TUSSOCK GRASSLANDS AND MOUNTAIN LANDS INSTITUTE

REVIEW
Sweet brier has long been a serious weed in many parts of New Zealand but, since the control of the rabbit, it has increased and spread so rapidly in the tussock country of the South Island that it has become a serious menace to production on thousands of acres of pastoral land and threatens hundreds of thousands more. The Committee of Management of the Institute is deeply concerned about the brier problem and is printing this article in an attempt to bring runholders up to date with available information.

There is much confusion in the spelling of the name, the following all being used: sweet brier, sweetbrier, sweet briar and sweetbriar. The New Zealand Government Printer prefers the form “sweet brier.”

Four different species of rose have been recorded as being found wild in New Zealand but only two are of any significance—sweet brier and dog rose.

**SWEET BRIER**

The correct botanical name is *Rosa rubiginosa*. The second word comes from the Latin meaning “rusty” and refers to the brownish-red tint often seen on the stems and leaves. Previously the plant was known as *Rosa eglanteria* which recalls the old name of Eglantine under which it had its praises sung by the poets.

Shenstone: “Come, gentle air! and while the thickets bloom
Convey the woodbine’s rich perfume,
Nor spare the sweet-leaved Eglantine.”

Shakespeare: “Quite over-canopied with luscious-woodbine,
With sweet musk roses and with eglantine.”

Scott: “Here eglantine perfumed the air.”

(Incidentally, Sir Walter Scott was so fond of brier that when he commissioned the tree planting at Abbotsford, he ordered 2000 sweet briers planted as underwood.)

The name brier comes from the Latin “bruariurn”—a waste place, and refers to the kind of ground that the plant normally occupies in Britain, Europe and Central Asia, the countries which it originally inhabited.
The plant is easily recognised by the aromatic scent of the foliage when rubbed. This comes from small glands occurring freely on the leaf stalks and on the under side and edges of the leaflets. The stems are noted for their vicious, large, hooked prickles interspersed with smaller, straight ones. Suckers sprout freely from the woody root-stock.

The flowers are pink. They may be solitary or in clusters of three to seven. The five sepals, five petals and numerous stamens are arranged round the rim of a deep, hollow receptacle. Numerous carpels are sunk in the receptacle, each carpel having a long style. Unlike most roses, sweet brier secretes nectar on the broad fleshy margin of the receptacle. After fertilisation, each carpel forms a small, dry fruit covered with stiff hairs, each fruit being known as an achene. As the achenes ripen, the receptacle swells, encloses the fruits and turns red. Although not a true fruit it is usually thought of as such. The English name is “hip” which comes from the old Saxon.

The woolly down which surrounds the fruits within the hips was believed to be the reason why brier was a remedy for round worms. The down acted mechanically on the worms without irritating the mucous membrane lining the bowel. It is probable that the hairiness helps the passing of the fruits unharmed through animals.

The medicinal qualities of the brier were recognised as far back as the days of Pliny. The hips now are valued in many countries as a source of Vitamin C. The collection of hips for the production of syrup provides lucrative employment for New Zealanders. Hips were formerly eaten in Britain as a delicacy. “Hips maketh,” said Gerarde, “most pleasant meats or banquetting dishes, as tarts and such like, the concoction whereof I commit to the cunning cook.”

It is probable that the early missionaries brought brier to New Zealand as Charles Darwin in 1835 observed it in gardens at Paihia, Bay of Islands, a missionary settlement. A Christchurch nurseryman advertised it for sale in 1861. As early as 1865, plants were introduced into the Mackenzie to “improve the appearance of the lonely station homesteads.” The plant must have been regarded as a pest by the end of the century for in the Noxious Weeds Act of 1900 it was classified, along with Californian thistle and blackberry, as a noxious weed everywhere in New Zealand. Since then it has spread over much of the North Island, especially in parts of the King Country, Manawatu, Wairarapa, Poverty Bay and the tussock country in the Central Plateau, and over the South Island from Nelson and Marlborough to Southland, especially on tussock grassland up to
3000 feet. Birds, rabbits, pigs, horses, sheep, cattle, deer and goats eat the fruits and distribute the seed.

**DOG ROSE**

The botanical name is *Rosa canina*. In Britain this is the commonest and most widespread of the various species of wild rose growing there. Sometimes it is also called dog brier. The origin of the name, like so many folk names, is not clear. Ancient tradition has it that an extract from the root will cure the bite of a mad dog; some claim that the name comes from the old English “dagge” or dagger and has some reference to the large thorns found on the stems; others say it refers to the flowers being of lower quality than those of garden roses. Dog rose is one of the progenitors of the modern garden rose and for 150 years has been used as a stock for propagation.

Dog rose occurs sparingly in many parts of New Zealand and is to be found in quantity in parts of Nelson, the upper reaches of the Waimakariri River in Canterbury and in the Cardrona Valley in Otago.

The following table drawn up by Mr B. P. J. Molloy explains the main differences between the New Zealand forms of sweet brier and dog rose.

<table>
<thead>
<tr>
<th>Sweet Brier</th>
<th>Dog Rose</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>(R. rubiginosa)</em></td>
<td><em>(R. canina)</em></td>
</tr>
<tr>
<td><strong>Habit</strong>—</td>
<td>More straggling, open.</td>
</tr>
<tr>
<td>Upright, compact.</td>
<td>Greater tendency to arch.</td>
</tr>
<tr>
<td><strong>Canes</strong>—</td>
<td>Robust prickles only, less frequent.</td>
</tr>
<tr>
<td>More or less erect.</td>
<td>More often brownish red.</td>
</tr>
<tr>
<td>*Large, flattened, hooked prickles mixed with short, straight bristles especially on flowering branches, abundant.</td>
<td></td>
</tr>
<tr>
<td>Grey-green or brown in winter.</td>
<td></td>
</tr>
<tr>
<td><strong>Leaves</strong>—</td>
<td></td>
</tr>
<tr>
<td>Sub-orbicular to oval-elliptic, tip blunt or acute.</td>
<td>Oval-elliptic, tip acute, never blunt.</td>
</tr>
<tr>
<td>Hairs on main veins below, slightly hairy above.</td>
<td>Without glands usually, sometimes scattered on margin.</td>
</tr>
<tr>
<td>*Densely glandular beneath and on leaf stalks and stipule margins.</td>
<td>Gives off faint scent.</td>
</tr>
<tr>
<td>*Highly aromatic when rubbed, reminiscent of fresh apples.</td>
<td></td>
</tr>
<tr>
<td><strong>Flowers</strong>—</td>
<td>White, or if pink, faintly so.</td>
</tr>
<tr>
<td>*Bright pink, bleaching early, rather smaller.</td>
<td></td>
</tr>
<tr>
<td><strong>Fruit</strong>—</td>
<td>Oval, smooth.</td>
</tr>
<tr>
<td>Usually pear-shaped but variable; smooth or with few bristles at base.</td>
<td></td>
</tr>
</tbody>
</table>
Sepals—
*Pinnate, somewhat leafy at times, erect or spreading. After flowering, persistent until, and sometimes long after, fruit reddens. Outer sepals usually entire, similar position after flowering but readily deciduous.

(Those marked * are the most striking differences.)

II

(The following section has been contributed by Mr A. R. Dingwall, Department of Agriculture, Christchurch.)

