A SOIL-TESTING PROCEDURE FOR PREDICTING PHOSPHORUS STATUS OF *PINUS ELLIOTTII* PLANTATIONS

by F. R. HUMPHREYS* and W. L. PRITCHETT**

SUMMARY

An examination of soils from both Florida and Eastern Australia which are supporting the growth of *Pinus elliottii* showed that a satisfactory prediction of foliage P levels can be made from soil analysis, provided intensity and quantity factors are used.

INTRODUCTION

*Pinus elliottii* (Engelm) has often shown a positive response to phosphate fertilizers, especially when planted outside its natural habitat \(^1\) \(^{11}\) \(^{12}\) \(^{16}\). The amount of fertilizer needed to give the desired yield is normally determined by local knowledge or experience, although one attempt has been made to estimate it by soil testing procedures with very limited success \(^1\). Rather better precision has been reported using foliage analysis which is closely related to growth in these circumstances \(^10\). However, as major responses to P amendments are in the first years immediately following planting, this information is not available early enough to maximize yield. A satisfactory P soil test for forestry purposes should be reasonable insensitive to location, soil type, degree of disturbance, and previous fertilizing and cropping history. It should give some indication of the probable length of time which P amendments will usefully yield P to a growing forest, and indicate in what form, quantity, and by what method of application (spread or banded) this amendment

* Forestry Commission of N.S.W., Sydney, Australia.
** University of Florida, Gainesville, FLA., U.S.A.
should be made. The aim of this investigation was to find to what extent any one or combination of P soil testing procedures could meet these requirements.

MATERIALS AND METHODS

The sites

Seven sites in Florida on six different soil series (Bladen, Kershaw (2), Pomello, Rutlege, Myakka, and Leon) were selected as previously described. Each site contained plots with three replications of three fertilizer treatments (nil, 39 kg/ha P as superphosphate, and 314 kg/ha P as Florida rock phosphate, surface applied, 7 to 12 years previously), and supported *P. elliottii* trees planted in the same year as the fertilizer treatments were carried out.

Four Australian sites were selected on the coastal plain of Eastern Australia between latitudes 29°S and 35°S. Three sites (Barcoongere, Whiporee, and Banyabba) were located in summer/autumn rainfall areas with a mean annual precipitation of 1100–1400 mm. The fourth (Conjola) was the most southerly and had a mean annual rainfall of about 1000 mm with no defined seasonal distribution. The Barcoongere soils were yellow podzolics (Pd 18 and Pb 57); the Whiporee and Banyabba soils, sandy with mottled yellow clay subsoil (Wc 8); the Conjola soils, yellow acid mottled soils containing ironstone gravel (Tb 38). These sites supported *P. elliottii* trees ranging in age from 5 to 32 years, some of which had received phosphatic fertilizer treatment in the form of superphosphate.

Sampling procedures

a) Foliage. The Florida samples were composite samples of four trees. The foliage samples from the Australian sites were from a co-dominant tree adjacent to the soil sampling position. In both locations the foliage initiated in the previous spring was taken from a branch of a spring whorl in the top third of the crown. The needles were collected in winter, (December in Florida, June in Australia). The Australian samples were not all collected in the same year. Because of the wide distribution of the plots each of the groups (except for the Whiporee and Banyabba samples) had quite different environmental conditions in the same growing season. All samples were dried at 70°C, ground and stored in stoppered bottles.

b) Soils. The Florida soils were sampled at 15 randomly selected locations per plot as previously described, 0–20 cm samples being used because it had been found that, in very sandy soils, *P. elliottii* fine roots penetrate to this depth. The Australian soils were sampled at 0–10 cm. All soils were air dried in the laboratory, thoroughly mixed, passed through a 2-mm sieve and the proportion of stones calculated.

Chemical analysis

a) Foliage. Phosphorus was determined by the method of Murphy and Riley on a solution prepared by dry ashing and solution in HCl.