THE WEEDS OF CANTERBURY

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Summary

Canterbury, like the rest of New Zealand, has its quota of weeds. To list them all would serve little purpose: to comment on each and every one is a task beyond the space allotted this paper. Comments are confined to the problem weeds, both actual and potential. As physical environments and farming systems tend to influence the type of weeds present and the problems associated with and methods adopted for their control, reference is made to these factors by way of introduction.

LOCATION AND CLIMATE

CANTERBURY PROVINCE, some 200 miles long by 60 to 90 miles wide, forms the mid-eastern sector of the South Island. The region's southern boundary extends almost to the 45th parallel—half way from the Equator to the South Pole.

Location suggests a climate in the "mid-latitude, marine" group—one of moderate temperatures with no marked divergence between summer and winter means and no, definitely defined, "dry" or "rainy" seasons of the year. So far as Canterbury is concerned, the high, snow-capped ranges modify this generalization. They induce relatively long and cold winters and strong, hot, north-west winds that counteract the effectiveness of summer rains.

Average annual rainfalls, at low altitudes, vary from 25 to 45 in. It is only in the remote hinterlands that falls reach 60 to 70 in. or more.

The frequent, hot, dry autumns, supplemented by the low, moisture-holding capacity of many soils, plus the persistent depredation of insect pests—grass grub (*Costelytra* spp.) and subterranean caterpillars (*Oxycaenus* spp.)—render many pastures and crops vulnerable to invasion by both annual and perennial weeds.

General speaking, the climate throughout is a grassland one. Originally fescue and *Poa* tussock associations formed the predominant vegetation below the bush line. Mountain forests of beech (*Nothofagus*), mainly between 2,500 and 4,500 ft, persist in the rangelands. The mixed (podocarp-*Nothofagus*) bush of Banks Peninsula has disappeared. The formerly treeless lowlands are now patterned with conifer shelterbelts and plantations.

LAND FORMS AND FARMING SYSTEMS

Canterbury is a region of contrasting plains, downlands, hills and mountain ranges. Plains and downs, with coastal hills to the north and south, occupy the eastern, coastal section: mountain ranges, the western backdrop.

PLAINS AND DOWNLANDS

The coastal plains are founded on delta fans of deep, greywacke gravels of glacial origin, deposited by wide, braided rivers. They rise from sea level to approximately 1,200 ft. The northern, inland, Amuri plains and the vast, elevated, Mackenzie Basin in the south, are of similar origin. Soils types on the plains range from thin, stony, free-draining soils to deep sandy or silty loams, in some parts, influenced by high water-table levels. Light land soils predominate (over 1 million acres), but fairly extensive areas of

friable, fertile loams exist throughout. Marked variations in soil type appear on most farms and, frequently, within individual fields.

The downlands, to the north and south, rise from easy, rolling, contours to high, steep-sided downs. Their soils are, basically, silts and clays, with occasional belts of limestone. Some of the steeper slopes of cold, shady aspect, are scrub-infested. The farming systems of the plains and arable downs are, predominantly, devoted to either fat lamb production or mixed (arable) farming, combining cash cropping with fat lamb raising. The principal cash crops are wheat, barley, oats, peas, potatoes, linseed, and small seeds.

The steeper downs feature fat lamb and cattle raising, while the high and colder Mackenzie Basin is farmed on high country lines.

Dairying, largely for town milk supply, is restricted mainly to the more fertile and sometimes high water-table soils near main centres of population, excluding the Mackenzie Basin.

There are approximately 1¼ million acres of plains and downland soils.

HILLS AND HIGH COUNTRY

The coastal hills and inland mountain ranges stand out in bold and rugged relief on the Canterbury landscape. Most hills rise to 1,500 to 2,500 ft, with moderately steep to steep slopes and rocky outcrops of contrasting, shady and sunny aspects. Soil depth and rockiness vary with slope but sunny facings are often hard and dry.

Wool, store sheep, and cattle and a proportion of fat stock are the main products of the hills and valleys. On the steeper, more fertile volcanic and loess soils of Banks Peninsula, dairying is often combined with sheep and cattle raising and fattening.

The mountain rangelands (including the Mackenzie Basin) are higher and more rugged, though there are many easier basins and extensive river terraces. Soils of the slopes are young, often unstable, and still actively forming and/or eroding. The basin and river terrace soils vary in depth and stoniness. The high country tussock grasslands and snowgrass basin above the forest line are grazed up to 5,000 ft or more in summer, but under the 3,000 ft level in winter. These rangelands are the home of fine-woolled, halfbred and Merino sheep. Wool, and some store stock, including cattle, are the main products of extensive rangeland, grazing management.

