

SIMULATIONS OF NATURAL TREE RESISTANCE IN COASTAL DOUGLAS-FIR INFECTED WITH PHELLINUS ROOT ROT

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INTRODUCTION

This report examines the effects of natural tree resistance in coastal Douglas-fir infected with *Phellinus* root rot through simulation with the TASS-ROTSIM model described in a previous report (W.J. Bloomberg, Incorporation of *Phellinus* root rot impacts in the tree and stand simulator (TASS), Progress Report, Contract #49782, March 31, 1991). The latter report examined the effects of inoculum level (number, size, and spatial distribution of infected stumps). A second report dealt with effects of stand density and site index on root rot (W.J. Bloomberg, Preliminary yield tables for coastal Douglas-fir infected with *Phellinus* root rot, Contract #69198, June 10, 1991). Other reports have dealt with the effects of juvenile spacing and stump removal as methods of controlling root rot.

Natural resistance is the capacity of Douglas-fir to arrest the spread of *Phellinus* mycelium in the roots, thus preventing mortality. Typically, resistance occurs when the fungus has spread to within 1 m of the bole and is manifested by prolific production of callus from which new, adventitious roots arise. This reaction, termed bole resistance, also prevents the fungus spreading to the other roots via the bole. (W.J. Bloomberg and A.A. Hall. Effect of laminated root rot on relationships between stem growth and root-system size, morphology, and spatial distribution in Douglas-fir, *Forest Science* 32: 202-219, 1986) Providing that the tree is not exposed to windfall, it may continue growth, often with little above-ground symptoms. An additional benefit is that the number of infected roots is reduced, thus reducing inoculum in the current and following rotations. It is estimated that approximately 10% of Douglas-fir have resistance.

Studies have been undertaken to propagate by cuttings trees which demonstrate bole resistance (G.D. Jensen, personal communication). By increasing the proportion of resistant trees, volume loss through mortality could presumably be reduced. TASS-ROTSIM has an option for setting the percentage of resistance. Simulation of various proportions can give some estimates of the potential gains.

METHODS

Natural resistance is simulated in TASS-ROTSIM by randomly assigning resistance to trees up to a specified percentage. Bole resistance is implemented by preventing further spread when the fungus reaches 0.5 m from the bole. Resistance was set at 0, 10, and 30%, representing the minimum, and estimated mean, and maximum occurrence in nature. Initial stocking was set at 1000 stems/ha.

Inoculum levels were represented by five root rot classes: very light, light, moderate, heavy, and very heavy as defined in the above reports. All stands had a site index of 35m. corresponding good site.

Methods for simulating root rot in stands and calculating effects on stocking (stems/ha) and volume are described in the above reports.

RESULTS

Resistance of 30% increased volume by 4% over resistance of v. light severity and by 28 and 26% at moderate and v. heavy severity (Table 1). Stocking was increased by 6, 21 and 51% respectively. Resistance of 10% increased volume by 1% over 0% resistance but produced volumes less than 0% resistance at v. and v. heavy root rot severities. Stocking was about the same v. light and moderate severities and 20% less at v. heavy severity.

T A B L E 1 .
EFFECT OF TREE RESISTANCE ON IMPACT OF HEAVY ROOT ROT IN DIFFERENT STAND DENSITIES

	Percent resistance					
	0		10		30	
	Stocking/ha	Volume/ha	Stocking/ha	Volume/ha	Stocking/ha	Volume/ha
Root-rot severity	At stand age 90					
V.Light	554	1099	544	1074	589	1145
Moderate	454	852	461	938	549	1053
V.Heavy	288	627	230	490	435	793

The inconsistent results of the 0 and 10% resistance at v.light and v. heavy root—rot severity can only be attributed to the small effect of 10% resistance being offset by configurations of stumps and trees which allowed the disease to spread more rapidly in the higher resistance stand.

The proportions of killed and living infected trees varied among resistance classes. For example, in v. heavy root rot, percentages of killed trees were 46, 48, and 36 for resistances 0, 10, and 30%, respectively. Percentages of living infected trees were 18, 17, and 32, respectively. Thus, 30% resistance greatly decreased mortality and increased volume and stocking.

