SESSION 7

CONTROL OF WOODY PLANTS

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The control of woody plants presents peculiar problems because their size and woody nature make it impossible to handle them with ordinary cultivating implements and because many of them can store large amounts of reserve food material. In opening up timbered land for agriculture or improved pasture, the clearing of woody species is one of the major obstacles to be overcome. The control of woody secondary invaders such as Lantana, Blackberry, Wild Tobacco, African Boxthorn and Groundsel-bush is another problem.

It is relatively simple to kill the trunks and branches of trees and shrubs and even of thorny scramblers. The chief difficulty in control lies in preventing the production of adventitious shoots or in killing them if they are produced. The crux of the problem, then, is to find methods of treatment which will destroy the whole plant, root and branch together.

Some species will die completely if they are cut down or knocked over and some will die if exposed to fire. There is no particular biological problem involved and their control becomes a matter of economics only. For those species which do produce suckers, methods must be found which will kill the roots as well as leaves and branches. We can distinguish between two types of suckering:-

1. suckers which arise from stem tissue, usually from the base of the trunk or from the hypocotyl.

2. suckers which arise from root tissue, often from lateral roots.

Examples of suckers from stem tissue are afforded by many Eucalypts, by Wild Tobacco (*Solanum auriculatum*), Black Tea-tree (*Melaleuca pubescens*) and Mesquite (*Prosopis juliflora*). Examples of woody plants which sucker from lateral roots are Brigalow (*Acacia harpophylla*), Limebush (*Eremocitrus glauca*) and Cockspur-thorn (*Cudrania javanensis*). Some plants may produce suckers from both kinds of tissue.

To deal with plants that sucker, two techniques have been in use for a long time. They are:-

1. ringbarking the original tree instead of cutting it down.

2. removing the sucker shoots at frequent intervals.

In ringbarking the aim is to interrupt the downward flow of elaborated food materials from leaves to roots without interfering with the upward flow of water and minerals from roots to leaves. Since the downward flow is mainly through the inner bark and the upward flow through the sapwood, the proper technique of ringbarking is to cut completely through the bark and the cambium layer but not to cut too deeply into the sapwood. This can be achieved by removing a collar of bark or, in some cases, by cutting a frill right round the tree, making the cuts meet in the sapwood. This latter technique is generally employed in the drier regions where cambium activity is not so likely to bridge the gap.

In theory, the leaves remain alive because the upward flow of water remains uninterrupted and the roots continue to function until they can no longer obtain elaborated food materials from reserves stored in tissues below the cut. When these reserves are exhausted the root tissue dies, the roots cease to function and there is rapid death of the whole tree. In practice this is easy to do with some species but not with others. The same species growing in different localities or under different conditions can vary greatly in its susceptibility to ringbarking.

Species which are difficult to kill by ringbarking are generally those with large stores of reserve food materials. In order to kill them by ringbarking, it is necessary to know something of their growth rhythm and the periods when reserves of food material are at their lowest level. Generally, this is when the tree is growing vigorously or when it is flowering. In almost all such cases, ringbarking in the dormant season results in heavy suckering. The practical ringbarker expresses it by saying that the proper time to ringbark is when the sap is up and not when the sap is down. This usually coincides with the period when the bark strips readily from the sapwood.

It is possible to exhaust underground reserves by repeated removal of suckers but it is a slow process. Here again, a knowledge of the period when reserves are in a depleted state is useful in determining the best time to remove the suckers and in reducing the number of treatments necessary for a complete kill. With trees like brigalow that sucker from lateral roots it is not easy to exhaust the reserve food material by repeated removal of suckers since the suckers are individual erect stems forming dense thickets. Often it is necessary to allow these suckers to grow for several years until they are large enough to cut down or ringbark.

Repeated cutting with a brush-hook is a common method of dealing with rain-forest regrowth and with the woody plants such as Wild Tobacco which frequently invade such areas.

Since the after-treatment of suckers is slow and costly, various chemical treatments have been used in an attempt to prevent trees from suckering. Except on a few species, the chemical most commonly employed is arsenic, either as arsenic pentoxide or as sodium arsenite. In treating trees, this is poured into a frill cut round the tree as near the base as possible. The frill is normally cut somewhat deeper than in ringbarking. With most species best results are obtained when the plants are under some water stress and when underground reserves are at a low level. In Queensland this is mostly about April and May, when soil moisture levels are falling and the plants are carrying large numbers of actively transpiring leaves. Under such conditions arsenical solutions can be translocated downward very rapidly if they are applied immediately after the transpiration current is broken. It is often possible to kill sufficient of the root tissue to prevent suckering.