There are some 5¼ million acres of hills and high country soils.

LAND USE

Today, the approximate acreages devoted to the various crops and pastures are as follows:

		(acres)	
Cash Crops			
Cereals	.....	186,000	
Others	.....	41,000	
Total	.....	227,000	
Forage Crops			
Roots	.....	120,000	
Greenfeed (brassica)	.....	109,000	
Other	.....	25,000	
Total	.....	254,000	
Total crops	.....	481,000	
Sown pastures	.....	2,275,000	(including lucerne)
Unimproved	.....	4,800,000	(mainly tussock grasslands but including ¼ m. acres of scrubland)
Total occupied area	.....	7,620,000	

Canterbury's 9,000 holdings, averaging 850 acres per holding, carry over 7¾ million sheep (including 5¾ million breeding ewes); 150,000 beef cattle (including 47,000 breeding cows); and 89,000 dairy cattle, including 55,500 cows in milk [1959-60 A. & P. Statistics].

Under these environments the weeds of Canterbury exist and, at times and in places, flourish.

CASH CROP WEEDS

Cropping, with both cash and/or forage crops, forms an integral feature of Canterbury farming. Consequently, crop weeds are of considerable local significance.

CEREAL CROPS

Of the cash crops, the grain cereals, especially wheat, are the most widely grown. Wheat is autumn sown, mostly on the medium and high fertility soils. It normally follows either grass or rape in the rotation, but may be preceded by peas, potatoes or linseed. Barley, the next in importance, is spring sown, usually after winter roots or greenfeed. Oats, like barley, normally fit in as the second or only cereal in the rotation. The weed risk in cereal crops is reduced if the crop follows grass or a clean cultivated crop like potatoes—though, owing to lateness of the main crop harvest, potato crops are not always clean.

The chief weeds of cereals include Californian thistle (*Cirsium arvense*), wild turnip (*Brassica campestris*), cornbind (*Polygonum convolvulus*), wild oats (*Arvena fatua*), vetches or tares (*Vicia* spp.), and nodding thistle (*Carduus nutans*).

On heavy wheat land, in wet season or unthrifty crops, fathen (*Chenopodium album*) and redshank or willow weed (*Polygonum persicaria*) can prove troublesome.

Most weeds in cereals can be controlled, though not necessarily eliminated, by chemical spraying. MCPA is normally employed but amine salt of 2,4-D is required for the more difficult-to-kill species like cornbind, fathen, and redshank.

Crop varieties producing a heavy flag are useful weed suppressors on weed-prone cereal ground.

Difficult-to-control weeds in cereals are discussed by Allen (1962) and Meeklah (1962).

PEAS

The pea crop is very susceptible to weed competition and is grown, mainly, on medium soil types. In addition to those already listed for cereals, weeds often prolific and troublesome in pea ground include fumitory (*Fumaria officinalis*), wire weed (*Polygonum aviculare*) and black nightshade (*Solanum nigrum*).

Where, as is usual, peas follow grass, weeds are, generally, not a grave problem. Where they are, chemicals can be employed using either a phenol or MCPB or a combination of both. The phenols control a wide range of annuals but are unsuitable for perennials like Californian thistle. Fortunately, MCPB handles most perennials (except *Polygonum*) without undue crop damage. Post-emergence harrowing is fairly common practice for control of early weeds in peas.

POTATOES

Weed competition in the growing potato crop is, normally, combated by cultivation. Post-emergence harrowing, followed by inter-row cultivation, suppresses most weeds, except in wet seasons. Weeds likely to prove troublesome, if unchecked, include fathen, Californian thistle, cornbind and couch grass (*Agropyron repens*). Bare fallowing with repeated surface cultivations and heaping and burning of the mass of rhizomes brought to the surface when pre-

paring the ground for planting, is still standard practice for couch control.

As Canterbury's main-crop potatoes are lifted late in the season, matted weeds like yarrow (*Achillea millefolium*) and speedwell (*Veronica* spp.) developing after crop growth has ceased may cause trouble at harvest. Two chemicals can be employed to relieve the situation, and are often used in the dual roles of weed suppressors and crop dessicants. Arsenical compounds have been used for some time for such purposes. The recently introduced dibromide compound, diquat, is also effective and, in addition, non-poisonous.