Habitat

The thin soils of dry, sunny aspect, the open, weakly-competitive tussock swards of hills and terraces and the vast expanses of gravelly riverbeds and rocky screes and gullies in low rainfall regions, provide ideal sites for the ingress and encroachment of brier. With an altitude range from sea level to over 3,500 feet, it can flourish in the fertile soils of low land and in high-rainfall areas but not so aggressively in the face of repressive competition from dense, vigorous pasture swards or other scrub species better suited to such environments.

Reproduction and Regeneration

The tenacity of this tough, thorny perennial is due, in large measure, to its modes of reproduction and regeneration. The prolific crop of hard-coated seeds exhibits, under natural conditions, a definite period of dormancy. Seed shed in winter or early spring, normally does not germinate before the following spring. When, as often occurs, the seeds pass through the digestive tracts of birds and animals, they germinate much more readily.

There is scant factual information concerning the longevity of brier seed in the soil. Circumstantial evidence as provided by the early and widespread appearance of seedling briers on areas kept virtually devoid of vegetation for many years by rabbits, indicates appreciable longevity. Seed stored for seven years has retained, at least, 50 per cent viability.

Individual plants can regenerate from (a) dormant buds located in the lower sections of the canes, (b) crown buds of the well-protected rootstock and (c) adventitious root buds from which suckers arise. Thus, all bud-bearing portions must be removed or destroyed in order to ensure eradication of brier plants.
Browsing

Apart from the succulent hips and soft seedling shoots, brier offers little attraction to browsing animals. Moreover, in its natural habitat, grazing pressure is rarely sufficiently concentrated to prevent the establishment or halt the progress of brier. Where pasture improvement and adequate subdivision enable controlled concentrated grazings, the encroachment of brier can be retarded or even prevented. Sward improvement and judicious grazing management should be adopted, wherever feasible, when brier threatens to invade or re-invade an area.

Burning and Cutting

Brier does not burn or cut readily and neither fire nor cutting will suppress regeneration. Repeated burning or cutting generally tends to induce suckering and enlarges rather than removes the problem. The only useful purpose either serves is to temporarily suppress seeding or render plants conveniently accessible to more positive control measures, such as basal treatments. For instance, brier can be eliminated by cutting and removing the top growth, followed by chemical treatment of autumn regrowth and supplemented by continuous browsing from the time of treatment and throughout the subsequent winter. This method is economical of chemicals and permits the use of cheap weedicides, that, in themselves, are not fatal to brier. Unfortunately it incorporates some practical difficulties especially where large-scale infestations and difficult terrain are involved.

Grubbing and Pulling

Hand and mechanical grubbing (including bulldozing) and pulling are of restricted value as practical control measures. Grubbing by hand has little appeal except for odd scattered plants that herald brier invasion.

A tractor or four-wheel-drive vehicle, with chain or wire rope and hook can be employed on well-established plants. This method is best used when the soil is loose and moist, to avoid leaving too much broken root in the ground. A bulldozer with scrub-tooth bar attached will uproot extremely large plants or thickets of old briers where the terrain is suited to machine operation. On thin to moderately-dense stands of spindly briers, crushing, giant discing, grubbing and/or ploughing may offer possibilities.

Chemical Control

Though useful under certain circumstances, orthodox manual and mechanical methods of attack on brier have their practical limitations. Hence, considerable attention
has been devoted to attempts to evolve a successful and acceptable chemical control method.

The chemical approach is by no means a recent innovation. In 1899 a weedicide was reported as showing promise on brier, and in the 1930's sodium chlorate was being recommended as a basal applicant. Sodium chlorate and other inorganic chemicals like the arsenicals will kill brier if applied basally and in sufficient quantities. These chemicals have never proved sufficiently reliable to gain continued acceptance in practice.

**Coverage Sprays**

The advent, in 1950, of organic chemicals with brush-killing propensities stimulated renewed interest in the possibility of eradicating brier by chemical means.

The efficiency of these “growth-regulating” chemicals is largely dependent upon their ability, not only to penetrate plant tissue, but also to translocate throughout the whole of the plant system.

The first of these to prove effective on woody perennials was an ester derivative of trichlorophenoxy acetic acid, commonly known as 2,4,5-T.

The emulsifiable ester 2,4,5-T (3.6 lb acid equivalent per gallon) diluted to 1 in 100 to 150 in water and applied as a foliar-coverage spraying at the full-leaf flowering stage (November to mid-December) gives spectacular top growth kill of briar and will largely suppress seeding for two seasons. But plants almost invariably recover by way of crown shoot regrowth from this initial application. Two further regrowth sprayings may give satisfactory kills. The initial spraying will involve at least 3.6 to 4 lb ac. eq. per acre. Subsequent requirements will vary according to extent of regrowth, but is not likely to be less than 4 lb ac. eq.

Dilution rates of 1 in 500 or even greater, will defoliate and open up a dense stand of brier to facilitate subsequent treatments.

The mixed isomer formulation of trichlorophenoxy acetic acid, is very similar to ester 2,4,5-T in its action and effects upon sweet brier.

The propionic acid derivative, ester 2,4,5-T P (4.8 lb ac. eq./gln) appears somewhat more efficient than 2,4,5-T as a coverage spray but its relative efficiency has not been conclusively demonstrated.

The only chemical showing decided promise as a foliage spray is the derivative of trichlorobenzoic acid, commonly referred to as 2,3,6-T BA, though a dichloro. formulation is also promising in a recent trial.
2,3,6-T BA is commercially available as both sodium salt and amine formulations. Both materials have proven ability to translocate in brier, an attribute not exhibited by the 2,4,5-T weedicides.

Commercial amine TBA contains 2.4 lb ac. eq./gln; the sodium salt formulation has 15 per cent active ingredients.

The benzoic acid weedicides affect brier much more slowly than 2,4,5-T and their final results take longer to assess.

Both 2,3,6-TBA materials have successfully suppressed moderately-dense stands of small to medium-sized briers, when applied at dilutions ranging from 1 to 20 to 1 in 40, with water as the carrier. Sprays should be applied to plants in the full-leaf stage and preferably well prior to hip formation.

In the eradication of large-scale infestations, it would appear that, at least, 10 lb acid equivalent per acre of these materials has to be applied, i.e., from at least four to five gallons of commercial formulation per acre.

As a coverage spray on brier, 2,3,6-TBA is definitely superior to 2,4,5-T, but the chemical costs of treatments are high at present prices.

**Spray Coverage**

In any foliage spray work on brier, it is essential to achieve complete coverage of all foliage and stems with spray solution. Especially is this so if non-translocatable materials like 2,4,5-T are used. To date, aerial spraying has not proved satisfactory except for opening up stands as previously mentioned, though, as yet, 2,3,6-TBA has not been tested aerially. Ground-equipment spraying has so far proved much more efficient than aerial application and high-volume spraying more efficient and reliable than low-volume spraying, though the latter is generally more feasible, and is reliable if carefully done.

**Basal Applications**

Several chemicals are available for basally treating brier plants. Chemicals may be applied as sprays or in dry forms of powders or granules.

