060105

REFORESTATION TECHNIQUES

by D. Spriggins, D. Haswell, & P. Van Keppell

1.0 INTRODUCTION

In 1976 at the invitation of the Public Works Department, reforestation trials commenced on Stenes farm, located just east of the 800mm annual rainfall isohyet.

Faced with the problem of steadily rising increases in the salinity of Wellington Reservoir, P.W.D. were hopeful that the trials would give some indication of the effect of reforestation in lowering groundwater tables and reducing saline discharges.

There is a considerable gap in the knowledge of how tree species (other than the natives) will grow both in the short and long term in these parts of the Collie catchment. Any older and well established planting trials are either in the higher rainfall areas (1,000mm/year) to the west or are in the various wheatbelt arboretea well to the east.

There was also negligible hard data available on the effect which tree planting generally, let along individual species, might have in lowering groundwater tables and reducing saline discharge.

The great differences in groundwater tables beneath native forest and adjoining cleared pasture do give some indication of the possible effect which reforestation could make.

Therefore, whilst being well aware that the question of how reforestation would be in controlling saline discharge was largely unknown, the objectives of the planting trials were:-

(1) to identify problems and key factors involved in establishing and maintaining tree growth on the various sites including saline affected areas.

(2) to establish reliable cultural techniques for tree establishment.

(3) to measure the effects of tree growth in lowering groundwater tables.

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2.0 REFORESTATION

Current approach is as follows.

2.1 Site Planning

Planning should commence at least 12 months prior to any planting. Broad locations for strategic block planting are chosen in association with the Water Supply Authority. Locations are influenced by probable intake and valley seepage sites.

Following a soil survey of the area, field demarcation is carried out in late spring to exclude sites which are already indicating surface salt and/or waterlogging at the surface.

A proposed planting plan is then drawn up selecting species on the basis of soil types and topographic position.

Currently the following core species are used:-

Eucalyptus rudis - Flooded gum	Lower Slopes
Euc. camaldulensis - River Red gum	Lower Slopes
Eucalyptus wandoo - Wandoo	Mid Slopes
Eucalyptus calophylla - Marri	Mid Slopes
Eucalyptus globulus - Blue gum	Upper Slopes
Eucalyptus accedens - Powder Bark Wandoo	Upper Slopes

E wandoo?

The approach in the planting pattern is to have a mixture of species including both fast growers together with the slower and probably more reliable (in the long term) native species. The aim is to obtain some tree cover quickly and to ensure against the possible failure of some species.

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2.2 Site Preparation

2.2.1 Burn grass in late November to incinerate seed bearing heads of annual rye and barley grass.

2.2.2 Fence areas where grazing is planned in adjacent paddocks.

2.2.3 Deep rip to 50cms depth. Effective equipment has been the use of a tractor drawn sub-soil ripper. It is possible that ripping may not be required on all sites.

2.2.4 Strip spray along ripped planting lines (from May onwards and when grass germination is about 2cm high) using a weedicide such as Vorox AA, at the rate of 5kg. active ingredient per hectare.

2.3 Planting

Planting shall not commence until winter rainfall is assured and saturation of the soil profile has occurred to a depth of one metre. This period usually extends from the end of May to the end of July.

At this stage planting is carried out by hand, using container stock. Stocking has been at 1250 per hectare (4m. x 2m. spacing) to date.

Survival on most upslope sites has been so good though that an initial planting rate of 500 per hectare is being considered for future years.

Various hand planting methods have been used, the best is a wedge shaped planting spear. Seedlings are planted to one side of the ripped line to ensure firm establishment and to avoid air pockets caused by ripping.

2.4 Application of Fertilizer

Fertilizer is required to improve the chances of the seedling becoming established and then to provide rapid growth to overcome competition from annual grasses. A N:P fertilizer such as Agras 18:18 is recommended. Application rates of 160 grams/tree are used. Where salinity in the soil may be a problem, superphosphate only should be used.

Fertilizer should not come into contact with the recently planted seedling as severe "scorching" can result. Fertilizer is placed in a vee shaped notch approximately 20cm. away from the seedling and on the down slope side.

2.5 Post Planting Assessment

This is carried out 12 months after planting on a 10% systematic sampling basis to record the percentage surviving.

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3.0 PROBLEMS

These refer both to the cultural process of establishment and the longer term performance and maintenance of a tree cover.

3.1 Grass Control

Areas that have been intensively grazed in the past usually provide a vigorous germination of annual rye, barley and other grasses.

Control before planting must be guaranteed if planting programmes are to succeed.

Experience has been that in the winter after planting, grass growth returns with great vigour even though the control in year one was effective. If seedlings are kept weed free in year one though, they are able to establish themselves quite effectively.

Experience has shown that burning of seed heads in the summer prior to planting combined with chemical control is an effective method of grass control in year one.

3.2 Sites

The establishment of trees in areas affected by salt scalds or severe waterlogging has proved to be difficult.