FORAGE CROP WEEDS

The brassicas, turnips, and swedes for winter fodder and rape for autumn fattening account for the major portion of the forage crop acreage in Canterbury. Turnips and rape are grown on the lightest to the heaviest soils. Swedes and other winter forages like choumoellier, and the very limited areas of mangolds and fodder beet, are found on the more fertile soils. Greenfeed cereals, barley, oats and, occasionally, ryecorn, are grown as catch crops for winter/early spring feeding. Maize for autumn greenfeed or silage is restricted to dairying land. The only other fodder crop of any consequence is blue lupins, grown on light land.

Weed competition is not generally serious in greenfeed cereals and lupins. The rape crop is prone to suffer more frequently from drought and/or insect (aphid) damage than from weeds. Maize is grown in weed-prone ground and 2,4-D is employed against fathen—the most serious weed of local maize crops.

Problem weeds of turnip and swede growing include spurrey (*Spergula arvensis*), Californian thistle, fathen, red shank, chickweed (*Stellaria media*), and sometimes nodding thistle and Scotch thistle (*Cirsium lanceolatum*), wild turnips and speedwell.

Because of the large acreages grown and the susceptibility of crop seedlings to both weed competition and chemical treatments, turnip and swede growing poses decided weed problems. These can be largely overcome by ridging. Ridging, though not universally practised in Canterbury, is often adopted under irrigation and in higher rainfall districts. As spurrey and fathen are not controlled by MCPA and other chemicals are severe on crop plants, post-emergence spraying is unsafe. Pre-emergence treatment has proved unreliable under local environments. Sowing after grass helps and winter and spring fallowing can also assist.

CROP HUSBANDRY

Though post-emergence use of herbicides can and does serve a useful purpose and is employed fairly extensively on such cash crops as peas, the cereals and potatoes, the Canterbury farmer tends to rely upon traditionally adopted, and normally effective, crop rotation and cultivation techniques to overcome the actual and potential weed problems of arable ground.

Bare fallowing, thorough seedbed preparation, timely sowing with viable seed of good purity and with adequate manuring, pre- and post-emergence harrowing, and inter-row cultivation, where feasible, coupled with a sound crop rotation programme, are all, basically, sound principles in mitigating the weed problems of cropping land.

PASTURE WEEDS

The establishment and maintenance of dense, vigorous swards of compatible and useful species is the obvious solution to pasture weed problems.

In a region of relatively low rainfall subject to seasonal droughts, where many soils are light and free-draining or exist on steep,

rugged and exposed slopes, where the depredation of sward-destroying insects are of common occurrence, where river and stream beds are wide, gravelly and much braided, and where other favourable sites for weed propagation abound, the achievement of the ideal is "easier said than done". Throughout Canterbury, a dozen or more weed species constitute serious pasture problems whilst numerous others are of lesser, but, nevertheless, annoying importance. Several as yet localized, are of serious potential if allowed to proceed unchecked.

Most of the more serious species and many of the lesser and potential ones are declared noxious by the majority of the 24 local county councils administering the Noxious Weeds Act. Thirteen of these counties have adopted the entire 1st schedule list; eighteen operate in group associations of six combined Noxious Weeds Committees employing full-time inspectors. One acts independently with a full-time inspector and five with part-time inspectors. Only one county does not administer the Act. Administration costs county ratepayers about £6,000 per annum and State subsidies amount to £5,400.

Examples of the more serious weeds of pastures (and waste places) in Canterbury are as follows.

NASSELLA TUSSOCK (*Nassella trichotoma*)

If a weed's significance is judged by the fact that a special Act of Parliament (Nassella Tussock Act 1946), a special authority (North Canterbury Nassella Tussock Board) with a State subsidy of £58,000 per annum (plus £7,000 county contribution) has been set up to deal with it, then nassella tussock must take pride of place. This domineering, xerophytic tussock well merits the dubious honour conferred upon it.

Within the local Board's district, 900,000 acres are ranged in search of it. Scattered infestations of serious potential exist elsewhere in North and Mid-Canterbury and are engaging the active attention of the counties and other local and State organizations concerned. Most of the former, densely infected, "nucleus" areas have been controlled by aerial spraying with 2,2-DPA or, in one or two instances, by tree planting. Infestations of scattered plants are arduously hand-grubbed, property owners being materially assisted in this work by the Board's grubbing gangs and ranging staff — involving up to 100 men, in peak periods, each year.