**Basal Spraying**

Where sprays are used, complete coverage should be given to all canes to a height of, at least, 12 inches above ground level; to the crowns of the plants; and to the surrounding ground within a radius of 12 to 15 inches from the circumference of the crowns. A medium-sized plant (with up to six canes of half an inch diameter, approxi-
mately six feet high with a crown diameter of about nine inches), normally requires 1½ pints of spray solution to achieve this coverage and 50 to 75 gallons of solution should prove adequate for moderately dense stands.

Suitable basal spraying chemicals include:
(a) Oil-miscible concentrate 2,4,5-T or mixed isomer formulation (7.2 lb ac. eq. per gallon) in dieselene or fuel oil at dilution rates of 1 in 80 to 1 in 100.
(Note: Emulsified ester 2,4,5-T in water is unreliable and not recommended for basal treatment of brier.)
(b) Amine 2,3,6-TBA, 1 in 30, or sodium salt of TBA, 1 in 20, both in water solutions.

Where few plants or small infestations require attention, knapsack spraying is satisfactory. For extensive infestations, low-volume, tractor-operated or portable equipment, employing two hose leads fitted with three-nozzle, curved wand heads or, alternatively, hand-gun sprayers, is recommended.

Basal sprays are reasonably reliable, when applied at most times of the year, but are best applied in July or August.

**Basal Dusts and Granules**

The most effective “dry” chemicals for basal treatment of brier are the substituted ureas, fenuron and monuron. In powder form (80 per cent active ingredients) one half to one ounce per plant of either materials is sufficient for medium-sized plants, treatment being applied to the crowns and surrounding ground.

Dusts are not easy to apply, but granulated forms are available. Fenuron pellets (25 per cent active ingredients) at two to three ounces per plant can be very effective on brier, but the efficiency of treatment depends on the material being absorbed into the root zone of the soil. Hence, these pellets are rather unreliable in low-rainfall regions or when two or three weeks of hot, dry weather follow immediately upon application.

Pelleted or granular materials are best applied in late autumn, early spring or in winter when rainfalls and soil moisture conditions are more reliable.

On sloping ground, heavy rains occurring soon after application may cause serious “creep” and as these chemicals are non-selective soil sterilants, affected ground is likely to remain bare of vegetation for about 12 months.

Fenuron pellet treatment of brier is much more costly (of materials) than basal spraying, but offers the decided advantages of ease of transport and application, especially
when dealing with scattered plants in isolated or difficult country.

In recent trials, pelleted 2,3,6-TBA has been tested but with results inconclusive owing to the exceptionally dry spring and interference with the action of applied chemicals by excessive extraneous basal trash protecting the crowns of the plants.

Basal applications whether as sprays or pellets, prove most reliable where plants exist as distinct, individual crowns and are clear of basal trash. Thicket brier with very extensive sub-surface rooting systems with a propensity for suckering, and plants protected by dense basal trash, are more resistant to basal applications. Under such circumstances conditions for basal treatment can often be improved by prior grazing, or coverage spraying as mentioned earlier. Burning off also facilitates basal work, but there is evidence suggesting that regrowth following burning is somewhat resistant to chemical treatment. There appears to be no valid explanation or reason why this should be so and trial results may have been fortuitous.

Current Investigations

The chemicals mentioned are those, amongst the many tested, that have shown any great likelihood of being worthwhile for the control and eradication of brier. Current investigations include the further testing of benzoic and propionic acid derivatives in various forms and formulations and other chemicals such as pentachlorophenol, amitrol and the triazines.

III.

RESEARCH INTO BIOLOGICAL CONTROL OF SWEET BRIER

(Dr W. Cottier, Director of the Entomology Division, Department of Scientific and Industrial Research, Nelson, has supplied the following statement on the present position regarding biological control.)

This Division has embarked on an investigation into the possibilities of controlling this weed biologically. We have provided funds for the Commonwealth Institute of Biological Control to make a search in appropriate parts of the world for such biological agents. The Commonwealth Institute of Biological Control is a Commonwealth Agricultural Bureau organisation established to provide natural enemies of insect pests and weeds in the Commonwealth. Its headquarters are at present in Ottawa, Canada, and it has stations in California, U.S.A., Switzerland, India, Pakistan
and the West Indies but it searches for biological control agents all over the world. The current work for us on sweet brier is at present being carried out by the station at Delémont in Switzerland and has been in progress since August, 1961. Areas surveyed so far have been different areas in Switzerland and in the Rhine Valley, South West Germany. So far 11 species of insects, including five saw-flies, two moth species, a fruit fly breeding in the hips, a gall wasp and two species of gall midges have been taken from various *Rosa* species. Really only one species, a saw-fly, shows promise as a biological control agent and the trouble with this is that it is reported also to attack garden roses. However, the survey has really only started and has been going for less than one full season. It must be fully realised that sweet brier is closely related to roses, raspberries and boysenberries and that the problem of finding something that will destroy sweet brier but not other related plants is a very real one. Should it be possible to find in some part of the world an insect, fungus or virus, that destroys sweet brier satisfactorily there will still be a great deal of work required in the way of plant tests and starvation tests to decide whether the agent can be introduced into our environment without danger to useful plants.

At present we have nothing suitable in view but we will continue the search until the field has been satisfactorily explored. It is emphasised that we might easily come to the conclusion that nothing suitable seems to be available but unless we make an investigation we just will not know what is possible.

IV

FURTHER RESEARCH INTO SWEET BRIER

The Department of Agriculture has a continuing programme of research into the control of sweet brier by chemicals of various kinds and by modifications of grazing management.

Mr A. A. Duncan, Farm Advisory Officer, Department of Agriculture, Alexandra, is investigating the effects of grazing management on an area of 240 acres of fescue tussock on hill country on the property of Mr J. R. Scurr, Cardrona. Mr Duncan points out that experience with other weeds indicates that it should be possible to limit the spread of brier by management. If this spread can be prevented, the cost of eradication of existing bushes will become a diminishing one rather than a constant or increasing cost. Although the spread was very rapid after rabbit control became effective, Mr Duncan's observations in Central Otago
indicate that the rate of spread, as measured by seedling establishment, is very much slower than it was. This is, no doubt, a reflection of improved vegetative cover. Mr Duncan says that if a small change in environment can slow down the rate of spread to such an extent, surely the much larger changes possible through oversowing and topdressing, fencing and generally improved management, will reduce the rate of spread still further, possibly to an almost negligible extent.

The trial on Mr Scurr’s property has just started and it will be several years before worthwhile results can be expected. The project will involve the movement of large mobs of sheep outside normal run management and runholders will certainly appreciate the inconvenience that Mr Scurr will suffer on their behalf.

The autecology of sweet brier is being studied by Mr B. P. J. Molloy, Department of Agriculture, Christchurch. This investigation has two main aims: to produce an outline of the autecology of sweet brier; and to provide more detailed information about certain ecological problems, particularly those concerned with establishment, early growth, and survival in the tussock grassland environment.

(Autecology is the detailed study of a plant and its life history in its natural habitat.—Ed.)

Many brier populations have been visited in the South Island and much observational data recorded. It is hoped to accord North Island populations similar treatment. Detailed field work is largely confined to the Waimakariri Valley, Canterbury, and all laboratory and greenhouse experiments are being carried out in the Plant Science Department, Lincoln College. The entire research programme is supervised by Professor R.M.H. Langer, and is supported by the Department of Agriculture and Lincoln College, and by a grant for technical assistance by the Tussock Grasslands and Mountain Lands Institute. The results will be submitted as a dissertation in part fulfilment of the requirements for the degree of Doctor of Philosophy. A summary of the important features will appear in published form.