Waterlogged sites can be ameliorated by mounding prior to planting but the procedure is costly and is currently not carried out on a routine basis. In 1977, on low lying mounded areas, the experience was that by the time grasses had germinated and were to be sprayed with weedicide, the ground had become so wet that tractors became bogged and weedicide application was impossible. This lack of grass control had a disastrous effect on tree survival.

At this stage waterlogged sites are not planted. It is anticipated that when adjoining plantings ameliorate the waterlogged condition, then tree planting may proceed. Experiments are in hand to determine if native scrub cover can be achieved by direct seeding these waterlogged flats.

3.3 Vermin

Rabbits can cause significant damage to trees up to age one. Control is achieved by ripping of warrens, fumigation and by perimeter poison baiting.

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3.4 Stock

Sheep and cattle must be fully excluded from planting sites until the growth has reached a height of 2-3 metres. In the absence of ground feed, sheep will browse eucalypt vegetation and young trees can be trampled by cattle.

3.5 Planting Stock

To ensure successful establishment in the first year good quality stock must be produced. The plant must be 20cm. and have a vigorous root system.

Seedlings must also be "hardened off" in at least the month prior to planting to withstand the severe frosts which are common in the Collie river system.

3.6 Tree Performance

At this stage there is a lack of data for individual tree species on longevity, rooting habits and transpirational ability.

How individual species will perform if salty groundwaters continue to rise into the rooting zone is unknown. This is a further reason why extensive tree plantings on lower lying waterlogged sites is not recommended for the time being.

Although there is much information on the performance of individual tree species when grown in monoculture, there is considerably less on the growth habits of species mixtures.

3.7 Plantation Maintenance and Protection

The management of extensive tree plantings over a long term must be catered for. Protection from fire, pathogens and insects must be considered and provided for.

To maintain vigorous crown growth, thinning of plantings may be necessary. This is immediately apparent with the plantings of 1200/ha. Although an initial stocking of 500/ha. may delay the time of thinning, some release will probably be needed.

These problems are accentuated by the likely scattered type of planting that will occur and their relative remoteness.

4.0 FUTURE REFORESTATION POSSIBILITIES

4.1 Reasons for Investigating New Approaches

Although establishment methods as outlined in Section 2 have now been developed, new approaches are being investigated. The objectives are to test techniques which:

(a) will allow establishment to be completed more rapidly.

(b) could offer cost savings.

The following approaches are being examined.

4.2 Ground Preparation Prior to Planting

Current practice of ripping or total ploughing whilst very effective, is time consuming and relatively costly. In deeper soil areas, cultivation may not be so essential.

Alternatives being tested are:

(a) reduction of grass competition by burning only in the spring prior to planting.

(b) above plus varying rates of weedicide (Vorox AA) application prior to planting.

4.3 Type of Planting Stock

The standard seedling raised in a 6cm. x 6cm. x 6cm. jiffy pot container has proven its reliability over many years. If reliable results can also be obtained with smaller container stock there could be valuable savings in nursery, transport and actual planting costs.

Over 2 million open rooted Karri seedlings are raised each year and planted in the Karri forest. The technique allows a relatively cheaper plant than container stock to be produced but whether this type of seedling will survive in these northern areas which in comparison to the Karri region are much harsher, is unknown at this stage.

Being tested this year are:

(a) small jiffy pot stock (3cm. x 3cm. x 4cm.).

(b) small paper pot stock (4cm. x 4cm. x 5cm.).

(c) open rooted stock - 4 species.

4.4 Planting Method

With the aim of speeding up the planting operation the following will be tested.

(a) planting machines.

(b) improved hand planting tools and plant carying gear.

4.5 Fertilizer at Time of Planting

Trials include:

(a) fertilizer tablets (10 gms/tree to 100 gms/tree).

(b) agras 12.52 - 100 gms, 200 gms/tree.

4.6 Post Planting Weed Control

Where pre-planting weed control has not been entirely successful, an overspray with a weedicide which will not affect the planted seedling would be very useful. Tests cover:

(a) weedicide "Hoe".

(b) vorox AA - varying rates.

4.7 Direct Seeding

Natural regeneration of Euc. rudis has been comonly seen when grazing is excluded. 1978 trial sowings of 1kg./ha. were successful. The technique offers considerable cost savings if proven to be consistently reliable.

Problems are lack of sufficient seed for broadcast sowing rates of 1kg./ha. and a lesser reliability than planting. A long period without rain following germination could be disastrous.