The remaining major infestations are currently being attacked by the Board and by increasing State participation. The Lands and Survey Department recently purchased some 15,000 acres of heavily infested properties (with an additional 6,000 acres under negotiation) where control measures were beyond the physical and financial capabilities of private ownership.

The problems posed by nassella tussock lie not so much in the nucleus areas, which can be suppressed by chemical spraying (though this is costly), but by the fact that (a) nassella tussock's prolific seed is widely distributed by many agencies and remains viable in the soil, as a continual source for re-infestation, for many years; (b) scattered nassella tussock and re-infesting seedlings require laborious hand grubbing, mostly in difficult country; (c) labour for grubbing is difficult to secure; and (d) the establishment and maintenance of a useful, competitive cover is difficult to achieve in the environments where many infestations of nassella tussock are to be found.

Nassella tussock research is summarized by Leonard (1962) and Maxwell (1962).

NODDING THISTLE (*Carduus nutans*)

This thistle is viewed almost, if not as seriously, as nassella tussock. It is prevalent throughout the plains of Mid-Canterbury and is rapidly encroaching to the north and south.

Nodding thistle makes most noticeable advances in a sequence of dry seasons when climatic effects, aggravated by insect damage, lead to close grazed, open swards, vulnerable to weed invasion. Like all other serious weeds, nodding thistle infests waste places. Its seed is readily transported, especially in sheep's fleeces.

In the small rosette stage, this thistle is susceptible to low rates of hormone herbicides, but, being a perennial, plants at various growth stages are likely to be present at most times of the year. This introduces difficulties when implementing control measures (Delahunty, 1962).

CALIFORNIAN THISTLE (*Cirsium arvense*)

This rhizomatous plant is widespread and has long been recognized as a serious weed of pasture and crops. It competes on soils of all degrees of fertility and is extremely difficult to eradicate, selectively, from established swards.

Californian thistle is more readily controlled by long fallows with repeated surface cultivations or by sprayings with MCPA, MCPB or 2,4-D in crops that can be selectively treated. Chemical spraying of strongly established Californian thistles in old pastures is seldom successful.

GORSE (*Ulex europaeus*) and BROOM (*Cytisus scoparius*)

These two aggressive scrub weeds are commented on in association. They often appear as such in pastures and waste places. Both are widespread and frequently conspicuous on unimproved lightlands, downs and hill pastures, along roadsides and in riverbeds and other waste areas.

A good deal of aerial and ground unit spraying of gorse is done — concentrate emulsifiable formulations of 2,4,5-T being usually employed. Chemical treatment, in itself, is seldom successful in eliminating established stands of gorse or broom. It can supplement, but is often best replaced by, burning, oversowing and topdressing, adequate subdivision and concentrated grazing management.

As roadside weeds these two species occupy much of the time of the eight spraying units operated by local counties and those used by the Ministry of Works along main highways.

BLACKBERRY (*Rubus* spp.)

Blackberries are localized weeds occurring in isolated areas in some downs and hill country districts. Infestations are usually confined to lower hill slopes, stream sides and embankments or to roadsides and waste places. It is sometimes found associated with gorse and broom.

Blackberries can be eliminated by spraying, when in flower, with emulsifiable esters of 2,4,5-T or other similar herbicides. Spraying is followed by burning, and, where feasible, oversowing. Re-growth spraying may be necessary.

SWEET BRIER (*Rosa rubiginosa*)

This tough, thorny shrub occurs in all 25 counties and from sea level to 3,000 ft. It is most prevalent and encroaching most rapidly in the high country where the rugged terrain and open tussock canopy offer little resistance. Sweet brier is highly resistant to cutting, burning or browsing (except in the seedling stage) though its fruity, seed-bearing "hips" are relished by birds and animals which are largely responsible for sweet brier's widespread distribution.

bution. It is difficult and arduous to grub in most habitats. Coverage spraying is usually ineffective unless often repeated. Basal applications of 2,4,5-T-in-oil; 2,3,6-TBA-in-water, or substituted urea pellets are reasonably reliable provided the treatment can be thoroughly applied to individual plants (Dingwall, 1962).

This troublesome invader is spreading so alarmingly that, despite the drawbacks and deficiencies of available control measures, every effort should be made to confine present infestations and gradually reduce them.

MATAGOURI (*Discaria toumatou*)

This spiny, native scrub has a habitat range similar to sweet brier and, like the latter, is most troublesome in hill and high country where the two often occur together.