V.

EXPERIENCE OF FARMERS

1. Mr R. J. Lee, Cardrona.

"With the rabbit under reasonably good control, coinciding with the coming of aerial topdressing, I topdressed a block in the spring of 1954 with superphosphate and seed
and followed the advice of most authorities at that time to spell the area so as to get the oversowing established during the first season. During 1955 I realised the policy of spelling was proving a major disaster, as young briers were showing up in great numbers on much of the best winter country and it appeared as if much of it would be out of production in 10 to 15 years.

"I decided to embark on an eradication policy in January 1956 by getting a bulldozer to push out the bigger bushes where possible and pull the difficult ones by wire rope. Smaller ones were pulled by tractor or horse, most of the balance were grubbed and some were hormoned. I continued that policy until 1959 doing the grubbing mainly from January to March. From grubbing at this time we experienced little regrowth but with grubbing in the spring practically every plant grew again. During this period hormoning proved very disappointing except on fresh regrowth after dozing.

"With the coming on the market about that time of 2,4,5-T in concentrated form, suitable for mixing with diesel, we concentrated on more basal hormoning with very mixed results; the main problem appears to be to get complete coverage round the crown. Where there is tussock or grass growth, or in the bigger bushes where branches are numerous, results have been poor even with a second application.

"On tussock land the best and most economical results have been achieved when the tussock was burned off followed up by hormoning the brier crowns.

"In the meantime, it is essential as far as is economically possible to stock the country heavily to stop it going out of production with brier before an economic method of control is found.

"Best results are obtained with bulldozing when the ground is reasonably wet so that the maximum amount of root can be removed, but the time will often be determined by the availability of a dozer.

"On high-country properties the worst problem is on the winter country. This must be spelled during the summer to provide feed for the winter, and during this period of spelling, brier seedlings and young plants can get established."

Careful records kept by Mr Lee over the last six years show that labour charges for work on brier (grubbing, dozing, tractor work and hormoning) have amounted to about £500 each year. (On many properties in the South Island the small areas of brier now in existence could be eradicated for a fraction of that sum and future infestation kept in
check by the work of one man for a week each year.—Ed.) Where conditions are suitable for grubbing, this method gives the best results per unit of labour.

Mr Lee contends that we need a two-pronged attack on the brier problem. First of all the work done by various research workers and organisations should be collated and published in concise form for the use of farmers wanting to work on their brier problem now. Secondly there should be long term research to find an insect parasite or a fungus or some entirely new method of control, keeping in mind the many difficult areas where control by manual labour is not practicable and the fact that winter country must be spelled sometime during the growing period. Mr Lee comments that under the present system of valuation, a property well kept, with the noxious weeds well under control, may be affected adversely from the point of view of unimproved value.

2. Mr W. A. Urquhart, Streamlands, Mackenzie Country.

"We used to attack brier in the spring using a pick and endeavouring to drag out every root and runner. This was very slow and as soon as the soil got dry as summer approached it was quite impossible to pull out runners without breaking. We pulled out large bushes with a horse and snig-chain. At this stage we were able to do only a part of the run in one year, concentrating on the most heavily infested areas.

"Later when sodium chlorate and atlacide were used we made better progress, but soon found that summer and autumn were the best for killing. Spring is not very satisfactory, there being too much regrowth. We cut the brier off at ground level with a sharp adze, carrying a file to keep an edge and a small tin of atlacide with tablespoon for sprinkling on the cut surface. On very large bushes we might put on several spoons, making sure that any runners coming up are also cut off and sprinkled. Quite often a large bush will have to be done again the following year for a complete kill; but since we have had to go over the whole area every year for seedlings coming up, this has not been much trouble.

"When bushes were large and plentiful, a big drawback with cutting was the way sheep picked bushes up in their wool. I also think that big numbers of sheep on a block lick the atlacide and so reduce its effectiveness.

"What amazes me is the number of seedlings coming up over the whole area every year even after doing it systematically for about 10 years. Many of these will be carried from neighbouring bushes left to seed; but I have noticed
little isolated gullies where large bushes have been killed over ten years ago, where seedlings are still coming up. It must be seeds from those original bushes.

"I have not tried any of the new hormone sprays. Since a gallon tin of atlacide will do a full day, it is much handier to carry than a knapsack spray and the liquid to keep it going on this class of country; but for good results the atlacide must be fine and free-running so that it will stick to and cover the cut surface."

3.

Another runholder took up a property of 15,000 acres in 1920. Brier was already a serious weed, especially along the flood plain of streams passing through 9000 acres of flat. The upper reaches of these streams are also badly infested with brier and over the years have continued to supply fresh seed with every flood.

For many years the brier was attacked by digging the plants out. Later sodium chlorate was used and more recently 2,4,5-T in diesel from a knapsack sprayer. If spraying is carefully carried out this runholder can expect a kill of 75 to 80 per cent with the first application. Spraying is carried out in December-January when the plants have heavy foliage and are in flower.

As this run is constantly being reinfested from adjoining properties, it is essential that the control work be carried out every year. Carefully kept records show that to keep brier in control on this property now requires the effort of one man for two weeks grubbing and spraying seedlings along 11½ miles of stream bank.

4.

An attempt to eradicate brier by topdressing, oversowing and periodic heavy concentrations of stock has been made by a farmer in the Hakataramea Valley. Intensive rabbiting by the owner on this 2200-acre block had cleared out the rabbits by 1942. The apparent reward for hard work has been one of the heaviest infestations of brier in the country. Some 250 acres had "cane" brier too dense to walk through, a further 1000 acres has a less dense growth and something less than as much again is fairly clean. The rainfall is an uncertain 16 inches.

The attempt at control has been made in a 180-acre paddock of brier mostly so dense that sheep could not graze between the bushes. For this reason a controlled fire in September 1960 on a hot dry day carried well and burnt out the canes. Two hundredweight of superphosphate, two pounds of red clover and four pounds of white clover per acre were immediately spread on the paddock, which was not grazed for six weeks. After marking, 1300 Corriedale ewes
and their lambs together with 55 cows and their calves were forced on to the 180-acre hill paddock for three weeks. After spelling from the end of November to mid-January 1961, the paddock was stocked with the 1500 ewes on the property, now weaned, for two and a half months. At the end of this time their condition was very poor and there was nothing green on the paddock. After flushing elsewhere, the ewes later gave over 130 per cent of lambs but wool quality and quantity suffered. No further seed or fertiliser was applied in the spring of 1961 but the heavy stocking was repeated then and in the autumn of 1962.

The brier definitely is not dead but whereas with burning and no grazing the canes would have reached almost their original density in two to three years, all that remains, other than loose dead sticks, is a small wiry remnant, perhaps four to six inches high, of each original plant. Small new brier shoots are still being thrust up from the roots.

The owner plans to renew the fertiliser and seed this spring and continue with the grazing control. In addition a small area will be sprayed to find if the low growth can be killed now at one application. He is of the opinion that extension of this means of control to other parts of the farm (since all his sheep are being used to keep down the brier in this paddock alone) will mean closer subdivision—perhaps with electric fencing, and the forcing of a large number of sheep on to smaller areas for a shorter time. Water supply is however the commanding problem. (This farmer does not run wethers but he has suggested that where there is a wether flock they would be preferable to ewes for this method of control.)