Tests this year cover:

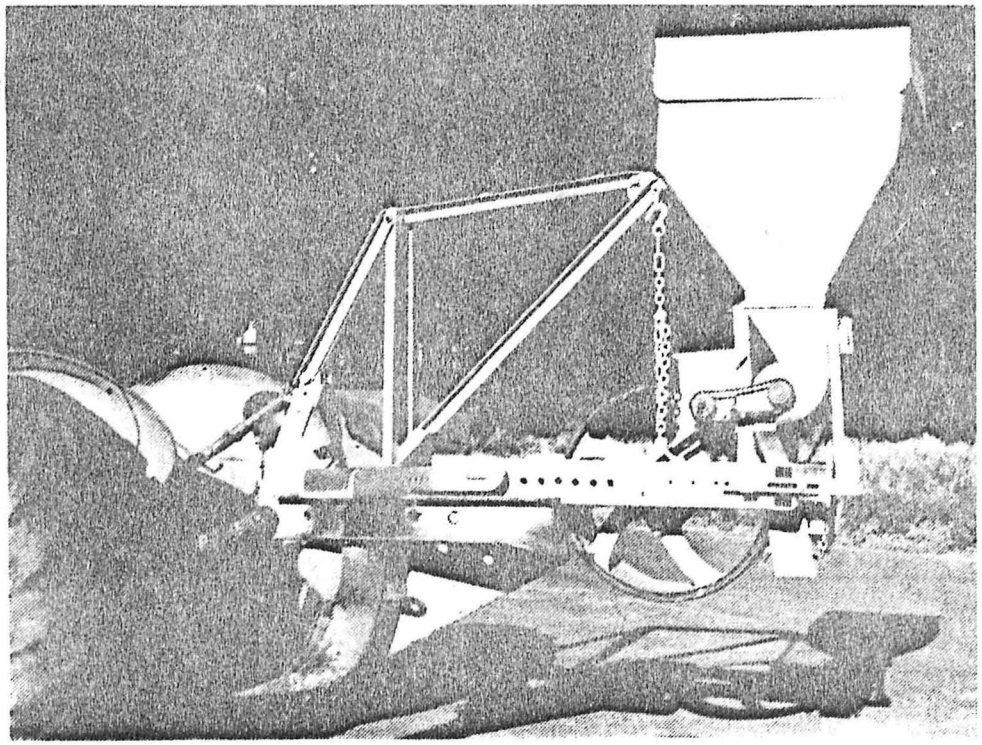
(a) broadcast sowing, 9 tree species.

(b) broadcast sowing, tree, legume and scrub species.

(c) spot sowing using Malan seeder borrowed from Agriculture Separtment.

(d) paraquat-diquat spraying in conjunction with direct seeding.

Three point linkage mounting allows for intermittent furrows and easy manoevring.



The Mallen Shrub Seeder

Invention

A new invention called the Mallen Shrub Seeder should help overcome plant establishment problems on salt–affected soils. The invention (a combined ridger, seeder and mulcher) carries out in one operation all the processes involved in planting seed of salt–tolerant plants, such as bluebush and saltbush.

The machine was invented by Mr. C.V. Malcolm, Research Officer with the Department of Agriculture, and Mr. R. Allen, a student (in 1973) with the Art and Design Section of the Western Australian Institute of Technology. Messrs T. Swaan and L. Liedel of the Department of Agriculture have given assistance with modifications.

Operation

The machine ploughs a furrow and forms a small ridge, presses a slope and niche near the top of the ridge and places seed covered with chaff in the niche, all in one operation.

The special seed-bed shape is designed to overcome various establishment problems observed in the field over many years.

The furrow provides a means of catching and storing subsoil water for the growth of the young shrub.

The bank allows the actual planting site to be raised above the general ground level to avoid waterlogging problems.

The niche provides a sheltered planting site with a firmed base for the seed to be placed on.

The pressed slope concentrates some run-off water where the seed is placed.

The chaff mulch encourages water penetration and salt leaching and reduces evaporation in the area around the seeds.

Flexibility

The seed and chaff are placed intermittently along the row to allow for bushes which can grow to several metres across. Spacing and seed and chaff rates can be readily adjusted.

On the standard chaff setting about 30 grams of chaff is placed at each point. A bag of chaff would provide over 1300 placements at this rate. Allowing for shrubs to be sown at 3 x 5 metre spacing a bag of chaff would be sufficient for about 2 hectares (5 acres).

The trip mechanism on the machine is designed to allow easy adaption to apply spray materials such as pesticide or bitumen to the planting.

The Mallen Seeder is mounted on 3-point linkage to allow for intermittent furrows and for ease of manoeuvring under difficult conditions.

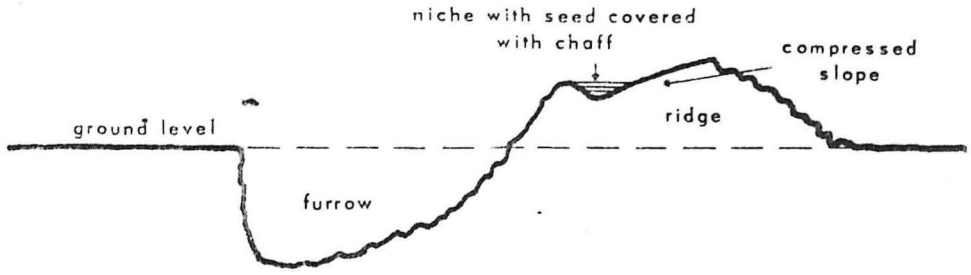
Application

The Mallen Seeder was designed for establishing forage shrubs from seed on saline soils. However the requirements for establishing forage shrubs in arid rangelands are closely similar and the machine will be tested in the pastoral areas of Western Australia.

