Report made up for Jim Armstrong 3/5/89

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TITLE: TREE WATER RELATIONS AND PHYTOPHTHORA CINNAMOMI RELATED DIEBACK

INTRODUCTION: Earlier work has shown that the growth of P. cinnamomi lesions in jarrah (Eucalyptus marginata) phloem is affected by the degree of water stress of the host tree (Fig. 1). In general, lesion growth is slower in trees which are water stressed than in trees which are well watered. A series of measurements to quantify the effect of changes to the forest environment on the water status of jarrah and on the aggressiveness of P. cinnamomi infections in jarrah have been initiated. The ultimate aim of the work is to predict the affect of changes in the jarrah forest environment on jarrah growth and survival in the presence of P. cinnamomi

1. WATER RELATIONS AND GROWTH OF JARRAH (EUCALYPTUS MARGINATA) ON SITES INFESTED BY P. CINNAMOMI.

Water potentials, stomatal conductances and growth of jarrah on sites of high (many trees dead or dying) and low/moderate (few if any jarrah deaths, few to many Banksia grandis deaths) are being compared during summer droughts. Three years data is now available for high impact sites, one years data for low/moderate impact sites. A summary of early data for the high impact sites is shown in Fig. 2.

In general, trees on dieback sites are more water stressed than nearby trees on apparently uninfested areas. Also, severe water stress is more frequent among trees on severely dieback affected sites than on less severely affected sites. Dendrometers used to measure tree growth recorded both the more severe water stress of dieback affected trees compared to unaffected trees. Overall effects of dieback on tree growth are complex, apparently being determined by the level of infection of individual trees, the "thinning effect" caused by dieback destroying competing trees and site, speculated to affect tree growth through both water availability and pathogen propagule numbers and dispersal.

2. GROWTH OF P. CINNAMOMI LESIONS IN JARRAH IN THINNED AND UNTHINNED FOREST.

A thinning trial is being installed so that the effects of known changes to site vegetation on growth of P. cinnamomi lesions in stem and root phloem can be examined.

3. WATER RELATIONS OF JARRAH IN THINNED AND UNTHINNED FOREST.

Water potentials and growth of jarrah in adjoining thinned and unthinned areas have being measured from spring until the end of summer drought (Fig. 3). Results will be correlated with rainfall and growth to assess the effect of thinning on water stress over a range of rainfall zones.

4. WATER RELATIONS OF JARRAH TREES, SAPLINGS, SEEDLINGS AND COPPICE.

Mature jarrah are only the most visible trees in the jarrah forest. Coppice, young trees and seedlings co-exist with the mature trees and are also susceptible to P. cinnamomi related dieback. Measurements of the water relations of these classes of jarrah in native forest have begun. Differences in leaf and xylem water potentials and stomatal conductances have been found between trees and coppice on low rainfall sites (<800 mm pa) but not in non-stressed trees on high rainfall sites (1200 mm pa) (Fig. 4). Measurements of bark and stem xylem and phloem water potentials will be continued.

Figures:

Fig. 1. Final length of lesions above inoculation point in jarrah vs. dawn water potentials at six sites in the northern jarrah forest.

Fig. 2. Separation of healthy (open bars) and dieback trees (closed bars) based on;
a: water status
b: stem growth
c: crown form

Fig. 3. Dawn water potentials (a) and growth (b)of jarrah on unthinned and thinned forest.

Fig. 4. Water potentials and stomatal conductances of jarrah saplings and stump coppice on a site with moderate late summer water deficit.