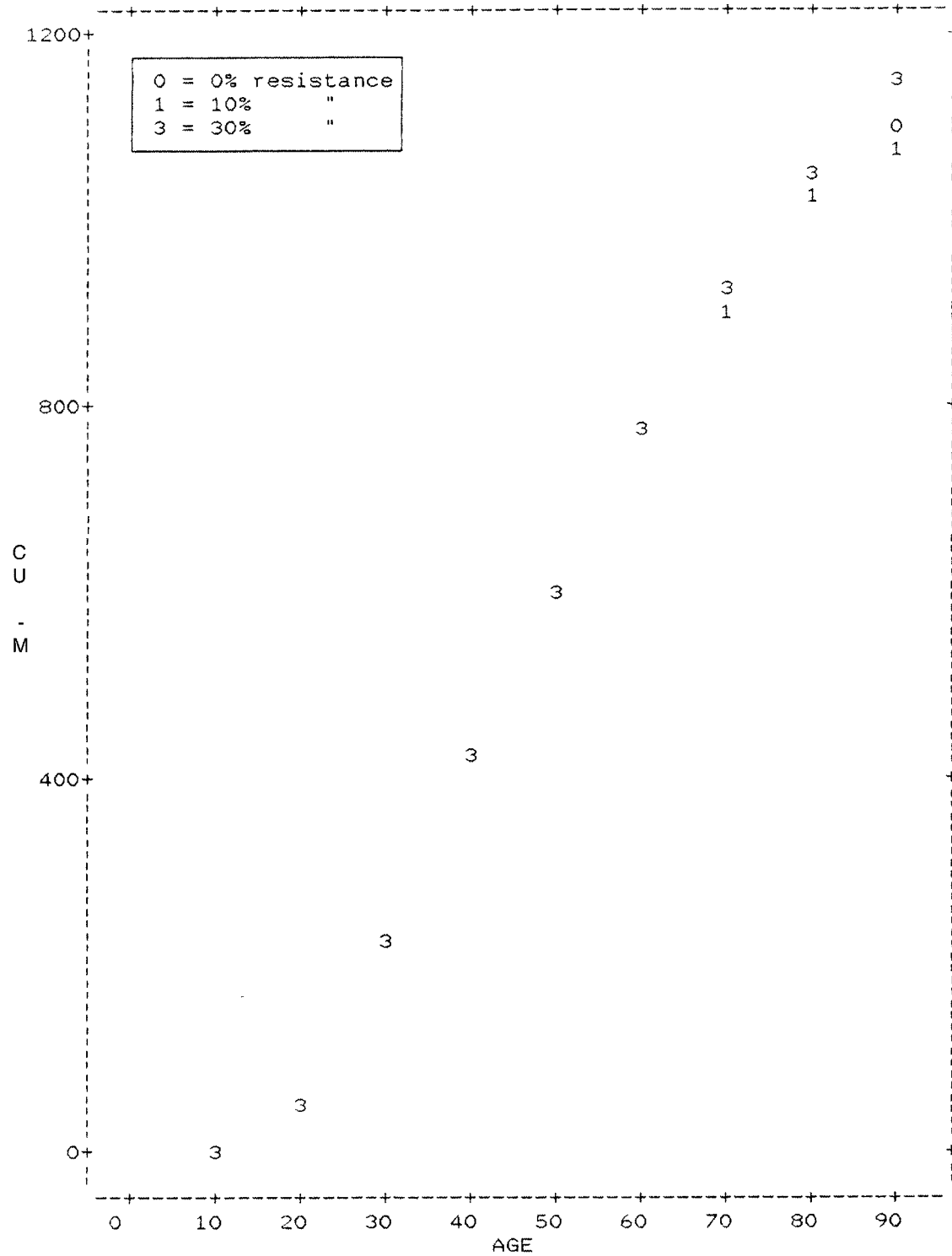
CONCLUSION

The gains of 26-28% in volume and 21-51% in stocking in moderate and v.heavy root-rot severities is almost proportional to the 30% increase in resistance. Simulation indicates that such increases would be worth achieving together with the benefit of reduced inoculum in the next rotation.