The Seeder has so far been tested on sandy and fine textured soils under good and slippery conditions and has performed well.

The seeder may be useful in overseas countries with similar saline and arid areas in need of revegetation as well as elsewhere in Australia.

ENQUIRIES concerning the Mallen Shrub Seeder should be addressed to the Chief, Soils Division West Australian Department of Agriculture, Jarrah Road, South Perth, Western Australia 6151.



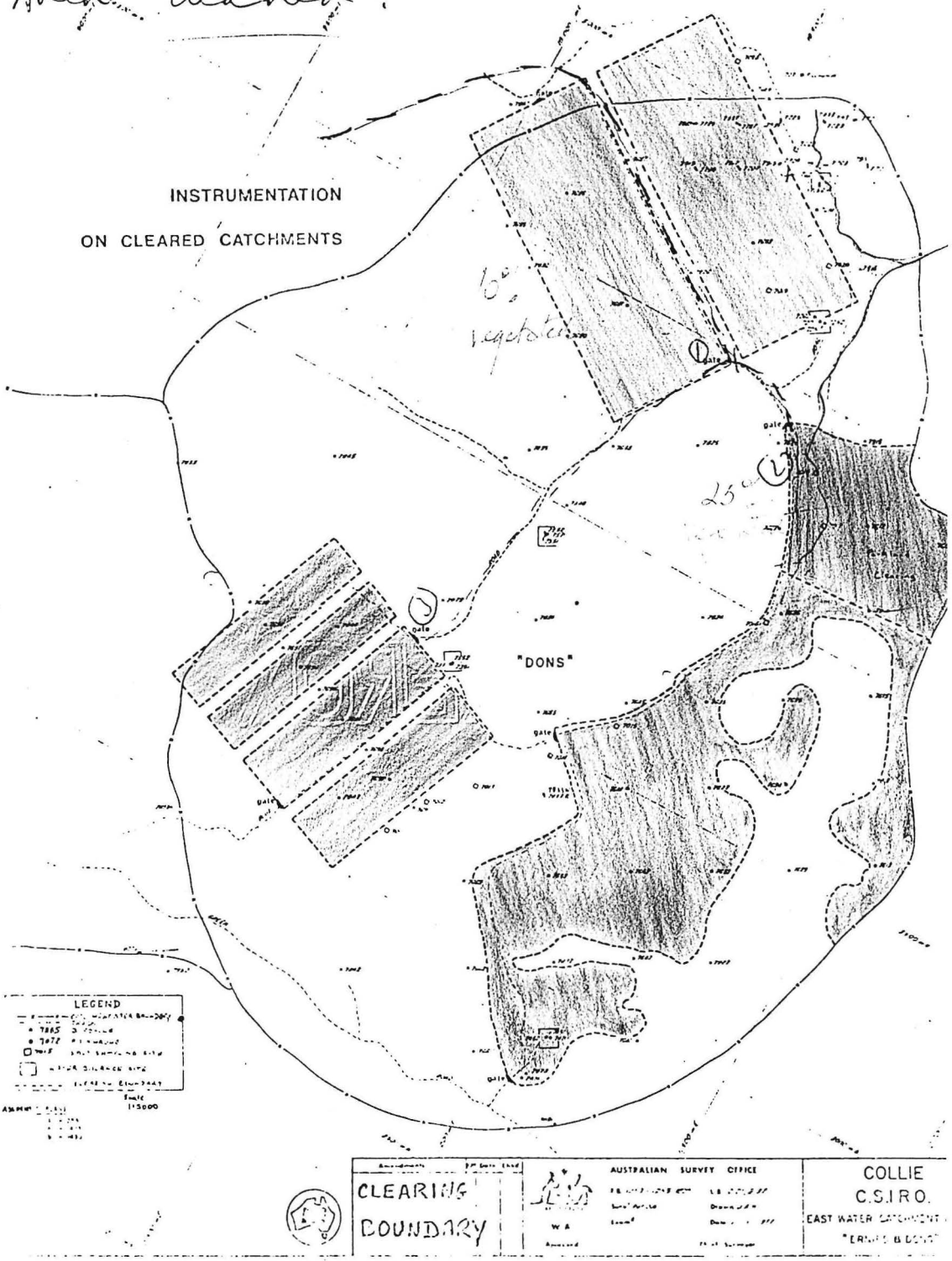
16 P/C 15

Area . Catchment :

Area . Cleared :

