THE CONTROL OF RIVERBED GROWTH IN SOUTH CANTERBURY

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These notes on the eradication and control of riverbed growth, cover briefly the salient principles and techniques which have been evolved and tested over a period of three years, on both the experimental and large scale work, which has been carried out by the South Canterbury Catchment Board. In this time, the Board has treated a quarter mile channel extending over 200 miles of the main riverbeds in the South Canterbury Catchment District.

The weeds, with which we are most concerned in the South Canterbury rivers, are willows, lupin, broom, gorse, blackberry and alders.

The serious effects of this growth, when allowed to thrive unchecked in the flood channels of streams and rivers particularly in the braided channel type of shingle river, include bank erosion, bed aggradation, island formation, obstruction or deflection of flood flows and the progressive decrease of the channel waterway. One other serious effect is the menace to the safety of bridges in times of flood, when the more easily uprooted growth is lodged against piers and superstructure.

We believe that possibly the solution to the problem lies in the use of the hormone type of weedkiller. With the exception of some initial trials laid down in November 1947 when arsenical compound poisons were compared with the hormone weedkillers, the Board has concentrated its attention on the hormone treatment. Control by hand-cutting, by gyrotiller cultivation, and by ploughing or other mechanical means, had been tried and found costly or unsatisfactory in some respects.

Generally, our work up to the present time shows the following progress:-

LUPIN AND BROOM: These are comparatively easy to kill, although follow up maintenance is essential for complete control.

WILLOWS: Willow trees can be successfully and economically eradicated, but the control of willow suckers for all the varying conditions in which they are encountered, has yet to be perfected.

GORSE: Some progress has been made, but an economical solution for its complete control in its riverbed environment has yet to be finally established.

ALDERS: A recent attack on the alder tree problem has been made, but it is too early yet to give a definite statement on the effectiveness of the hormone treatment of large alder trees. Highly satisfactory results have been obtained however on alder saplings.

BLACKBERRY: The control of blackberry is now the least of our worries, thanks to the well known and highly successful work carried out by the Ivon Watkins organisation in New Plymouth.

In giving the details of hormone treatment for each type of growth, the first to be considered is the willow, the control and complete eradication of which was a major problem until the advent of the hormone weedkiller.

THE CONTROL OF WILLOWS:

The methods used vary considerably, depending on the stage of growth, the season of the year when treated, and the environment in which they are established.

The principal technique for killing willow trees which range from 6 inches diameter to four feet or over, is the "frilling" method. This is used when it is intended to kill the tree completely before pulling it out or otherwise disposing of it.

When first employed the "frill" was made as follows:- Using a sharp tomahawk, a cut was made downwards through the outer and inner bark to solid wood and the bark was turned outwards to form a frill. Each cut was made at about 30 degrees to the vertical and the cuts made a full horizontal ring round the tree. The wound usually cut a waist height, was filled with weedicide in a liquid form. It was thought that the bark **would come** back together again and the poison would thus be carried up and down in the sap stream.

To turn outwards the thick woody bark on a three or four foot diameter tree was time consuming and very hard on the axeman's wrists. It was found to be just as effective and much quicker, to make two cuts, one at 30 degrees to the vertical as before and a nearly horizontal intersecting cut, using a **full** sized axe rather than a tomahawk. The weedkiller is then applied to the exposed cambium layer.

The "frill" method is in reality only a very efficient ring-bark with the added feature of mixing a tree-killing fluid into the sap stream.

There is a complete dying off within a week or two of the cambium layer four or five inches above and below the cut and there seems to be no connection between the upper tree and roots. Within two or three weeks the leaves turn yellow then black before falling from the twigs, and in two or three months the tree is completely dead.

It cannot be too strongly emphasised that the cut must make a complete horizontal circle around the tree trunk. It must be horizontal to prevent the poison running out of the cut and it must completely encircle the trunk, as an inch or two of cambium and bark will support a tree for a remarkably long time.

If a tree has dead or rotten timber in the line of the incision, this wood must be cut out so as to expose the thin cambium layer underneath. Extra time and care is necessary on a badly twisted or contorted tree to make the completely circular incision.

A common type of willow tree growth is the multi-trunk tree which appears to grow from a common root system. It is necessary in cases such as this to frill each individual trunk. Similarly, if the trunk is not easily accessible for frilling each main branch may be frilled.