EFFECT OF RESISTANCE ON VOL OF D. FIR WITH ROOT ROT

Initial Stocking 1000 sph, Site Index 35

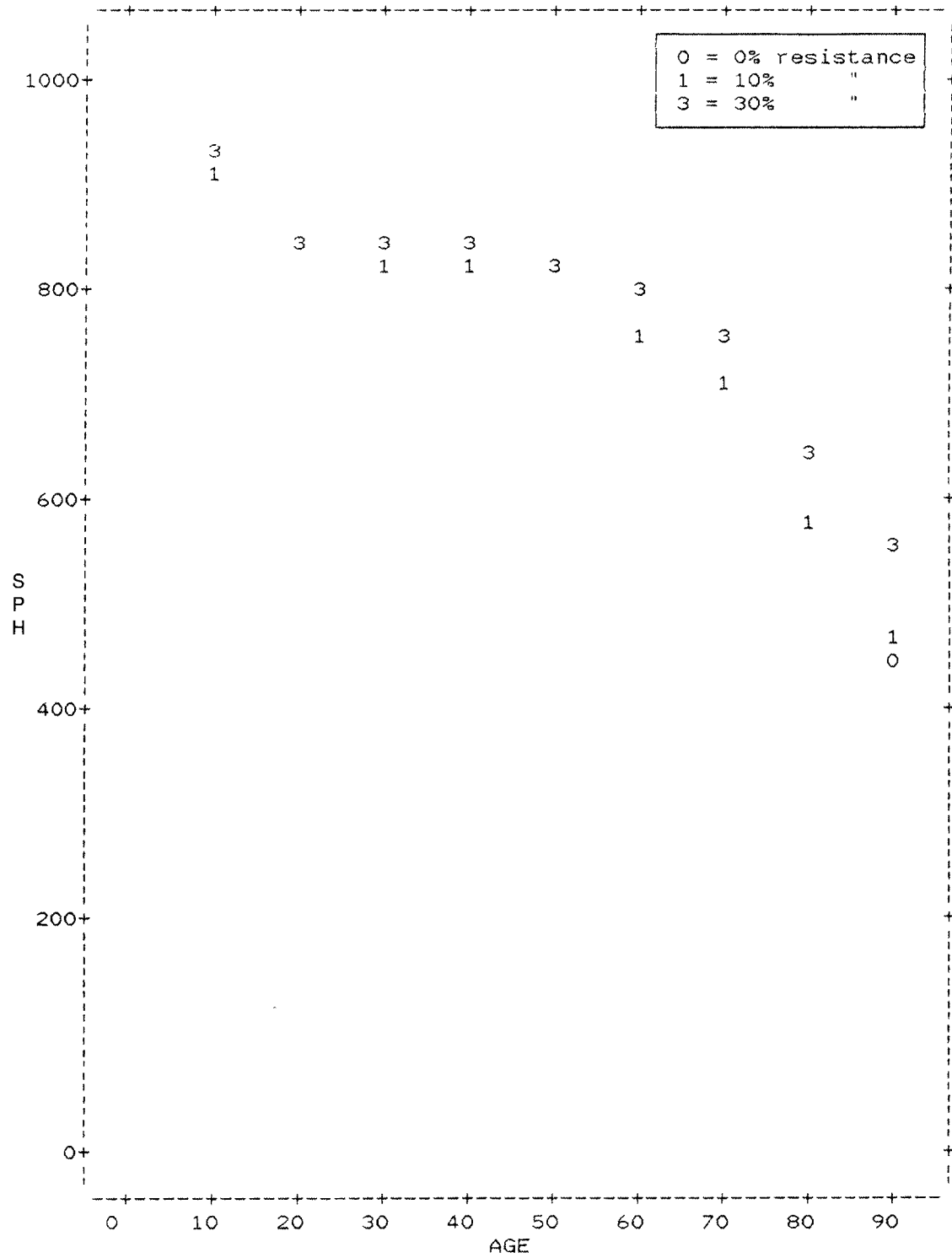
Very Light Root Rot



EFFECT OF RESISTANCE ON SPH OF D. FIR WITH ROOT ROT