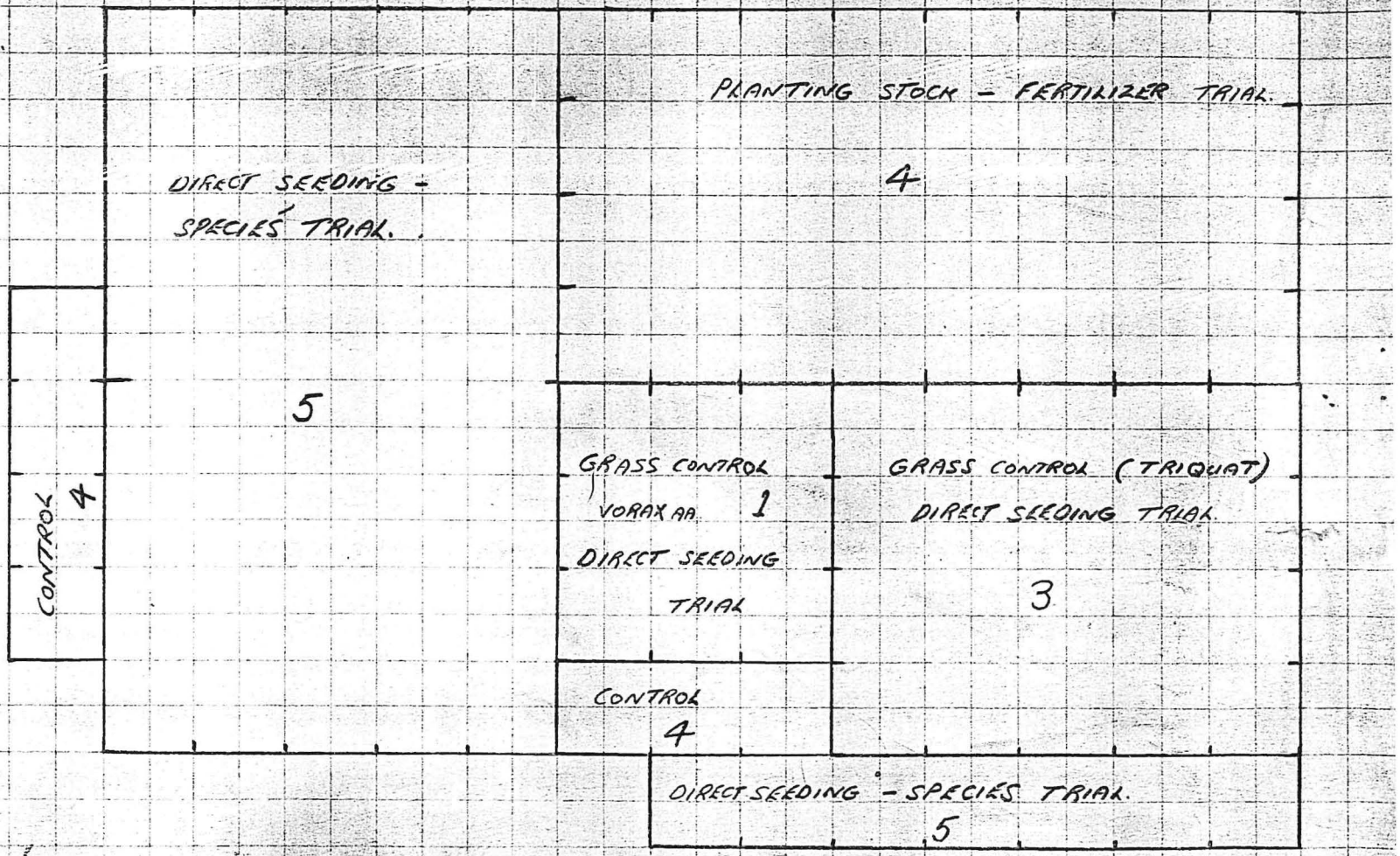
INSTRUMENTATION

ON CLEARED CATCHMENTS



ESTABLISHMENT TRIALS.

1979.



1/ GRASS CONTROL —— DIRECT SEEDING TRIAL.

AREA CHISEL PLOUGHED (MAY)

HERBICIDE - VORAX AA.

DATE SPRAYED 16-5-79

DATE SEED SOWN 9-7-79

1·7	1·4	1·1
1·8	1·5	1·2
1·9	1·6	1·3

VORAX AA
5 KG/HA

CONTROL
NOT SPRAYED

VORAX AA
2½ KG/HA.

DIRECT SEEDING
WITH
100 gms EUC WANDOO
100 gm EUC RUDIS
100 gms MELELAUCA.

3/ GRASS CONTROL —— DIRECT SEEDING TRIAL

AREA CHISEL PLOUGHED.

GRASS CONTROL TRIQUAT 5KG/ha 17-6-79.

DIRECT SEEDING - 29-6-79.

SEED TYPE - EUC WANDOO AND EUC RUDIS.

3·17	3·13	3·9	3·5	3·1
3·18	3·14	3·10	3·6	3·2
3·19	3·15	3·11	3·7	3·3
3·20	3·16	3·12	3·8	3·4

TRIQUAT
17-6-79

TRIQUAT
17-6-79

RESPRAY - AUG.

TRIQUAT
17-6-79
RESPRAY - SEPT

CONTROL

NO GRASS CONTROL.

SEEDING RATE.