The frilling party consists usually of five axemen and a single sprayer operator. The simplest method of applying the weedicide in large scale frilling work, is to use a two or three gallon knapsack sprayer fitted with a coarse nozzle. This obviates the carrying of reserve supplies of weedicide by the operator and leaves his hands free to control and operate the sprayer.

It is important to carry out the frilling on a definite and rigidly controlled frontage, as it can be extremely difficult to differentiate between treated and untreated frilled trees after a small interval of time. Some method of strongly colouring the liquid poison would be an invaluable aid in both this and spraying work.

It is not possible to give accurately the number of trees that may be treated per hour in view of the widely differing conditions which are met but in close growing willow jungle, approximately twenty trees per hour can be frilled by each axeman.

The period which gives most satisfactory results with frilling in the South Canterbury Coastal Districts is from the end of October to the end of February, that is, after the first flush of spring growth to a month before the leaves turn yellow in the autumn. To frill outside this period produces results which one could expect from ordinary ringbarking and the trees may take some years to die completely. The explanation appears to be that in the colder weather the sap movement is slower and volumetrically smaller than in the warmer November-February period, with the result that, although the exposed cambium layer in the frill wound is killed, the poison which enters the sap stream does not travel far before it appears to lose its toxic properties.

Originally the quantities used for frilling were based on the assumption that the required volume of weedkiller of a constant strength would vary as the diameter or the circumference ratio of the trees. The strength of the weedkiller used was one pound of 2,4-D acid equivalent to the gallon and this was applied neat. The quantity used was a third of a pint for a three foot diameter tree down to one sixth of a pint for one foot diameter trees. This quantity is just sufficient to thoroughly wet the wound surface and fill the frill without overflowing.

Trees treated with these quantities and strengths in the January-April period did not show the same results. Trees up to eighteen inches died quickly, but larger trees lived for some considerable time, in some cases for more than two years.

It has since been realised that the roots and foliage of a tree, or more explicitly the sap stream system, is more likely to vary as the square or perhaps the cube of the tree diameter. The strengths of the weedicide employed have been altered to suit this now conception with excellent results.

The strengths and quantities now used for frilling are:-

6" to 18" diameter trees, weedkiller in the ester, amine or sodium salt forms, with the quantity varied in the ratio of the diameters using 1/6 pint for a one foot diameter as a standard. The strength of the weedkiller being 1 lb. of 2,4-D acid equivalent to the gallon of weedicide.

Above 18 inches diameter, weedkiller in the ester, amine or sodium salt forms with a concentration of not less than 3.5 lbs. of 2,4-D acid per gallon of weedicide, with the quantity varied in the ratio of the diameters using 1/3 pint for a three foot diameter tree as a standard.

In the poisoning season just passed, the Board carried out willow frilling operations on 42 miles of the Rangitata riverbed using these strengths and quantities. A one hundred per cent kill was obtained and every tree was completely dead within two months.

No success at all was achieved by spraying the base of the trunk, or by spraying the ground in the vicinity of the trunk base, so that this type of experiment was abandoned.

When it is absolutely necessary to attempt to poison trees in the winter months, the following method has much to recommend it, although it is too early yet to give a definite indication of its efficacy. The tree is felled and the stump's cambium layer is treated.

The tree is cut down to within a foot or two of the ground, using cross cut or power saws with the saw cut horizontal or nearly so. The bark is stripped off for at least four inches from the top of the stump, care being taken to see that the top of the bark left on the stump is horizontal. This prevents the weedicide running off the ledge which the remaining bark provides. The weedkiller is liberally painted on the exposed cambium layer, the top of the stump being untouched except the outside two inches which is also painted. The quantities and concentrations used are the same as for the frilling method. It is considered necessary to paint the stumps soon after the 4" width of bark has been stripped off.

Work carried out last winter using this method gave variable results. This was because the necessity for providing a horizontal ledge to hold the poison was not realised at that time and also because low concentration hormone weedkillers were used on the larger stumps. Work done during the last month was carefully carried out to the revised technique and the results should be available after the coming summer.

This stump method has been successfully employed in the November-February period, when it has been considered that the possible regrowth of broken-off willow twigs does not constitute a future maintenance problem. If done in this period, it is not necessary to strip the bark off; the poison

is simply applied on the outer two inches of the stump top with a paint brush.