Initial Stocking 1000 sph, Site Index 35

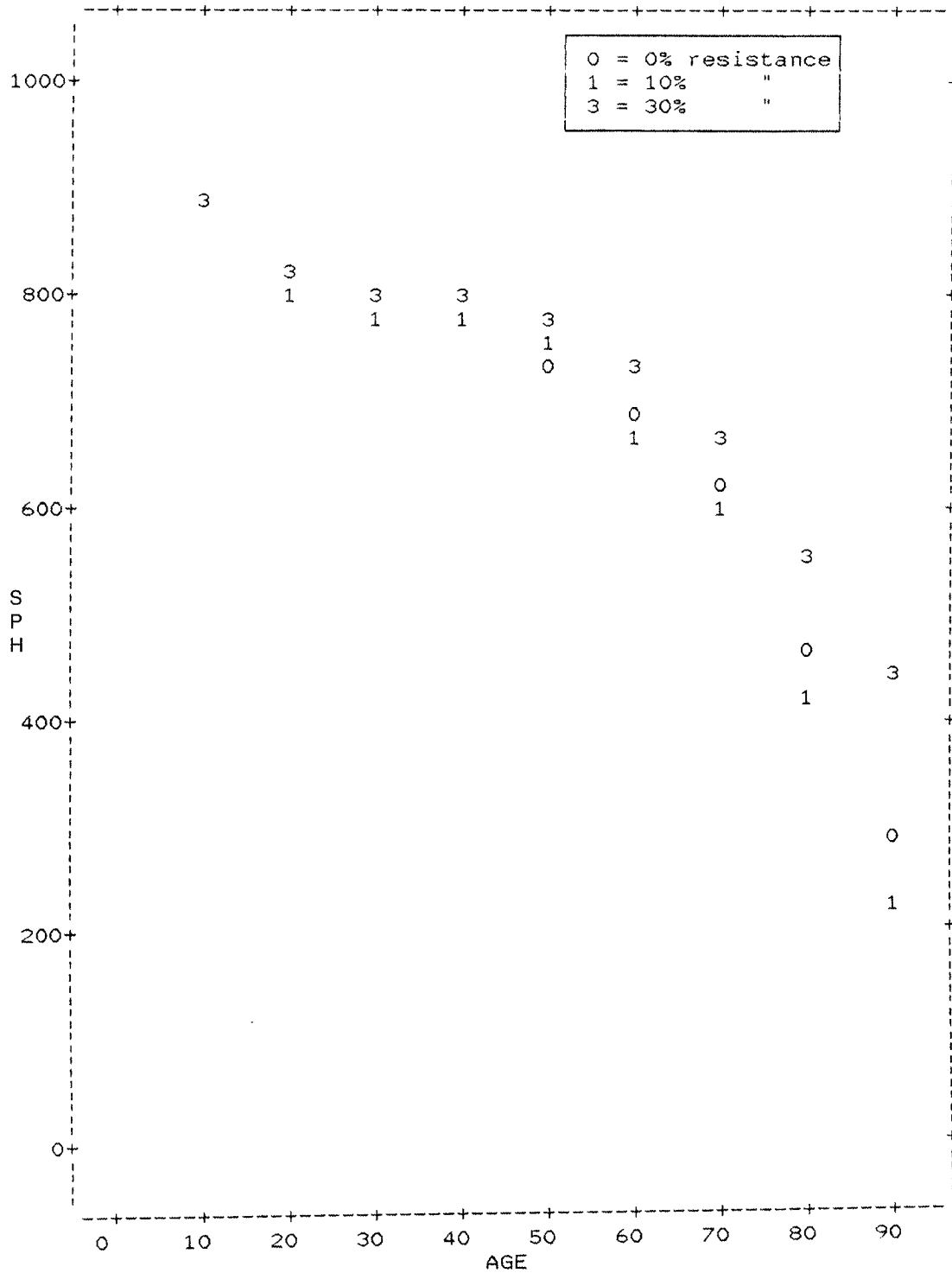
Moderate Root Rot



EFFECT OF RESISTANCE ON SPH OF D. FIR WITH ROOT ROT

Initial Stocking 1000 sph, Site Index 35

