some were concerned with the objectives of controlling weeds in general while other papers were specifically concerned with wild oat.

In considering the general objectives of weed control in cereals, Eddowes (1972) saw these as being the avoidance of physical and financial crop losses which might occur in the following ways:

(a) by reduced crop growth and yield because of competition for mineral nutrients, water, light, and possibly carbon dioxide;
(b) by necessitating the use of control measures which may themselves injure the crop and reduce yield;
(c) by interfering with harvest and thereby increasing harvest costs and yield losses;
(d) by lowering the quality of cereal grain through contamination with weed seed and foliage, by increasing the moisture content of the harvested grain, and by preventing uniform cereal maturation;

(e) by reducing yield and quality as a result of adverse effects of diseases and pests associated with weeds.

Subsequent speakers amplified Eddowes' general theme.

A similar view was put forward by Dashwood (1972) when providing four rules that a farmer must obey:

(1) The land must be free from weeds which carry over disease.
(2) The land must be free from weeds which compete with the crop and therefore reduce the yield.
(3) The land must be free from weeds which delay and complicate the harvest.
(4) The land must be free from weeds which will contaminate the final product.

Cussans (1972) saw the general object of weed control to be mainly economic: to ensure the continued profitability of a chosen system of cropping. Secondary objects are a satisfactory visual appearance and an orderly system of cropping. Carter (1972) similarly advocated an economic approach in that the individual farmer should seek the largest margin between financial output and costs of production. He requires high yields and low costs. The paper went on to advocate analysis of the relationship between crop growth and weed infestation on a field basis so as to lead to more logical decisions about control measures, the overall object being to live with weeds as cheaply as possible.

A specific concern with the objectives of controlling wild oats was apparent in a paper by Elliott (1972) which considered the subject in two ways. Since it is the seed in the soil that provides the continuity of an infestation from year to year and accounts for the rise and decline of populations of wild oat, seed—especially the reduction of seed entry into the soil—must become the central objective of control. The paper went on to point out that farmers have different objectives in control and therefore their control systems could be different. A distinction is drawn between four contrasting weed situations, arising in each case from the interaction of the farmer's attitude and the wild oat status of his land. These four situations are:

(1) where the farm is free of the weed and the farmer wishes it to stay that way;
(2) where the weed has entered the farm and is beginning to establish;
(3) where the farm is contaminated and reduction is the objective;
(4) where the farmer wishes to live with wild oat.

These contrasting situations call for varying inputs of hygiene and herbicide for control according to the needs of each situation. In the case of the first, proper application of inspection and roguing combined with care in preventing wild oat seed entry on to the farm should prevent the onset of the situation where the use of herbicide is necessary. On the other hand the farmer who lives with wild oat is mainly concerned with his herbicide policy, what it should be and how cheaply it can be achieved. It is suggested that the

key to control lies in restricting seed inflow to a level which would be lower than the average outflow.

For practical guidance on the objectives of wild oat control, the publications taken collectively provide inadequate assistance. The statements on general objectives are so general as to be inapplicable to particular wild oat situations. For example, it is of limited use to know that weeds interfere with harvesting unless such knowledge is supplemented with further information relating to the extent and form of interference. The specific statements of objectives are more helpful; however they provide hardly more than a starting point for a further development of the subject. The weed can be contained or reduced only by the systematic application of control measures over a period of years; therefore to be effective the systems need to be based on clear objectives. Since wild oats undoubtedly cost British farming many millions of pounds in lost crops and on expenditure for control, it can be argued that too little thought and research has occurred on the objectives of control. Similar criticism applies to many other countries.

SYSTEMS OF CONTROL

Until recently the literature has been extremely short of publications relating to systems of controlling wild oat. The few references that occur are either general or have been invalidated by the passage of time.

Petzold (1956), studying the effects of a change to combine harvesting in West Germany, concluded that the use of this machine would not have a directly deleterious effect, provided good farming methods were used but might induce weed problems through the encouragement of monocropping. In retrospect it can be said that the adoption of combine-harvesting, in greatly increasing the return of seed to the soil, has been a potent factor in encouraging wild oat.

