CURRENT WEED CONTROL PRACTICES IN PEAS

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Summary

Cultural practice for the pea crop has been modified to include chemicals as the normal method of weed control. Dinoseb and MCPB either singly or mixed in varying proportions, and MCPB fortified with MCPA are the principal chemicals used. MCPA, sodium chloroacetate and barban are used in special circumstances.

INTRODUCTION

THE INCIDENCE and importance of weeds in peas is determined to some extent by the ecological requirements of the two main groups of varieties, garden peas and field peas, and by the way in which the crop is utilized.

Garden peas are grown on good class soils in districts where adequate moisture, either from rainfall or by reason of a moisture retentive soil, is available during the flowering and pod setting period.

Field peas are less affected by adverse conditions at flowering and can therefore be grown successfully on lighter soils and in less favourable climates.

Peas can also be classified according to whether they are vined green for freezing, canning or dehydrating (garden varieties only) or whether they are threshed, when ripe, for seed to be used for food or resowing. Each group has special weed problems.

In vining peas the berries of black nightshade (*Solanum nigrum*) and the flower buds of Californian thistles (*Cirsium arvense*) and mayweed (*Anthemis cotula*) are similar in size to shelled peas, and are undesirable adulterants. In seed peas the vines pack down towards the ground as they ripen and a few green weeds at harvest can prevent direct heading and force the farmer to windrow with its attendant risks. This leads to a call for almost weed-free conditions, a standard higher than that required by the usual yardstick of cost of control versus increases in yield.

Table 1 shows the area of crop for threshing and for vining. No figures are available for apportioning threshed peas into field and garden varieties but an estimate based on a knowledge of county cropping patterns gives a ratio of 60% field to 40% garden. This would place the field pea area at approximately 18,000 acres and the total garden pea area at 25,000 acres. Since less than a third of field peas and more than two-thirds of garden peas are sprayed, the area treated probably lies between 20,000 and 25,000 acres.

TABLE 1: TOTAL ACREAGE OF PEAS

Season	Threshed (ripe)		Vining (green)
	Area (acres)	Yield (’000 bu)	Area (acres)
1959-60	28,370	700	10,280
1960-61	28,314	404	10,657
1961-62	28,030	545	12,812
1962-63	(30,000) estimated	—	13,202
Mean 5 yr	28,536	467	

The importance of various districts are reflected in the provincial figures shown in Table 2.

TABLE 2: AREA OF PEAS BY PROVINCES, 1961-62

	Threshed	Vining
Gisborne	16	907
Hawke's Bay	674	6,685
Wellington	3,685	—
Marlborough	4,585	1,680
Nelson	101	2,150
Canterbury	17,868	1370
Otago	749	—
Southland	348	—

CULTURAL WEED CONTROL

Peas are frequently grown after grass since the germinable weed seed population is lowest at this point in the rotation. Pre-planting cultivation to strike and kill weed seedlings and perennial weeds is normal practice.

Post-planting cultivation, designed partly for weed control and partly to leave clod- and stone-free conditions favourable for harvesting equipment, often consists of harrowing and rolling at the 4- to 5-node stage. The alternative, harrowing and rolling after drilling, is also practised but risks a poor strike of peas if heavy rain occurs before the crop emerges. Harrows and mechanized weeders can be effective for post-emergence control on free soils, specially for spurrey, but in most cases the kill of weeds is not sufficient to cut out the need for subsequent chemical control. Furthermore cultivation tends partly to cover surviving seedlings with soil and thus reduce the efficiency of contact chemicals, and to delay subsequent chemical control beyond the optimum time. As a consequence, many farmers are now omitting this cultivation unless required to break a rain-formed crust. Spraying with the appropriate chemical is then carried out at the optimum time for treatment.

CHEMICAL WEED CONTROL

About sixty species of plants have been noted as occurring in sufficient numbers to interfere with the growth, harvesting and quality of the pea crop but the eleven listed at the top of Table 3 are the most frequent cause for concern. Many of the others are of limited distribution though of importance in a particular field, farm or district.