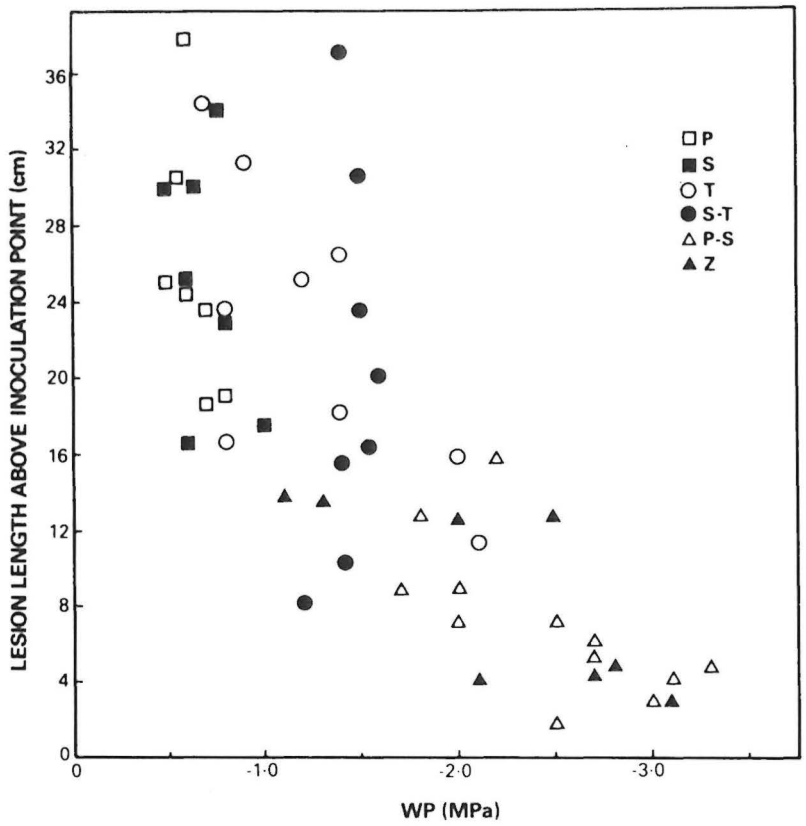
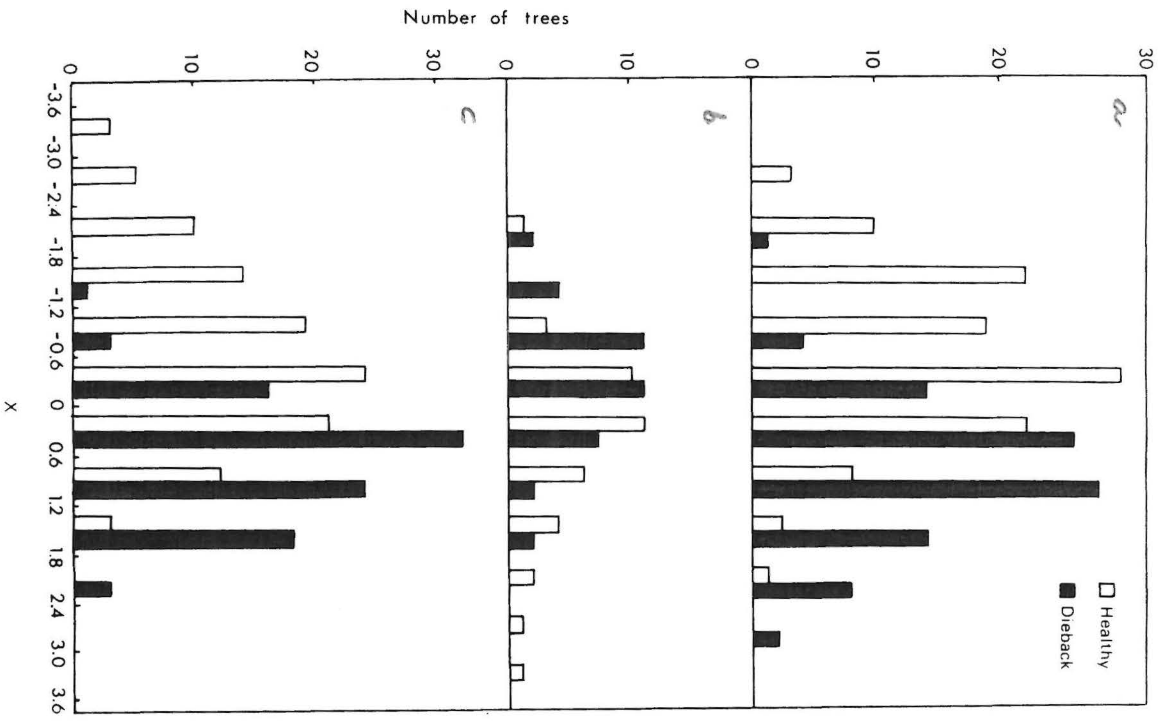
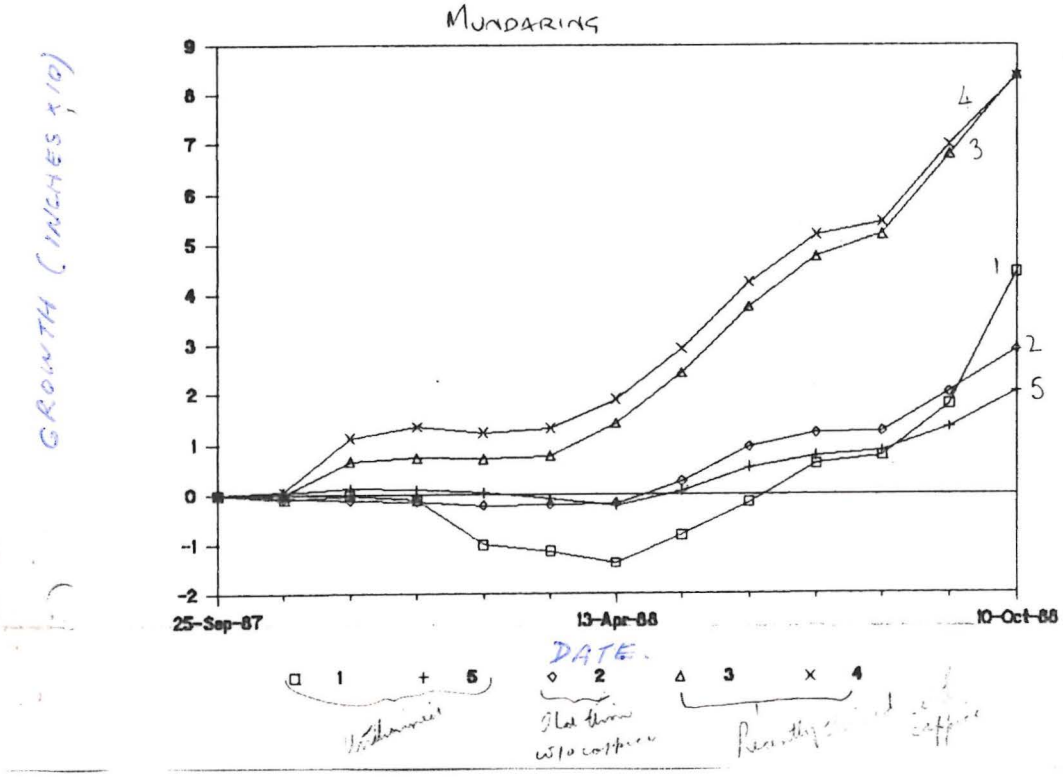