Matagouri is one of the few known, non-leguminous plants capable of "fixing" nitrogen and it responds to superphosphate in tussock grassland improvement work.

Burning at 5- to 7-year intervals has been standard control practice. Evidence regarding the possibilities of chemical control is inconclusive.

BRACKEN FERN (*Pteridium equilinum* var. *esculentum*)

This weed makes prolific growth, especially in shady aspects, on Banks Peninsula, but is less robust on the drier hills and colder high country. Chemical treatments show little promise and are unnecessary. Best results are achieved by burning, oversowing and concentrated grazing, preferably by dry sheep and cattle.

HEMLOCK (*Conium maculatum*)

This highly toxic plant occurs more prevalently in waste places and sheltered sites than in pasture swards. It is highly poisonous to humans (as well as to stock) and has caused several fatalities involving children. It can be distinguished from two similar, but more innocuous weeds, fennel (*Foeniculum vulgare*) and wild carrot (*Daucus carota*) by the purple blotching of its hollow stems.

Hemlock seedlings and plants to the full rosette stage are susceptible to ester of 2,4-D. More mature plants are resistant.

RAGWORT (*Senecio jacobaea*)

This toxic perennial is localized in the higher rainfall downs and hill districts where it often occupies the more fertile sites and becomes conspicuous on cattle country. Its prolific and very small seeds are readily distributed in the fleeces of sheep. Plants regenerate from root cuttings.

Ragwort can be controlled by "spot" spraying with salts or amines of MCPA or 2,4-D in the early rosette stage and esters of 2,4-D when more mature.

DOCK (*Rumex obtusifolius*)

This deep-rooted species is a problem of high fertility pastures and is prevalent on many dairy farms where it occupies valuable sward space and creates cropping difficulties.

Seedlings and re-growth docks, following through cultivation when cropping or renewing pastures, can be effectively controlled with 2,4-DB. Mature plants are highly resistant to treatment.

BARLEY GRASS (*Hordeum murinum*)

This annual species is becoming widespread and aggressive wherever swards are open or ground cover is broken and the soil fertility status improves. It often inhabits sites on which it is difficult to maintain a competitive cover—i.e., round plantations, buildings, gateways and on knolls and ridges.

Chemical treatment with TCA and 2,2-DPA is effective though, in practice, not all plants are prevented from seeding. Latest (North Island) control recommendations are: (a) Mark out, in January, area to be sprayed; (b) spray with TCA, 15 lb a.i. per acre in June, and (c) re-spray with 2,2-DPA, 1½ lb a.i. per acre in September.

CONCLUSION

The foregoing constitutes only a sample of the weeds that occur in the crops, pastures and waste places of Canterbury. Space does not permit comment on many others frequently encountered such as bidi bidi (*Acaena sanguisorbae*), burdock (*Arctium lappa*), sheep's burr (*Acaena ovina*), rushes (*Juncus* spp.), sedges (*Carex* spp.), buttercup (*Ranunculus* spp.), tutu (*Coriaria* spp.), vipers bugloss (*Echium vulgare*), foxglove (*Digitalis purpurea*), St. Johns' wort (*Hypericum perforatum*), and a host of others.

Nor has there been time to consider weeds of lucerne, drains and irrigation ditches, market gardens and other sites and situations where weeds are a problem.

In conclusion, it is considered appropriate that attention should be drawn to a number of species already established and tending to spread, and which constitute a potential menace if left to their own devices.

These potentially dangerous weeds include hawthorn (*Crataegus monogyna*), elderberry (*Sambucus nigra*), boxthorn (*Lycium ferocissimum*), Spanish heath (*Erica lusitanica*), wild currant (*Ribes sanguineum*), Grecian thistle (*Chamaepuce afra*), and variegated or milk thistle (*Silybum marianum*).

With the possible exception of variegated thistle, none of these species are easily controlled once they become strongly established. Early efforts should be made to prevent them from becoming major problems.

Boxthorn and wild currant and also hawthorn and elderberry of less than 3 in. diameter, should be basally treated with oil-soluble ester of concentrate 2,4,5-T-in-oil. Larger plants are best cut and "stump" treated. Spanish heath is susceptible to oil-soluble esters of 2,4-D and to soil fertility improvement, with particular attention to liming. Grecian thistles, when young, can be controlled with esters of 2,4-D whilst variegated thistle in the rosette stage is readily susceptible to MCPA and 2,4-D.

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