Leggett (1955a,b,c) in Canada found that delayed seeding of early maturing barley planted at a higher than normal seed rate, plus application of fertiliser, gave the best control of *Avena fatua*. Stubbs (1956) in England advocated a similar policy based on a stale seed bed and early maturing barley. He also recommended smothering the weed with heavy stands of autumn cereals. However, he accepted that an arable rotation containing cereals cannot eradicate this weed because of its dormancy and longevity. Only alternate grass and cereal farming showed real promise.

Dadd (1957), concerned with British farming, drew attention to the introduction and spread of wild oats in seed-corn, bags, combine harvesters, farmyard manure and animal feed. He blamed the combine-harvester for allowing seed to shed due to delay in cutting compared with the binder and difficulty in cleaning the machine between fields. Varying crop sequences were seen as the principal method of preventing seed shedding over a number of years, so depleting the seed reserves in the soil.

It appears that the discovery and development of the herbicides barban and tri-allate in the early 1960s discouraged further consideration of

long-term systems, probably because it was felt at the time, and for some years after, that these herbicides would provide effective means for farmers to achieve short-term control. Whatever the reason, the 1960s are notable for a lack of publications concerned with systems for controlling wild oat.

It is only in 1970 that the subject comes up again, this time with new and more potent weapons and ideas about control systems. Referring to work at Boxworth Experimental Husbandry Farm, Selman (1970a) concluded that although elimination may be economically desirable there are many difficulties in achieving this end. He envisaged three contrasting situations occurring on different farms. On one farm there are only 1-2 wild oat plants/yd^2 (say 1-2 plants/m^2) in the barley, requiring the use of tri-allate in alternate years. On another farm, there are 2-40 plants/yd^2 in the barley, and tri-allate should be applied for 1-5 years consecutively, according to the wild oat density. The third situation relates to populations over 40 plants/yd^2; here the spray programme appeared open ended but would still be based on tri-allate.

Roebuck (1972) reported on a long term study of *Avena fatua* under seven systems of control applied to the same areas in each year in commercial crops of spring barley. Late sowing was compared with pre-emergence tri-allate and barban post-emergence applied each year, in alternate years only and the two herbicides alternatively. At the end of four years, there was evidence that the control measures effectively reduced the population of *Avena fatua* to rogueable levels and the value of the extra yield of barley covered the cost of treatment.

Carter (1972) referred to the need in intensive cereal cropping to relate wild oat control to that of other weeds such as blackgrass *Alopecurus myosuroides* and couch *Agropyron repens*. He emphasised the need for a systematic approach to the control of all weeds in cereals. A smaller labour force, larger farms practising reduced cultivations and intensive cereal systems, with a greater emphasis on wheat, will raise problems from mixed grass weeds and volunteer crops behaving as weeds. There is a need for systems which will integrate cultivations, husbandry and the systematic and economic use of herbicides.

Elliott (1972), reviewing progress over the broad field of wild oat research, pointed to the need to classify the very diverse situations which call for radically different approaches to control (see p. 114 for further details). For these contrasting situations, a combination of inspection, roguing and the systematic use of different herbicides were suggested. The role of the different herbicides as containers or eradicators of wild oat was described, the basis of the approach being to ensure that seed inflow into the soil is kept below the normal average outflow for policies of containment and is prevented altogether where eradication is the object. He concluded that a great deal of research is still required to establish effective systems of wild oat control in the long term at acceptable financial cost to farmers.

It is apparent from the paucity of publications that the information relating to systems of control is quite inadequate. However, in the last three years the number and type of publications show that research and advisory

workers are attempting to correct this situation. Unfortunately, most of the publications have related to spring barley whereas wild oat can be very serious in winter wheat. More emphasis ought to be given to the systematic control of *Avena fatua* in winter wheat.