In the last few years 2,4-D and 2,4,5-T have been used, both singly and in combination, in attempts to kill woody plants. Many of them have been found susceptible to one or both of these chemicals but a large number of them have not. Susceptibility often varies with stage of growth, locality and time of application.

As examples let us consider Brigalow (<u>Acacia harpophylla</u>) and Lantana (<u>Lantana camara</u>). Brigalow is a native tree which, when mature, varies in height from about 10 feet to 60 feet. It frequently grows in dense scrubs with the canopy closed or almost so.

The brigalow tree itself has a peculiar root system. There is no tap-root but under each trunk the root bends at right angles and extends horizontally, branching in a horizontal plane as it goes. Frequently these horizontal roots give rise to bunches of new shoots at intervals along their length so that many trunks of brigalow may share a common root system. From the lower surface of the horizontal roots smaller roots extend obliquely downward. The plant stores starch in large quantities throughout the trunks and roots, mainly in the wood parenchyma and not in the cortex or phloem parenchyma.

In Queensland more than 7 million acres of brigalow country has been cleared. Most of this was originally treated by frill ringbarking with an axe. Since the war attempts have been made to speed up the process by pulling the trees down with heavy cables and chains drawn by two large bulldozers. Many early attempts at clearing brigalow by ringbarking were ruined by premature firing. In most circumstances the roots remain alive for three or four years after ringbarking and if the area is burnt before the roots are dead wholesale suckering takes place and the resulting crop of suckers is usually much more dense and much more difficult to handle than the original scrub. The same problem has followed mechanical clearing. The necessity for early burning to clear up the great tangled masses of logs and branches left lying on the ground has made suckering almost a certainty.

Several methods have been worked out to treat the suckers. Cultivation is satisfactory if the suckers are small and if the local land use makes it profitable. Most of the brigalow country is used for grazing merino sheep or beef cattle and only in those areas devoted to cotton, dairy farming or grain growing has cultivation been an economic practicability. Work with disc ploughs at Biloela showed that if bigger suckers could be leaned over and the bark shaved from along one side death often followed due to exhaustion of root reserves and insufficient replacement.

If an axe is to be used to clear them, it is necessary to wait several years until the suckers are big enough to cut. Cutting high is reputed to give better control than cutting low of suckers higher than about 4 feet but this does not always work out in practice. If machinery is to be used it is also necessary to wait for several years before the suckers are big enough to pull over.

Sheep have been employed to control brigalow suckers after a burn. If they are hungry enough, sheep will eat very young, succulent brigalow suckers but once they become green and begin to harden off the animals usually neglect them or at least will not eat them in sufficient quantity to exercise any control. It is common to crowd strong sheep on to newly burnt brigalow country in sufficient numbers to eat all the suckers as they appear. If there are enough sheep and not too much other feed, the brigalow roots are exhausted in the course of about twelve months. This method has several disadvantages, chief of which are the necessity to confine the sheep in small areas to ensure reasonably uniform grazing, the high rate of stocking needed, the inability to use the ashes of the burn for establishing sown pasture species, loss of condition in the sheep and the lowering of wool production. It is frequently stated that sheep on brigalow suckers produce 3 lb. to 5 lb. of wool less per sheep than on the native mixed pasture. Since it is necessary to have at least one sheep per acre per year to control the suckers the direct monetary loss is considerable.

Recent work with 2,4,5-T has given rather spectacular results on brigalow. In experiments laid down in April, 1951 mixed esters of 2,4-D and 2,4,5-T were used, emulsified in water and applied at 3 gallons per acre. Rates of application were 1 lb. 2 lb. and 3 lb. mixed acid equivalent per acre. Both virgin scrub and regrowth suckers were treated. The trees were rather dry at the time of treatment and were carrying no new shoots. No rain fell until February, 1952, the first effective rainfall for thirteen months. Apart from some discolouration of the leaves and a certain harshness of texture, no results were observed from the time of treatment until the rain fell 10 months later. Following the rain, wholesale defoliation began and continued for several months except on the plots treated at 1 lb. per acre where the effects were patchy. In the spring of 1952, approximately 16 months after treatment, the first suckers appeared. They died shortly afterwards, exhibiting typical symptoms of hormone damage. A second crop followed and most of these died in the same way. A third crop appeared before the end of the summer and many of these survived the winter of 1953. They were not so numerous or so vigorous as those in similar areas treated with a bulldozer and there were very few in the virgin scrub.

Following the promising results obtained in this experiment, a Melbourne firm treated several 200-acre blocks in November, 1952, using the mixed esters of 2,4-D and 2,4,5-T at 2 lb. acid equivalent per acre in 3 gallons of water. This treatment was made when the plants were carrying new shoots and results were immediate and spectacular. By the following February, only three months after treatment, most of the trees were defoliated except where there was shielding by other trees.