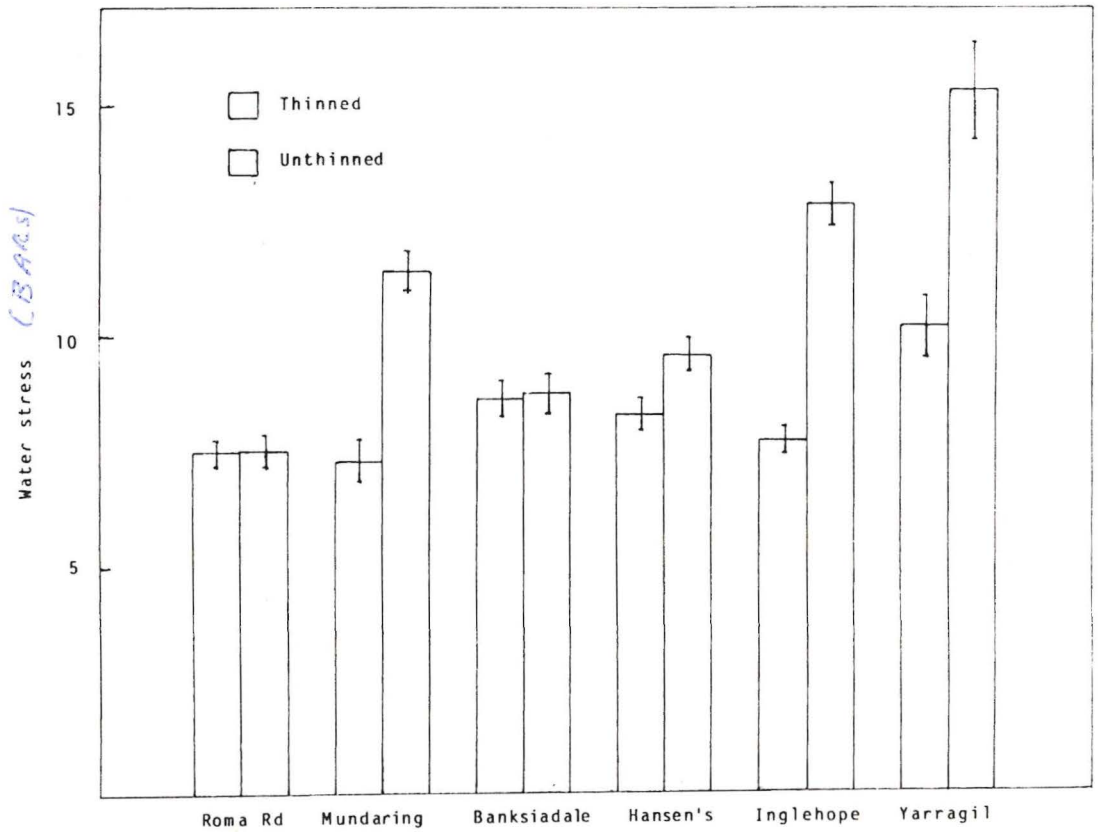
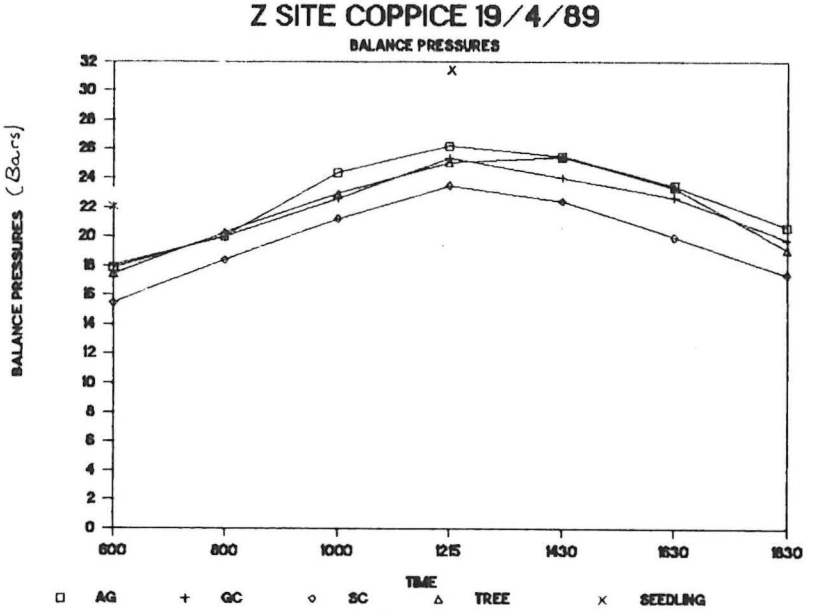