The treatment used in a field depends on the species of weeds present and their susceptibility to the chemicals available (Table 3). Limitations may be imposed by the variety, stage of growth or health of the crop and by prevailing weather conditions at the time of treatment. Each field must be assessed separately. District and seasonal patterns do occur, however. For example, redroot (*Amaranthus hybridus*) is a serious weed in the North Island, Nelson and the Wairau Plains but absent or a curiosity further south. In these northern districts, the spray programme is largely determined by the various combinations of this weed, fathen (*Chenopodium album*) and black nightshade. But redroot germinates later in the season than the other two so that early sown crops can often be sprayed with dinoseb whereas later sown crops must be sprayed with MCPB or the dinoseb/MCPB mixture.

The following treatments are in general use by farmers and contractors.

DINOSEB (DNBP)

The ammonium salt of dinoseb is used in the North Island and the north of the South Island in crops which contain black nightshade and fumitory (*Fumaria* spp.) but not redroot or Californian thistles. In Canterbury it is used when fumitory or cornbind (*Polygonum convolvulus*) are troublesome and at the cotyledon stage to kill pale willow weed (*Polygonum lapathifolium*). Redshank (*Polygonum persicaria*) can also be controlled but results are less reliable.

Amine salts of dinoseb are used to a limited extent because there is little risk of burning the peas at high temperatures and they are more effective than the ammonium salt against cornbind. These advantages are offset by the need for higher rates for equivalent weed control, less effective control of fathen and poor performance below 65°F.

Rates of application are varied between 0.6 lb and 0.9 lb phenol equivalent of the ammonium salt and 0.9 lb to 1.2 lb as amine salt according to growing conditions, size of weed and temperature at time of application.

MCPB

MCPB has the advantage of no toxic hazard and systemic action, but unfortunately continued use has brought to light a number of factors which limit its usefulness. Control of black nightshade, cornbind, fumitory and wireweed (*Polygonum aviculare*) is not reliable and recovery can, especially in the case of seed crops, give trouble at harvest. Black nightshade in processing crops can reach the green stage by vining time. Wild turnip (*Brassica campestris*) and shepherd's purse (*Capsella bursa-pastoris*) are not controlled early in the season when growth is slow, and, even under warm conditions, an unacceptable amount of recovery occurs. Redshank, spurrey and mayweeds are resistant, as are a number of lesser weeds the presence of which detract from the apparent effectiveness of the chemical.

However, MCPB is effective against Californian thistle and redroot which are not controlled by dinoseb, and as it also controls fathen it is used whenever these weeds occur without any quantity of the difficult weeds listed above.

Rates of application vary from 1 lb to 1¼ lb acid equivalent per acre with 1¼ lb the most frequent rate.

MCPB is used in all varieties of peas, including the purple flowered field peas (*Pisum sativum* var. *arvense*).

MCPA

MCPA at 0.5 lb acid equivalent per acre was used extensively in Canterbury to control Californian thistle until the introduction of MCPB. Good yields were obtained but limited evidence indicated that yields were reduced compared with weed-free peas. Purple-flowered field peas suffered severe yield reduction at rates over 0.25 lb MCPA (Allen, 1956).

Some MCPA spraying is still done because of the low initial cost and its effectiveness against wild turnip in conditions not suitable for dinoseb.

SODIUM CHLOROACETATE

This chemical gives good control of cornbind and spurrey at rates from 12 to 20 lb per acre and is used occasionally for this purpose. Patterson (1961) has advocated its use in mixtures with MCPB for redshank and fathen but field results have been disappointing.

DINOSEB PLUS MCPB MIXTURES

Since it was first shown in the Hawke's Bay district (June, 1959) that mixtures of the translocated MCPB and contact dinoseb would give adequate control of mixed populations of black nightshade and redroot, use of the mixture has increased considerably and spread to other districts with combinations of weeds susceptible to one and not the other.

The proportions used are those found by the individual spray operator to be effective under the conditions existing at the time of operation. As little as 0.2 lb of the ammonium salt of dinoseb added to 1 lb of MCPB can produce outstanding results with cornbind and fumitory but for reliability rates must be equal to or in excess of the minimum recommended dose of each chemical. Rates in practice range from 0.5 to 0.9 lb ammonium dinoseb plus from 0.7 lb to 1.5 lb MCPB.

Dinoseb at 0.5 lb plus MCPB at 0.7 lb is used for actively growing seedlings. Higher rates are used for older weeds and unfavourable growing conditions in proportions related to the known susceptibility of the weeds.