BURDOCK

(Arctium lappa, from the Greek Arktos, a bear, from the coarse appearance, and lappa to seize.)

Suggestions have been made to the Institute that burdock is on the increase in tussock country and that some publicity should be given to its significance as a weed.

So called because of the clinging burrs and the large leaves faintly resembling those of dock, burdock is usually found round sheep yards, on sheep camps or on similar areas of high fertility. This restriction of habitat makes plants normally easy to locate for treatment. If the plants on these areas are controlled, the chances of spread to isolated spots on the runs are greatly reduced. Burdock
sometimes occurs on roadsides; County Councils should take action there.

Burdock is a biennial growing up to four feet high. The lower, heart-shaped leaves are very large, sometimes 18 inches long and 12 inches across. The upper leaves are much smaller than the basal ones and are broadly egg-shaped. All the leaves are green and nearly hairless on the upper surface, but are usually covered with a short, white, cottony down underneath. The edges of the leaves are bordered with minute teeth.

The flower heads will be found fully expanded from mid-summer into autumn. At first glance the purple florets resemble those of the Scotch thistle. The base of each flower is almost spherical in shape. As in all members of the daisy family, this sphere is covered with numbers of scaly leaves or bracts. Burdock is unusual in that each bract ends in a sharp point that is bent into a hook. Each hook is tough and strong and the hundreds of them in one head make the very tenacious burr that is so difficult to remove from wool. The presence of burdock on a property is often known only by the occurrence of burrs in the fleece. Attempts should be made to locate the source and take action to remove the plants.

Herbalists have long considered burdock a useful medical plant. From the seeds an extract was made for curing certain skin diseases, and an extract from the root was also
useful for this purpose. The leaves, if bruised and applied externally, give relief to bruises and swellings. A liquid extracted from the leaves has been known to cure long-standing cases of indigestion.

No possible medicinal use justifies the retention of any burdock plants on any farm. Plants round sheep yards, if few in number, can readily be dug out. If there are large patches, the plants will be found susceptible to normal rates of MCPA and 2,4-D up to the time the flower head forms. Bulletin No. 329 of the Department of Agriculture—“Chemical Methods of Weed Control,” says: “Seedlings require 8oz and older plants 1lb of the salts and amines of MCPA and 2,4-D. It is killed by emulsifiable esters of 2,4-D if it is growing in association with other plants in waste areas.”

The Institute would be interested to receive any information farmers may have regarding the occurrence of burdock and methods of control that have proved effective.

THE ROLE OF BURNING AND TOP-DRESSING IN SNOW-TUSSOCK MANAGEMENT


INTRODUCTION

No more vexatious topic has beset the camps of soil conservation and high country pastoralism than the burning of tall grassland. Some or other community that has flocks to graze and tall grassland or shrublands to graze them on has been involved in such controversy in nearly every part of the world. Anybody who has done his share of scrub-cutting on North Island hill country, who has seen a good, clean burn across the fallen manuka and a good strike of grass and clover in the oversown and superphosphated ash, will never forget that fire can be an extraordinarily useful weapon of successful agriculture. If, however, the effects of grazing and repeated burning on slowly recovering areas are to be judged from the history of many of our mountain soils, then great caution in the use of fire is likewise learned. For these two reasons, the author formulated, some few years ago, a simple rule which was offered to South Island Catchment Boards, Lands Department and the High Country Committee of Federated Farmers, intended to be applied as a rule of thumb for all decisions on burning tussock grasslands. This rule in brief was: “No burning without replacement.” If vegetation recovered from fire to give a complete
ground mantle before there was a chance of erosive forces like heavy rainstorms or frost, then burning could be justified on land suited for pastoral use and not required for critical water storage. Likewise if burning was to be followed by topdressing and oversowing with the reliable expectation that an effective cover to the ground surface could be obtained within one growing season, burning could be justified.

While this rule was offered with some confidence, it was never intended that it should be applied without confirmation from actual research. Work had already begun in Otago by officers of the Department of Agriculture on studies of changes in vegetation in different localities following fire. A preliminary report on this work was published recently by Barbara Hercus (1962). The author began studies with the experimental application of burning treatments at Mackenzie Pass at about 2,300 feet in spring 1958. This site was chosen for several reasons. First it was the scene of extensive burning, spelling and top-dressing trials carried out by the South Canterbury Catchment Board and Department of Agriculture a few years before. Second, it was easy of access and typical in many respects of a considerable area of South Canterbury mid-altitude snow-tussock country for which decisions on burning permits had to be made. Third, it was possible to carry out the experimental burning treatments as a trial of the proprietary fire retardant ("Firebrake") which the Soil Conservation and Rivers Control Council, New Zealand Forest Service, and Catchment Boards were eager to have evaluated.

With the active co-operation of all the above bodies, men of the Soil Conservation staff in Department of Agriculture Christchurch and of the South Canterbury Catchment Board carried out burning of experimental plots in heavy snow tussock grassland late in August 1958. The ground application of the fire retardant slurry was effective in confining the fire and three blocks were laid out each containing a burnt and an unburnt plot. The author, then Liaison Officer for Tussock Grassland Research in the Department of Agriculture, began a series of observations and measurements which have continued up to the present, designed to discover the effect of burning on the growth and behaviour of the snow-tussock itself, the effect on intertussock vegetation and on the establishment and growth of oversown clovers and cocksfoot. Further studies which were involved included comparisons of unburnt but cut tussocks with the burnt tussocks and observations on the effect of severe cutting on tussocks burnt 15 months previously. Fertiliser trials within each plot were laid down in September 1958 to
discover whether burning affected the response of clovers to sulphur and phosphate applications.

Results of these experiments are to be published in a series of papers in the New Zealand Journal of Agricultural Research, but some features of more practical value are presented here in summary form to be readily accessible to those for whom they have immediate interest.

The Effects of Defoliation on Snow-tussock:

Burning and a single cutting with removal of trash were found to be generally similar in their effect on snow-tussock and for this reason only results of burning are considered. Burnt tussocks were reduced to a stubble height of about two inches in a fairly severe fire. In three months the longest leaf on each burnt tussock reached about eight inches by November 1958. By November 1959 the corresponding measurement was 20 inches and by November 1960 it was nearly 25 inches. A further fire through the area in early spring 1961 prevented further measurements. Since the length of tallest leaves on unburnt tussocks remained at nearly 30 inches, it can be seen that even after more than two years, burnt tussocks had not recovered to the height of the unburnt tussocks. Growth in the third spring did not appear to be as long as in the first and second spring and it is impossible to tell from this trial how many years would be required for the full height of canopy to be restored. However, burnt tussocks were superior to unburnt tussocks in some respects as shown in Table 1.