Since then, work with 2,4,5-T alone has given good results and commercial flying has been in progress for nearly 12 months using 2,4,5-T butyl ester at 1 lb. acid equivalent per acre dissolved in diesel distillate or other fuel oil. Rate of application varies from 2.7 to 3 gallons per acre.

A further series of experiments is in progress. This includes mixed esters of 2,4-D and 2,4,5-T butyl ester of 2,4,5-T and butoxyethanol ester of 2,4,5-T. Two treatments have already been made, one in November, 1953 at the time of spring growth, one in March, 1954 following the summer flush of growth. A third is due in July, 1954 at a time when the trees should be dormant. Application is being made both in water and in diesel distillate. From these experiments it should be possible to determine which of these chemicals is most effective, what is the most economical rate of application, and the best type of solvent to use and whether there is any significant difference in effects of the same chemicals applied at different times of the year. Experiments are being carried out on virgin scrub and on suckers in each of two districts. Evaluation is expected to take at least twelve months from the date of the last experiment and possibly two years or more.

Results to date indicate that application of 1 lb. of 2,4,5-T acid equivalent per acre by aircraft can produce similar effects on brigalow to ringbarking, that is, defoliation and death of trunk and branches. It remains to be seen whether the roots also will die.

Experiments are also in progress on young suckers using ground spraying equipment. In addition, the Department of Public Lands has carried out a series of trials on brigalow with this type of equipment. They indicate that effects with overall spraying at 0.2 per cent. are usually more patchy than those produced by aerial application. A good kill was obtained by spraying freshly cut butts with 2,4,5-T and mixed 2,4-D/2,4,5-T at 1 per cent.

<u>Lantana</u>

Methods for killing Lantana may also be grouped into mechanical, biological and chemical. A common method of treating Lantana is to slash it with a brush-hook and then grub out the roots or burn the cut material. Sometimes arsenic is applied to the stumps after slashing. Some areas have been cleared with a bulldozer or other mechanical equipment. On flat land or land of moderate slope these techniques are usually satisfactory, especially if they can be combined with cultivation or pasture improvement. On steeper slopes they are often not completely satisfactory. In such situations they are laborious, time-consuming and costly.

Biological control has been attempted by introducing the seed-fly and the Lantana bug. Neither of these has been particularly effective in reducing the density of Lantana infestation except for a few places in the high rainfall areas of north Queensland.

One interesting form of biological control is the use of other plants to compete with Lantana. In Queensland there are two outstanding grasses and one legume which have been used successfully for this purpose. In the high rainfall areas of the far north coast, Molasses grass (Melinis minutiflora) and Calopo (Calopogonium mucunoides) have both been found capable of growing in competition with Lantana and of reducing its density and vigour and in some places replacing it.

In the Mackay area, Guinea grass (Panicum maximum) has replaced Lantana on some hilly country. Guinea grass seed is sown through the standing Lantana. Often it is sown only along crest lines and the grass is allowed to spread naturally down the slopes. When sufficient grass is growing through the Lantana to carry a fire the whole area is burnt. This kills the tops of the Lantana bushes and also the standing stalks of Guinea grass. Recovery of the grass is more rapid than that of the Lantana and the young Lantana shoots are eventually suppressed by competition from the Guinea grass.

Use of 2,4-D and 2,4,5-T on Lantana has given good kills under some conditions and not in others. Experiments by the Department of Public Lands and experience of farmers in various parts of the state indicate that where Lantana is growing in regions of high rainfall with good friable soils such as are found in cleared rain-forest areas, Lantana can be killed by spraying liberally with 2,4-D at a concentration of 0.2 per cent. A sodium salt and triethanolamine salt have given results as good as or better than the ethyl ester. 2,4,5-T and 2,4-D/2,4,5-T mixtures have proved less effective than 2,4-D alone. In areas of lower rainfall or poor soil where the Lantana is not so vigorous, overall spraying of the whole plants has given rather poor kill. It has been found possible to kill young regrowth in late summer but even so results are not as consistent as they are in the high rainfall regions.

It is fairly obvious that most of the work with 2,4-D and 2,4,5-T on woody plants is largely empirical and that a sounder understanding of the fundamental physiology of the species involved is necessary in order to explain apparent anomalies in experimental results. With plants like brigalow which store starch it is fairly simple to make iodine tests in the field at the time of treatment and thus obtain a rough guide to the state of the food reserves in different parts of the tree. This is being done in the course of the present experiments. For species which do not store starch some other simple field test would be extremely useful.