¼ KG/ha 10GMS

½ KG/ha 20GMS

1 KG/ha 40GMS.

1½ KG/ha. 60GMS

2 KG/ha 80GMS.

4/ PLANTING STOCK —— FERTILIZER TRIAL.

- AREA - CHISEL PLOUGHED (MAY)
- VORAXAA 5 KG/ha 17-6-79.

4·29 EUC CLADOCALYX P.T. 1m x 1m	4·25 EUC CALOPHYLLA L.J. 2M x 2M	4·21 EUC CAMELDULENSIS P.T. 1m x 1m	4·17 EUC ACCEDENS P.T. 1m x 1m	4·13 EUC SALIGNA S.J. 1m x 1m	4·9 EUC GLOBULAS P.T. 1 x 1m	4·5 EUC WANDOO P.T. 1m x 1m	4·1 EUC WANDOO L.J.
4·30 "	4·26 "	4·22 "	4·18 "	4·14 "	4·10 "	4·6 "	4·2 " L.J
4·31 "	4·27 "	4·23 "	4·19 "	4·15 "	4·11 "	4·7 "	4·3 " S.J
4·32. "	4·28 "	4·24 "	4·20 "	4·16 "	4·12 "	4·8 "	4·4 " S.J.

CONTROL.

4·36 EUC SALIGNA S.J.
4·37 EUC CALOPHYLLA L.J.
4·38 EUC GLOBULAS P.T.
4·39 EUC WANDOO P.T.

LARGE JIFFY POT 50mm x 50mm x 50mm = L.J.

SMALL JIFFY POT 25mm x 25mm x 50mm = S.J.

PAPER TUBE 35mm DIA x 50mm OLEO = P.T.

CONTROL

4·35 EUC L.J.	4·34 CALOPHYLLA	4·33 EUC GLOBULAS P.T.

FERTILIZER.

200gms/TREE AGRAS 12:5Z.

100 GMS/TREE. AGRAS 12:5Z.

2 x 10gm TABLETS AGRIFORM/TREE

1 x 10gm TABLET AGRIFORM/TREE.

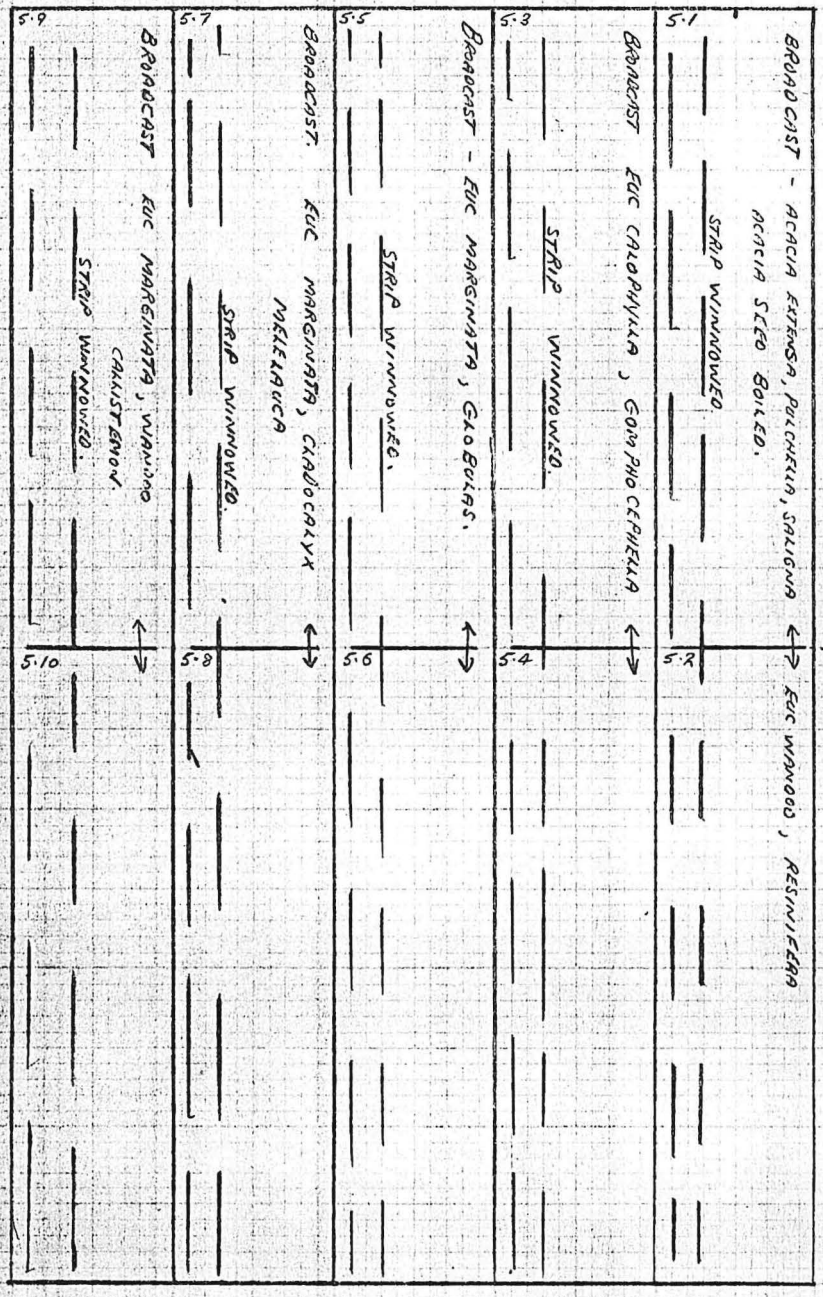
5/ DIRECT SEEDING —— SPECIES TRIAL.