Table I. Burnt and Unburnt Tussocks Compared 27 Months After Burning

<table>
<thead>
<tr>
<th></th>
<th>Burnt</th>
<th>Unburnt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of tillers per sq. inch</td>
<td>3.10**</td>
<td>2.15</td>
</tr>
<tr>
<td>Number of leaves per sq. inch</td>
<td>21.0†</td>
<td>15.3</td>
</tr>
<tr>
<td>Number of flowers per sq. inch</td>
<td>0.36*</td>
<td>0.07</td>
</tr>
<tr>
<td>Weight of green leaf per sq. inch</td>
<td>1.164g</td>
<td>1.585g</td>
</tr>
<tr>
<td>Weight of dead leaf per sq. inch</td>
<td>0.962g</td>
<td>1.544g*</td>
</tr>
<tr>
<td>Weight of flowering stems per sq. inch</td>
<td>0.150g*</td>
<td>0.035g</td>
</tr>
</tbody>
</table>

N.B.—**, *, † indicate values which have a probability of 1 in 100, 1 in 20, 1 in 10 respectively of being significantly superior to the corresponding values for the other treatment. By "significantly superior" it is meant that the differences measured represent real and not chance differences in the populations studied.

It is clear from Table 1 that burnt tussocks had a higher proportion of tillers flowering and a higher proportion giving rise to new tillers. The higher density of young
tillers resulted in a greater density of leaves but these leaves were younger, shorter and lighter in weight than those on unburnt tussocks.

It is noteworthy that not a single tussock died as an outcome of this fire. A number of burnt snow-tussocks were cut fifteen months after the fire and comparisons were made between the yield of herbage obtained in one cut after 27 months and that obtained from two cuts during the same period. From a single cut the yield was 2.302g per sq. inch. From two cuts it was somewhat less, 2.045g per sq. inch. Although there was apparently some loss of vigour in these tussocks cut back closely, fifteen months after burning, there were no deaths recorded among them when they were studied after a further twelve months.

So far as the snow-tussocks themselves were concerned, the trial can be summarised in the following terms. There was no tussock mortality, a large increase in flowering and tillering some time after burning, and reductions in average tiller and leaf size and in weight of dead and living canopy which had not been compensated for completely even 27 months after the fire. Topdressing had no direct effect on growth of snow-tussock during the trial.

The Effects of Fire on Resident Intertussock Vegetation:

The effects of burning on the intertussock grasses and other herbs were studied by cutting a number of small sample areas in each fertiliser plot, each November from 1958 to 1960. This meant that only the spring growth was measured each year. In the first year only the dead material was separated and discarded. In the second and third years, the cut herbage was dissected into its different components in the laboratory and yield of each component calculated for each burning-fertiliser combination. The effects of the fire on the grasses and weeds growing in between the snow-tussocks are shown in Table 2.

Table 2. Spring Yield of Grasses and Weeds Growing Between Snow-tussocks for Three Seasons Following Burning.

<table>
<thead>
<tr>
<th>Year</th>
<th>Component</th>
<th>Burnt</th>
<th>Unburnt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1958</td>
<td>Grasses and weeds</td>
<td>112</td>
<td>604*</td>
</tr>
<tr>
<td>1959</td>
<td>Grasses</td>
<td>404</td>
<td>706*</td>
</tr>
<tr>
<td>1959</td>
<td>Weeds</td>
<td>31</td>
<td>51</td>
</tr>
<tr>
<td>1960</td>
<td>Grasses</td>
<td>876</td>
<td>719</td>
</tr>
<tr>
<td>1960</td>
<td>Weeds</td>
<td>157</td>
<td>85</td>
</tr>
</tbody>
</table>
The main feature of Table 2 is the effect of fire in reducing yield of inter-tussock grasses during the first fifteen months after burning. In the harvest of November 1959, the difference in grass yield between burnt and unburnt plots was principally due to the reduction in Yorkshire fog and fescue tussock on burnt plots. By November 1960, fescue tussock had recovered on burnt plots to a very marked extent and it was clearly superior in yield to the fescue tussock on unburnt plots. Other native grasses, principally *Deyeuxia*, *Dichela* and *Agropyron* were little affected by 1960. The adventive grasses, principally sweet vernal and Yorkshire fog were similar on burnt and unburnt plots but it was noticeable in the case of sweet vernal that it had increased in yield on those burnt plots which had received phosphate.

It should be pointed out that since the burnt and unburnt plots each included 14 different sulphur-phosphorus combinations these effects of burning have been assayed from the means of several fertility conditions. It should be also remembered that these plots were all oversown with clovers and that grass yields were obtained in the presence of partial clover dominance on some plots in the final year. Clover yield was negligible in the first year and no more than grass yield in the second year. Therefore it appears that the main conclusions concerning grass growth as affected by burning derived from this experiment may have general validity for this community. These conditions are (i) that fescue tussock is adversely affected by fire for the current and following season but that it recovers subsequently, probably in response to the increase in incident light following burning of the snow-tussock; (ii) that other native grasses are not greatly affected in yield although *Deyeuxia forsteri* was measurably increased in abundance by burning; (iii) adventive grasses were generally decreased in yield in the season of burning and in the following spring Yorkshire fog being the most seriously affected and sweet vernal being the quickest to recover.

The Effects of Fire on Establishment of Oversown Clover and Grasses:

The outstanding effects of the treatments on clover establishment and growth were the effect of burning on the balance between white and red clover and the effect of sulphur, and only secondarily, of phosphate on the yield of clovers. No difference in early establishment of clovers was attributable to burning but very noticeable differences in density of clover seedlings were observed within the
burnt plots. In the bases of burnt snow-tussocks the density at 20.11.58 was 0.6 per square foot, the corresponding values for bare soil being 0.9 and for turf 2.6. Similar observations could not be carried out with the same detail in the unburnt plots, but it appeared that the bases of unburnt snow-tussocks were very sparsely populated with clover seedlings. Although it appeared that burning did not have an overall effect on clover establishment, it did affect the kind of situation in which the seed struck. Conditions following sowing on 4.9.58 were fairly dry in the district and the bare soil and somewhat elevated tussock bases were apparently hostile to clover establishment. Burning likewise affected survival of clover plants and their vegetative spread. By 22.11.60, 66 per cent of small (25cm²) sample quadrats on unburnt plots contained clover plants compared with nearly 90 per cent of similar sample quadrats on burnt plots. The contrast between no sulphur and the best sulphur treatments was, however, even larger, 54 per cent and 88 per cent respectively.

In clover yield likewise, the effect of fertiliser treatment was far greater than the effect of burning. This is shown in Table 3 where some sample yields are presented for means of different treatment levels.

Table 3. Clover Yields at November 1959 and November 1960, Comparing Means of Sulphur and Burning Treatments.

<table>
<thead>
<tr>
<th>Pounds dry matter per acre.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphur levels</td>
</tr>
<tr>
<td>S0</td>
</tr>
<tr>
<td>1959</td>
</tr>
<tr>
<td>1960</td>
</tr>
</tbody>
</table>

Although burning had little effect on total clover yield it was clearly demonstrated that the bulk of clover yield on unburnt plots was red clover, whereas on burnt plots, white clover was a much more important contributor to clover yield.