The mixture is more reliable for cornbind than for either chemical alone but is less satisfactory for Californian thistle than MCPB alone. It deals adequately with mixtures of weeds which recover from MCPB (wild turnip, black nightshade, fumitory, cornbind) and those which regularly recover from dinoseb (Californian thistle, redroot, nettles (*Urtica* spp.)).

It can be used on all varieties of peas provided the conditions for use of dinoseb are observed.

MCPB PLUS MCPA MIXTURES

This mixture was introduced to deal with the combination of Californian thistle and wild turnip frequently encountered in Canterbury (Allen, 1958).

It is usual to choose the rate of MCPB considered necessary for controlling the susceptible weeds and then to substitute about 1/7th of this with MCPA. For example using 4 lb acid equivalent products 2½ pints of MCPB can be cut to 2 pints 3 fl. oz and 7 oz of MCPA added.

Spraying is carried out as soon as most of the Californian thistle shoots are through the ground.

The mixture is not used on purple-flowered field peas or on early varieties such as William Massey when the latter are suffering a check in growth owing to drought or disease.

BARBAN

Field peas and garden peas for vining green and for seed have been treated for wild oats using 6 to 9 oz a.i. per acre.

APPLICATION OF CHEMICALS

Pea spraying is done with equipment designed for applying 10 to 40 gal of spray mix per acre at speed of from 3 m.p.h. to 8 m.p.h. Contractors use Landrovers, four-wheel-drive trucks or trailer-transported tractors. They favour high delivery roller rotary or piston pumps which may be coupled to the vehicle motor or driven by a separate motor. Farmers usually use tractor mounted equipment with p.t.o.-driven roller rotary or gear pumps. Spray tanks range from the standard 44 gal oil drum to specially designed tanks of 100 to 300 gal capacity.

MCPB is usually sprayed in 10 to 20 gal per acre of water with 15 gal per acre being the most usual volume. Observation trials have shown that, in light to moderate winds, curvature of the peas is greater at volumes less than 10 gal per acre than at 15 or more. Pressures of 30 to 50 lb/sq. in. are used. Failures due to faulty application are rare.

Dinoseb is sprayed in 20 to 40 gal of water per acre with 30 the most usual quantity. Pressures range from 30 to 80 lb/sq. in. Poor results attributable to incomplete coverage occur during "tough" growing conditions. These failures have led to a wide variation in spraying procedures other than that most likely to succeed, namely doubling or trebling the volume of water applied. This is because the farmer is not prepared to pay either directly or through increased contract rates for redesigning equipment, higher operating costs and for the higher rates of chemical needed when he already obtains a high proportion of success with the present "high volume" application. However, by using higher pressures, solid cone instead of fan tips (Featherstone, 1957) and 7 in. spacing instead of the usual 14 in. to 15 in. spacing of nozzles, some improvement has been obtained through increasing the drop-let numbers and angles of incidence.

Sodium chloroacetate and mixtures of MCPB and dinoseb are applied as for dinoseb while MCPA and MCPA/MCPB mixtures are sprayed in 15 to 20 gal per acre.

Barban is applied in 9 to 15 gal of water using 50 to 60 lb/sq. in. pressure.

ASSESSMENT OF PRESENT METHODS

The present range of chemicals enables growers to achieve the main purpose of weed control, namely, yields little affected by weed competition. Unsatisfactory results are the exception and peas are now grown with confidence on land formerly considered too weedy for this crop.

However, because of the high standard of control demanded, the poisonous unpleasant nature of dinoseb, the incomplete weed range of individual chemicals, the added cost and inconvenience of mixtures, and the limited conditions for success against a number of weeds, most users express some degree of dissatisfaction with present techniques. Redshank, cornbind, wireweed, spurrey, daisy weeds, mallow (*Malva* spp.), cleavers (*Galium aparine*) and barnyard grass (*Echinochloa crusgalli*) are weeds often reported as difficult or impossible to control. Cornbind and wireweed seem to be increasing in importance owing to the removal of competition from susceptible weeds.

As to the future, the change in outlook of farmers from regarding chemical weed control as an avoidable possibility to that of an inevitable necessity removes the psychological barrier to pre-emergence weed control. The dry surface conditions so frequent following drilling remain as a bar to the success of soil-acting chemicals. A non-poisonous foliage absorbed translocated selective chemical with a wide weed spectrum remains the ideal.