ALL SPECIES 80 GMS SEED PER DOUBLE PLOT ∴ 1 KG SEED/HA PER SPECIES.

DATE SOWN - 9-7-79.

AREA CHISEL PLOUGHED

VORAX AA 5KG/HA.



ACACIA SEED — EUC CLADOCALYX — EUC CAMELDULENSIS — EUC RUDIS

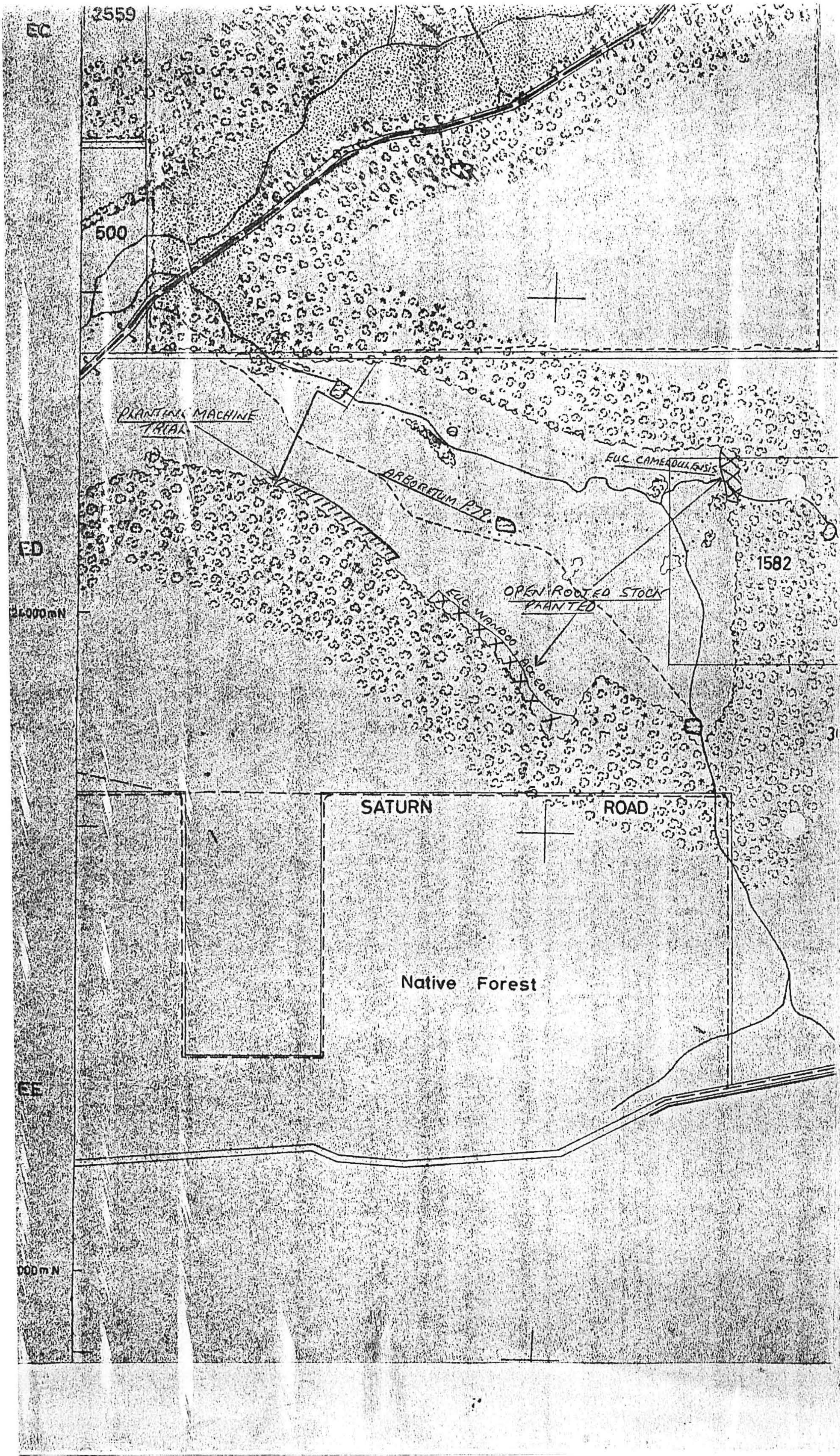
TH AFRICAN POPPY TREE — " RESINIFERA — MELELAUCA. — MELELAUCA

SEED - BOILED. 5MIN.