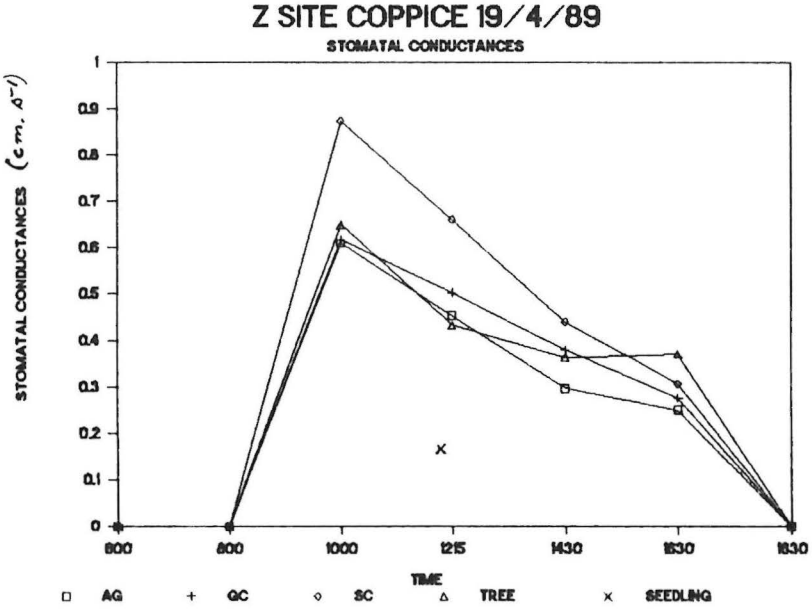
Fig. 1 Final length of lesions above the inoculation points vs. April predawn leaf water potentials (WP) for individual trees in plots 1–6 at the Jarrahdale and Dwellingup sites. Plots were in two different areas of the forest and were classified as Havel (6) vegetation site types P, S, T, S-T, P-S, and Z. Lowest predawn water potentials were recorded for the P-S and Z type trees.


Number of trees
Healthy
Diebank
0
10
20
30
-3.6
-3.0
-2.4
-1.8
-1.2
-0.6
0
0.6
1.2
1.8
2.4
3.0
3.6
X


MUNDARING
GROWTH (INCHES x 10)
9
8
7
6
5
4
3
2
1
0
-1
-2
25-Sep-87
13-Apr-88
10-Oct-88
DATE
1
2
3
4
5
□ 1 + 5
◇ 2
△ 3 × 4


Water stress (BARS)
15
10
5
Thinned
Unthinned
Roma Rd
Mundaring
Banksiadale
Hansen's
Inglehope
Yarragil


Z SITE COPPICE 19/4/89
BALANCE PRESSURES
BALANCE PRESSURES (Bars)
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
600
800
1000
1215
1430
1630
1830
TIME
AG
GC
SC
TREE
SEEDLING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STOMATAL CONDUCTANCES
STOMATAL CONDUCTANCES (c.m. s-1)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
600
800
1000
1215
1430
1630
1830
TIME
AG
GC
SC
TREE
SEEDLING