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TABLE 3: WEED SUSCEPTIBILITY TO CURRENTLY USED CHEMICALS

Weed	Dinoseb	MCPB	MCPB+ Dinoseb	MCPB+ MCPA	Sodium chloroacetate
A. OF MAJOR IMPORTANCE					
Black nightshade (Berry weed) (<i>Solanum nigrum</i>)	S	MS	S	MS	S
Californian thistle (<i>Cirsium arvense</i>)	CH	S	MS	S	CH
Cornbind (<i>Polygonum convolvulus</i>)	SL	CH	S	CH	S
Fathen (<i>Chenopodium album</i>)	S	S	S	S	CH
Fumitory (<i>Fumaria muralis</i> ; <i>F. officinalis</i>)	S	CH	S	CH	O
Redroot (<i>Amaranthus hybridus</i>)	CH	S	S	S	S
Redshank (<i>Polygonum persicaria</i>)	CH	O	CH	O	S
Spurrey (yarr) (<i>Spergula arvensis</i>)	SL	O	SL	O	S
Wild turnip (<i>Brassica campestris</i>)	S	CH-MS	S	S	MS
Willow weed, pale (<i>Polygonum lapathifolium</i>)	SL	O	SL	O	MS
B. OF LESSER IMPORTANCE					
Apple of Peru (<i>Nicandra physaloides</i>)	SL	—	SL	—	—
Catchfly (<i>Silene gallica</i>)	S	MS	S	MS	—
Chickweed, mouse-eared (<i>Cerastium glomeratum</i>)	S	O	S	O	S
Chickweed, slender (<i>Stellaria media</i>)	S	O	S	O	S
Cleavers (<i>Galium aparine</i>)	O	O	CH	O	MS

Creeping fathen (<i>Chenopodium pumilio</i>)	.....	MS	S	S	S	—
Curnow's curse (<i>Calandrinia ciliata</i> var. <i>men- ziesii</i> ; <i>C. compressa</i>)	.....	S	MS	S	MS	—
Hedge mustard (<i>Sisymbrium officinale</i>)	.....	S	S	S	S	S
Henbit (<i>Lamium amplexicaule</i>)	.....	MS	MS	MS	MS	—
Hoary cress (<i>Cardaria draba</i>)	.....	O	S	CH	S	—
Mallow, dwarf (<i>Malva neglecta</i>)	.....	O	O	O	O	—
Mayweed, scentless (<i>Matricaria inodora</i>)	.....	SL	O	SL	—	O
Mayweed, stinking (<i>Anthemis cotula</i>)	.....	SL	O	SL	—	O
Nettle (<i>Urtica urens</i>)	.....	SL	S	S	S	S
Orache (<i>Atriplex patulum</i>)	.....	SL	S	S	S	CH
Pansy (<i>Viola arvensis</i> ; <i>V. tricolour</i>)	.....	MS	O	MS	O	—
Red dead nettle (<i>Lamium purpureum</i>)	.....	MS	CH	MS	CH	—
Shepherd's purse (<i>Capsella bursa-pastoris</i>)	.....	S	MS	S	S	S
Speedwell (<i>Veronica persica</i>)	.....	MS	CH	MS	CH	S
Staggerweed (<i>Stachys arvensis</i>)	.....	S	CH	S	MS	—
Thorn apple (<i>Datura stramonium</i>)	.....	SL	MS	S	MS	—
Barnyard grass (<i>Echinochloa crusgalli</i>)	.....	—	—	—	—	—
Wild oats (<i>Avena fatua</i> ; <i>A. persica</i>)	.....	Barban	—	—	—	—

S=Satisfactory: killed or controlled sufficiently to cause no trouble at harvest.

MS=Moderately satisfactory: surviving plants controlled for variable period sometimes at harvest.

SL=Satisfactory, limited conditions: conditions for kill or satisfactory control limited, making reliable field-scale use difficult.

CL=Checked: control often sufficient to allow crop away but regrowth competes with crop and interferes with harvest.

0=0: no reaction or check of no benefit.

Note: Annual weeds as small seedlings. Rates chosen to suit prevailing conditions.

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