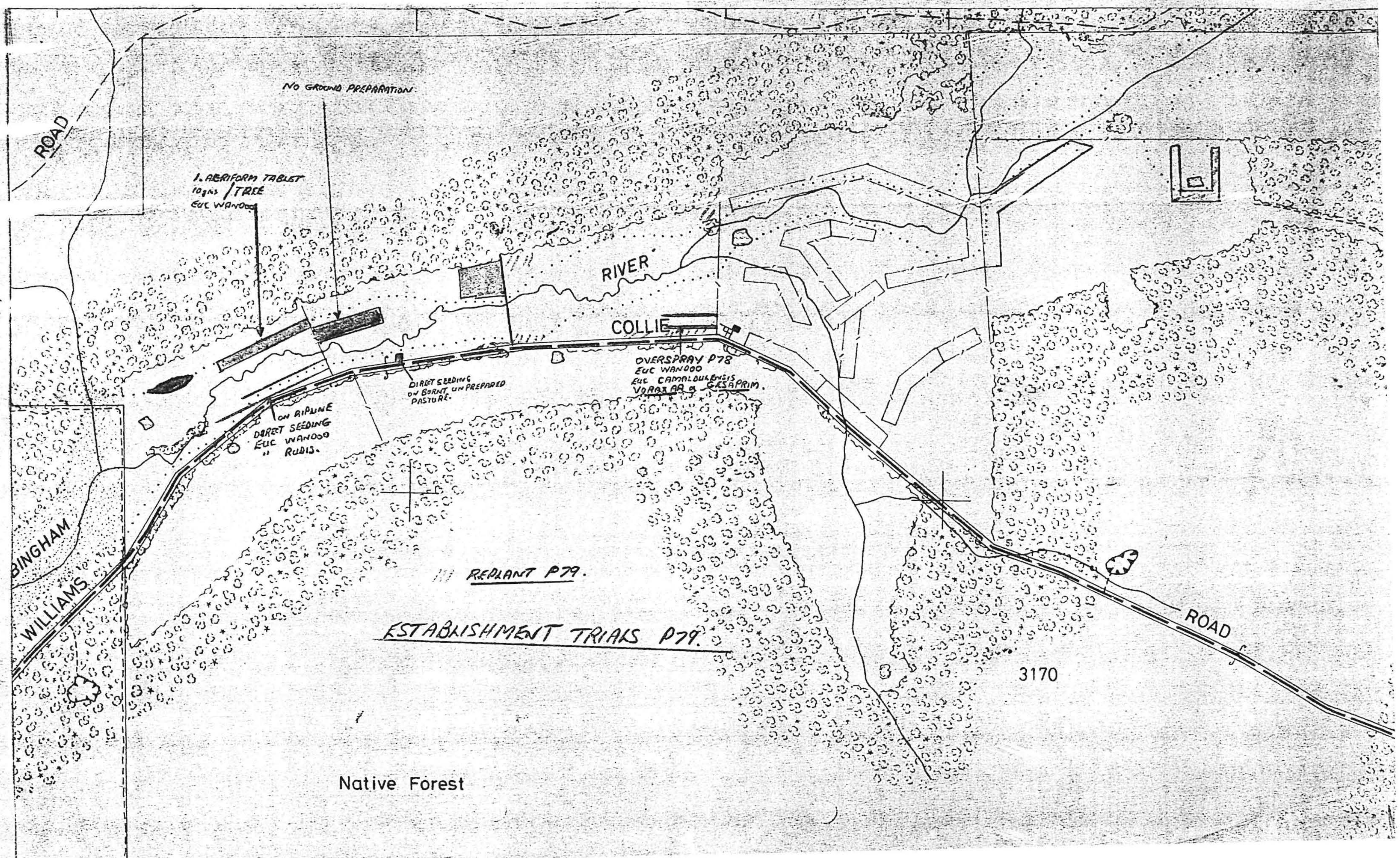
5.23 5.22 5.21 5.20 5.19 5.18 5.17

LOWER SLOPE.

MALLON SEEDER TRIAL.



2559
EC
500
PLANTING MACHINE TRIAL
ARBORETUM P.79
EUC. CAMELDULENSIS
ED
1582
OPEN ROOTED STOCK PLANTED
24000mN
EUC. WANDOO
EUC. ACCEDENS
SATURN
ROAD
Native Forest
EE
000mN


ROAD
NO GROUND PREPARATION
1. AGRIFORM TABLET
10gms / TREE
EUC WANDOO
RIVER
COLLIE
OVERSPRAY P78
EUC WANDOO
EUC CAMALDULENSIS
VORAX AA & GESAPRIM.
DIRECT SEEDING
ON BURNT UNPREPARED
PASTURE.
ON RIPLINE
DIRECT SEEDING
EUC WANDOO
" RUDIS.
BINGHAM
WILLIAMS
REPLANT P79.
ESTABLISHMENT TRIALS P79.
ROAD
3170
Native Forest