With the control of willow sucker growth, the Board has had some successes and some failures. Willow sucker growth is defined as all willow growth ranging in height from a few inches to twelve or more feet and ranging in trunk diameter up to five inches.

One method of killing the larger sapling growth, that met with considerable success, was employed on a comparatively small area in the lower reaches of the Orari River during the 1948 Clearance Programme. The saplings, up to five inches diameter, were cut down to the ground by axemen. A bulldozer then dozed out the roots, which were pushed up into windrows together with the felled foliage. The area was sprayed a month or two later and now, two years afterwards, the whole area shows very little trace of regrowth.

The Board employs a root rake for this type of work and its use has many advantages over the bulldozer blade. The rake is a heavy multi-tined rake fitted in place of the ordinary blade of a dozer. The spaces between the tines allow the soil and stones to drop away from the roots and foliage as they are being windrowed, thereby allowing greater loads being moved by the machine. The separation of the silt and shingle from the roots allows for much easier burning of the windrows when this is carried out after the drying-out of the material.

For spraying such areas as this, the Board employs a 375 gallon capacity, tractor-drawn orchard sprayer. A single nozzle, delivering approximately 20 gallons per minute at a pressure of 600 lbs. per square inch, is used. The spray gun to which the nozzle is fitted, is capable of a stream of spray for an effective distance of 40 ft. and the plant also gives satisfactory coverage for trees up to thirty feet in height.

In the past for willows, we have used 2,4-D at the rate of two pounds of acid equivalent per acre mixed with 100 gallons of water. This is satisfactory, but every care must be taken to ensure an even distribution of the spray. The most satisfactory form of 2,4-D weedkiller to use is the ester, and this applies also to broom.

When spraying easily traversable areas of growth, that is where tracks are not required to be cut and where the nature of the ground and the height and density of the saplings allow the passage of the tractor and sprayer, an even distribution of the spray can be ensured as follows:- The machine first travels up and down, then back and forth across the area, using half the required quantity each time.

Great difficulty is experienced in ensuring a uniform spray coverage on saplings more than ten feet high, due to the masking effect of the outer foliage of the inner. The remedy, other than using the aerial spraying methods as practised in the United States, appears to be the carrying out of repeated frontal sprayings over a period of years. In this way the inner foliage can be attacked as the masking outer growth dies off.

Willow sucker growth sprayed in the October-February season can be quickly and effectively killed provided that the root system supporting the plant matches the size of the foliage above. Where the sucker growth is the product of fallen and buried logs or branches taking root, complete control can be expected only after a period of maintenance sprayings have been carried out on the growth each time it appears.

THE CONTROL OF LUPIN:

Lupin is comparatively easy to control by spraying one pound of 2,4-D acid equivalent to the acre mixed with 100 gallons of water. The best time for spraying is in the summer months, but the plant appears to be susceptible to the hormone treatment at any time of the year.

Repeated maintenance sprayings are essential, as the removal of the

shade given by the parent bushes promotes the rapid growth of the dormant seed lying in the ground.

THE CONTROL OF BROOM:

Broom is effectively killed by spraying in the November-February period using two pounds of 2,4-D acid equivalent per acre mixed with 100 gallons of water. This plant appears to be less sensitive than lupin to the hormone treatment and a uniform spray distribution is essential.

THE CONTROL OF ALDER TREES:

Very recent trials carried out in March of this year on the control of alder saplings have given excellent results. Alder saplings up to 6 ft. in height were sprayed thoroughly using 1 lb. of 2,4-D acid equivalent to the gallon mixed with 25 gallons of water.

An alder tree 30 ft. high was frilled with neat woodkiller containing 4 lbs. of acid equivalent to the gallon, but it is too early yet to say whether a definite kill has been obtained.

QUESTIONS AND DISCUSSION

MR. GREEN: Have you tried 2,4-D or 2,4,5-T in oil on the base of the trunk? That seems to be the latest way in the United States.

MR. JONES: We have only used 2,4-D, and only tried it neat, not in oil.

MR. BRODIE: At the conference of the Institution of Engineers last year there was interesting information on the size of trees that had been successfully treated. Willow trees up to a height of 80 ft. have been killed and trees about three feet in diameter.

MR. JONES: Trees of 70 or 80 feet have been killed within a fortnight.

Replying to Mr. Albright, MR. JONES said that with arsenical compounds kills were slower.

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