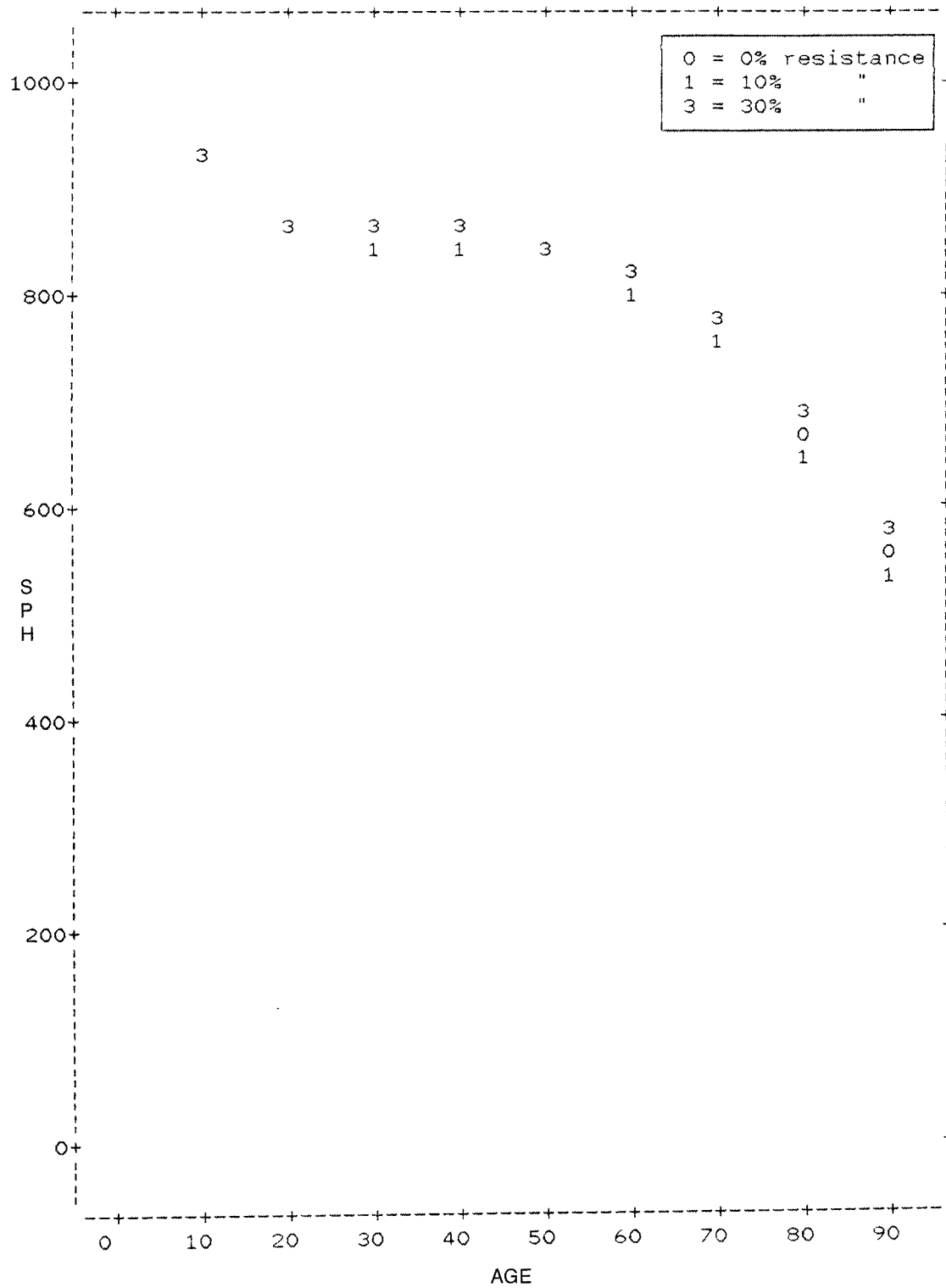
Very Heavy Root Rot



EFFECT OF RESISTANCE ON SPH OF D. FIR WITH ROOT ROT

Initial Stocking 1000 sph, Site Index 35

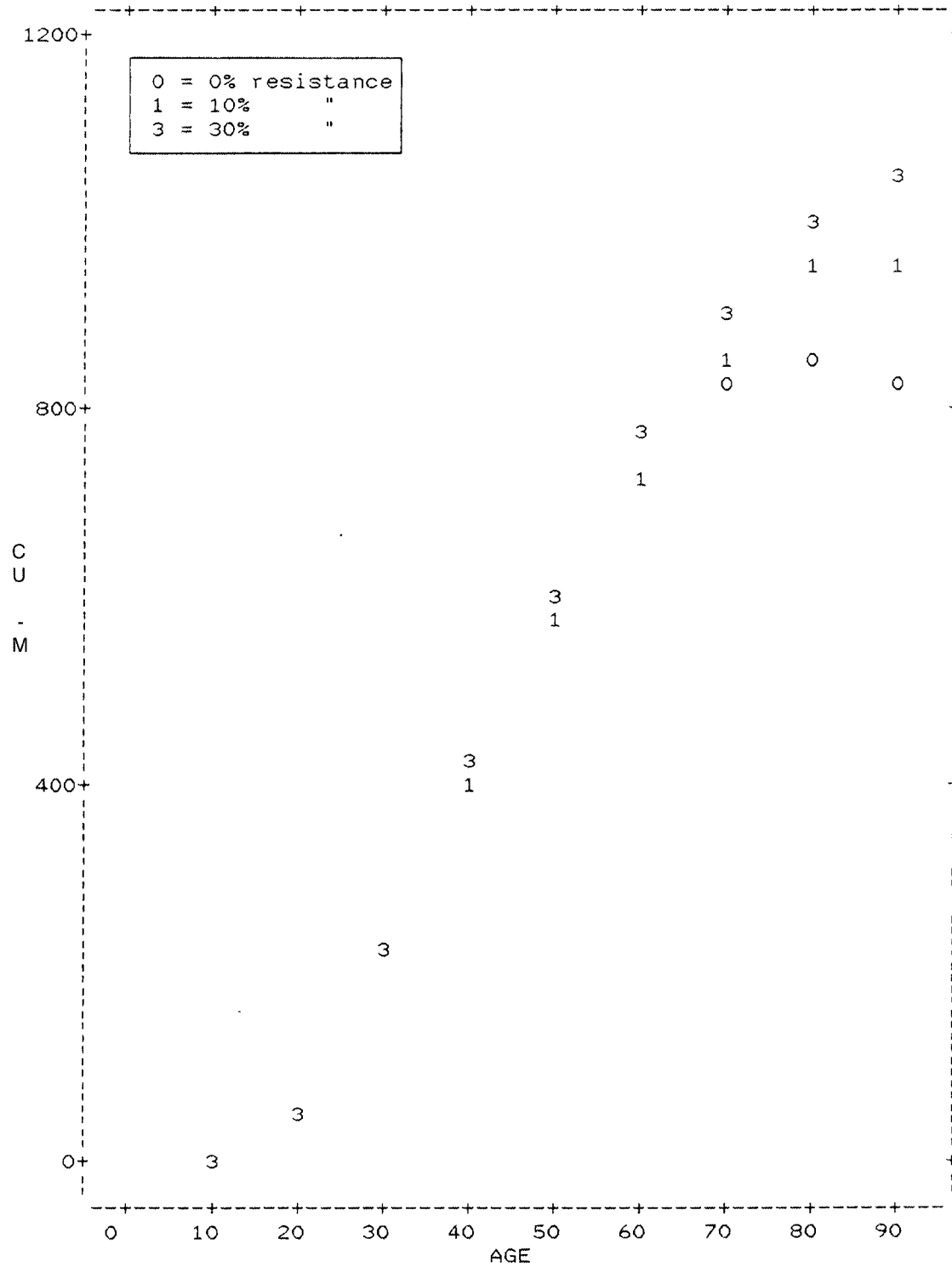
Very Light Root Rot



EFFECT OF RESISTANCE ON VOL OF D. FIR WITH ROOT ROT

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EFFECT OF RESISTANCE ON VOL OF D. FIR WITH ROOT ROT

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