Relating Results to Other Observations and Practice:

There is nothing dramatically new in any of the aspects unfolded in the foregoing experiment. What has been shown here clearly under controlled experimental conditions has, for the greater part, been indicated from observations of earlier workers. For example, Philippa Barker (1953)
recorded an increase in flowering a year following burning of snow-tussock. It is the first time that an increase in tillering has been reported from burning snow-tussock but this effect is common enough in other grasses and it would probably have been observed by others just as increase in flowering has been noted but for the fact that the increase in tillers is not so obvious in a snow-tussock until one settles down to the task of counting. The absence of deaths in snow-tussock following burning is at first surprising in view of the frequent warnings heard about the dangers of burning snow-tussock grassland. However, as Henry Connor suggested in a recent talk to high country farmers at Tekapo, the major damage done to any plant in the tussock grasslands is probably to graze it immediately after a fire. Alan Mark (1955) reported from his studies on the Maungatua Range in areas of known history that heavy grazing following burning apparently severely reduced the density of snow-tussock in comparison with lightly stocked or unburnt areas. This Mackenzie Pass experiment was fenced from sheep and hares for twenty-two months following burning and the effect of grazing in the winter of 1960 was only to clean up somewhat the mature growth of inter-tussock clovers and grasses. Cutting 15 months after first burning was not likely to be as severe in its effect on subsequent growth as frequent close defoliations during the summer following spring burning. The observed reduction in inter-tussock herbage production during the first few months following burning (Table 1) would suggest that sheep depastured on burnt snow-tussock grassland might be forced to concentrate on the fresh green shoots of snow-tussock. Arthur Rowell had observed a substantial and apparently lasting reduction in snow-tussock at this site when blocks were open to grazing in the season immediately following burning compared with those spelled for one year or two years.

This is the first occasion on which burning has been compared with no-burning in a controlled and replicated experiment on snow-tussock. The results indicate fairly clearly that for this kind of snow-tussock grassland at least, (i) burning alone has no mortal effect on snow-tussock, (ii) subsequent grazing treatments or inter-tussock cover conditions are likely to have a major influence on the snow-tussock grassland. Inter-tussock conditions have had a considerable effect on clover establishment, as indicated in the text. Likewise clover oversowing and fertiliser treatment had a considerable influence on the degree of coverage of the soil. At November 1958 the percentage of bare ground on all burnt plots was about 80 per cent. By July 1959 this
value had fallen to about 60 per cent on untopdressed plots (which had been oversown), but it had declined to less than 10 per cent on the best topdressed plots. Topdressing with an adequate sulphur-phosphate mixture had increased ground cover to a safe level to counter erosion by frost or rainstorms within a single growing season. Inadequate topdressing, even with oversowing and with complete spelling from grazing did not result in an effective counter-erosion mantle.

These results suggest that oversowing should be done without burning to preserve an effective anti-erosion mantle and that burning should not be done without effective oversowing and topdressing. However, there are some heavy tussock conditions where oversowing is not likely to be successful even with good topdressing practice unless this treatment is followed by or preceded by burning. It is apparent from the present experiment that moderate to heavy snow-tussock is hostile to the survival and production of white clover, which is our most valuable pasture legume. Burning therefore appears necessary if maximum pasture development is to be secured on this site. The most important requirement is adequate topdressing.

Not only does burning and sulphur-phosphate topdressing appear necessary for maximum white clover development but it would also appear that either burning or heavy grazing with cattle should be maintained until a low-tussock or sward grassland is induced. Studies are being continued to discover the effects of 1961 burning after three years' spelling of the previously burnt or unburnt snow-tussock. Preliminary results indicate that nearly double the ground area is occupied by turf vegetation in the burnt twice grassland compared with the burnt once area.

It may be asked to what extent these results apply to other localities. The detailed results of course cannot be extended beyond the community from which they were obtained. Some generalizations may have a much wider application, especially when the patterns of snow-tussock growth and of ground cover conditions that apply in different areas are interpreted in the light of results from this experiment. It has been shown in this experiment that a canopy equivalent to the pre-burning condition had not been fully restored even 27 months after the fire. Recent studies by the author, results of which are to be published in the near future, have indicated that at higher altitudes (4,200ft and 5,100ft on Craigieburn Range) recovery of snow-tussock after cutting is directly related to the length of stubble left on each tiller. Severe burning in such a locality is likely to
delay for several years the restoration of full canopy. In these more difficult environments there is a noticeable lack of volunteer vegetation capable of forming a sward and oversowing and topdressing experiments have not given very promising results.

CONCLUSION

These experiments have not solved all the burning problems of the tussock grassland. They do point up the importance of making a clear-cut decision on the major use to which a given piece of land is to be put. If its main use is for pasture, the improvement effort should be directed to obtaining a clovery sward or low tussock grassland with only minimal snow-tussock frequency. If its main use is to be to maintain water yield then it would seem that maximum development of snow-tussock canopy and litter may be desirable. This would suggest that fire and stock should be excluded. The Mackenzie Pass site suggests itself as suited to pastoral development. A few hundred feet up the slopes of the Dalgety Range above it and we find ourselves in open snow-tussock with bare soil patches, subject to frost heaving and solifluxion, probably only poorly suited to pastoral use even at a high level of culture and certainly not suited at the present cultural level.

Soil conservation is necessary on all soils. This demands vegetation management to ensure effective soil mantling. Under conditions of pastoral use, this frequently if not universally demands fertility building and maintenance by topdressing. In snow-tussock grassland areas, effective soil mantling with a perennial managed vegetative cover under pastoral use warrants fire along with topdressing to initiate at least the development processes.

While soil conservation is necessary on all soils, management for maximum water regulation is necessary only on some soils. It is not the purpose of the present paper to decide which these soils are. It should be clear enough that if recovery of snow-tussock canopy is not complete in two and a quarter years after burning at Mackenzie Pass which appears a favourable site, it might take much longer at other places, even in the absence of grazing. Studies were begun last April at fifty sites from the Waimakariri to Southland to determine the rate of recovery after defoliation at different times of the year and at different levels of stubble. Furthermore, the work of Department of Agriculture as reported by Barbara Hercus (1962) and of Catchment Boards as outlined by Grahame Anderson in a paper to the
recent 10th Science Congress, will contribute to our knowledge of the way in which the ground cover is differently affected by fire in different localities.

Meantime, "no burning without replacement" seems a very useful rule. What has appeared from its first test at Mackenzie Pass is that even at a favourable location, effective replacement of the snow-tussock mantle demands top-dressing and oversowing with legumes.

References cited:


Early snow during the autumn muster makes harder work for musterer and dogs.
(B. Tinnock)
RESEARCH AT THE UNIVERSITY OF CANTERBURY ON TOPICS IN THE HIGH COUNTRY

In the Botany Department of the University of Canterbury several research workers are engaged on topics which bear on the high country. These are not necessarily of immediate practical benefit to farming in the high country but are pieces of fundamental research. Some aspects of these topics will, however, have some value to the farmer in tussock country.

M.Sc. thesis: J. Sheppard is working on the ecology of scrub communities at Cass. The prime aim is to find out as much as possible about the biology of Cassinia fulvida (Golden Cottonwood). This plant is an important increaser species on fescue tussock land which formerly carried beech forest. The rate of increase and role of the species in ecological succession are being investigated. Incidental to this study, other species in the scrub communities, Leptospermum scoparium (Manuka) and Discaria toumatou (Matagouri) will receive some attention.

M.Sc. thesis: N. Lambrechtson is undertaking a study of the biology of Anthoxanthum odoratum (Sweet Vernal). This species is able to grow in a wide variety of sites and it is hoped to find out if genetically distinct races of the species are formed under different environmental conditions. This kind of study is very important for a fundamental background to the knowledge of genetic variability and thus the potential for breeding of desirable strains in plants of the grassland of high country and elsewhere. It should be undertaken for other species.

Ph.D. Thesis: Genetic variability in Rumex acetosella (Sheep Sorrel) is being studied by W. Harris. The plant is one of the most wide-spread adventive plants in New Zealand, ranging from North Cape to the Bluff and from sea level to 6000 ft. In view of the fact that Rumex is an important cover plant (some would say weed) in Central Otago, Mackenzie Country and Central Marlborough, this study will pay dividends in an understanding of the behaviour of the mixed native and adventive plant communities of high country.

Ph.D. thesis: C. J. Burrows is working on the ecology of some high mountain grasslands. The main sites are near the Main Divide at Arthur’s Pass and Lewis Pass, in high
rainfall areas. Thus the work may not have an immediate bearing on the problems of sheep farmers in drier regions to the east, but some knowledge of ecological processes in these grasslands will be transferable to other areas. The three grasses under most intensive study are *Danthonia australis* (Carpet Grass), *D. crassiuscula* (Curly Grass) and *D. oreophila* (Snow Patch Grass). The environmental conditions and ecological relationships of the grasses are being studied. Areas in Fiordland, in the Mount Cook region, and in the catchments of the Rangitata, Rakaia, Waimakariri and Hurunui Rivers, where certain of the grasses overlap with others, are being examined in some detail.
In the light of the report of the Royal Commission and the recommendations made, the Committee of Management has decided to print the submissions which it made to the Commission. They were as follows:

1. Machinery of Government.

Part of the policy of the Institute is “to examine the administration of the tussock grasslands region.”

In investigations already made we have consulted the High Country Committee of Federated Farmers. In this submission we are expressing the opinion of that organisation as well as that of the Institute.

Some 9,000,000 acres of tussock grassland are occupied under lease. Of this, 8,500,000 acres are owned by the Crown and administered by the Department of Lands and Survey, and approximately 500,000 acres comprise endowment lands of educational institutes and local bodies.

Concerning the Crown land, the Institute believes that, since the Crown is the owner of the land and administers it through the Lands Department, all negotiations which affect the rights or duties of the tenants in managing the land, should be conducted through the Lands Department. This Department should never be compelled to accept an arrangement resulting from negotiations in which it has taken no part.

The Institute also considers it desirable that, in order to obtain the maximum of uniformity in the tenure and conditions of occupation of the tussock grasslands, all endowments in these tussock grasslands held by educational institutions and local bodies should be administered by the Lands Department, and that new leases issued in respect of these endowments should be on the lines of existing Crown tenures.

2. Methods by which the quality and quantity of work might be improved.

The Institute is charged by Government “with providing a centre to facilitate the co-ordination of all research aimed to protect and improve the tussock grasslands and mountain lands.”

For over half a century, research into the tussock grasslands has been carried out by scientists of various Government departments and of the University. Projects have
been commenced and allowed to lapse; efforts of individuals have been dispersed over wide fields; frequently the nature of the project has borne little or no relation to the urgency of the need; and at no time has there been an integrated programme planned and followed through.

It was largely because of this lack of over-all planning and co-ordination that this Institute came into being. During its comparatively short existence, the Committee of Management has been impressed with the need of some kind of centre for the co-ordination of research in agriculture where broad priorities could be allotted and finance assured and where a periodic review and re-appraisal of projects could be made.

Accordingly at its recent meeting the Committee of Management decided to submit to the Commission the following resolutions which express its opinions:

(a) That a central authority be constituted to co-ordinate research on a national basis and to establish priorities.
(b) That the Committee of Management has not given consideration to the form such an authority might take. The field is so wide that it is in favour of the establishment of a special committee of inquiry to investigate and make recommendations.

3. Recruitment and retention of staff.

In its preliminary investigation of the tussock grasslands and their needs as far as research and extension are concerned, the Committee of Management of the Institute has been impressed by the serious shortage of extension officers and of research workers especially pedologists, entomologists, plant and animal ecologists and men capable of carrying out land capability surveys. The Institute realises that there is a general shortage of research and extension workers but feels the shortage is particularly acute in the areas with which it is concerned.

Realising that the primary answer to this problem is more recruits, the Institute would support such improvements in salary and conditions which will tend to attract well-qualified men into these fields. But even with more recruits into agricultural and forestry services, there will always be special difficulty in attracting and keeping field staff in the tussock grasslands and mountain lands. Remote-ness and the consequent isolation from other workers; long periods away from home and family and additional costs in maintaining a home; the arduous nature of duties often carried out under severe conditions of weather and terrain; the lack of opportunity of progressing towards higher
administrations positions; all these tend to deter men from entering this field of service or from remaining in it for long enough to produce the most fruitful results.

The Institute accordingly suggests that in any recommendations made as to salary and conditions, consideration should be given to the payment of adequate special allowances to workers in the tussock grasslands and mountain lands while they are working in the field in remote areas.

CONSERVATION RUN PLANS
(See article in previous Review)

The Institute believes that the Pastoral Lands officers could be used effectively in the promotion and implementation of conservation run plans and supports the following procedure:

1. Approach by the runholder to the Catchment Board for a run plan.

2. A Land Capability Survey is conducted by a Soil Conservation officer of a Catchment Board or a soil conservator of the Department of Agriculture.

3. The runholder, the Pastoral Lands officer and the Soil Conservation officer discuss alterations in management which aim at combining, as far as is economically and practically possible, the production and conservation aspects.

4. In the light of the discussion, the Soil Conservation officer sets out in the form of a conservation run plan, proposals to be implemented over a five-year period.

5. After agreement by the runholder and Pastoral Lands officer, the plan is submitted to the Catchment Board for approval of subsidy proposals.

6. The Institute’s Management Officer to be available for consultation at any stage.

The procedure outlined above has the approval of the Soil Conservation and Rivers Control Council and of the Department of Lands and Survey.
HIGH COUNTRY FENCING

With this issue of the Review, all farmers on tussock country will receive a complimentary copy of a booklet on high country fencing produced by the Management Officer, Mr J. G. Hughes. Further copies may be obtained from the Institute, price two shillings post free.

OUR COVER

Our artist shows an early stage in the settlement of the tussock grasslands. A runholder has completed his first dwelling and is watching the initial burn which will open up the country ready for stocking the following spring.
TUSSOCK GRASSLANDS AND MOUNTAIN LANDS INSTITUTE

Committee of Management

R. M. D. Johnson (Chairman), Soil Conservation and Rivers Control Council.
D. McLeod (Deputy Chairman), High Country Committee of Federated Farmers.
I. L. Baumgart, Department of Scientific and Industrial Research.
Dr M. M. Burns, Lincoln College.
D. A. Campbell, Soil Conservation and Rivers Control Council.
L. P. Chapman, N.Z. Wool Board.
J. T. Holloway, N.Z. Forest Service.
T. W. Preston, Department of Lands and Survey.
S. H. Saxby, Department of Agriculture.

Secretary
H. G. Hunt, Lincoln College.

Director
L. W. McCaskill.

Management Officer
J. G. Hughes.

Postal Address: Telephone
Box 56, 62-839 Christchurch.
Lincoln College, Christchurch.