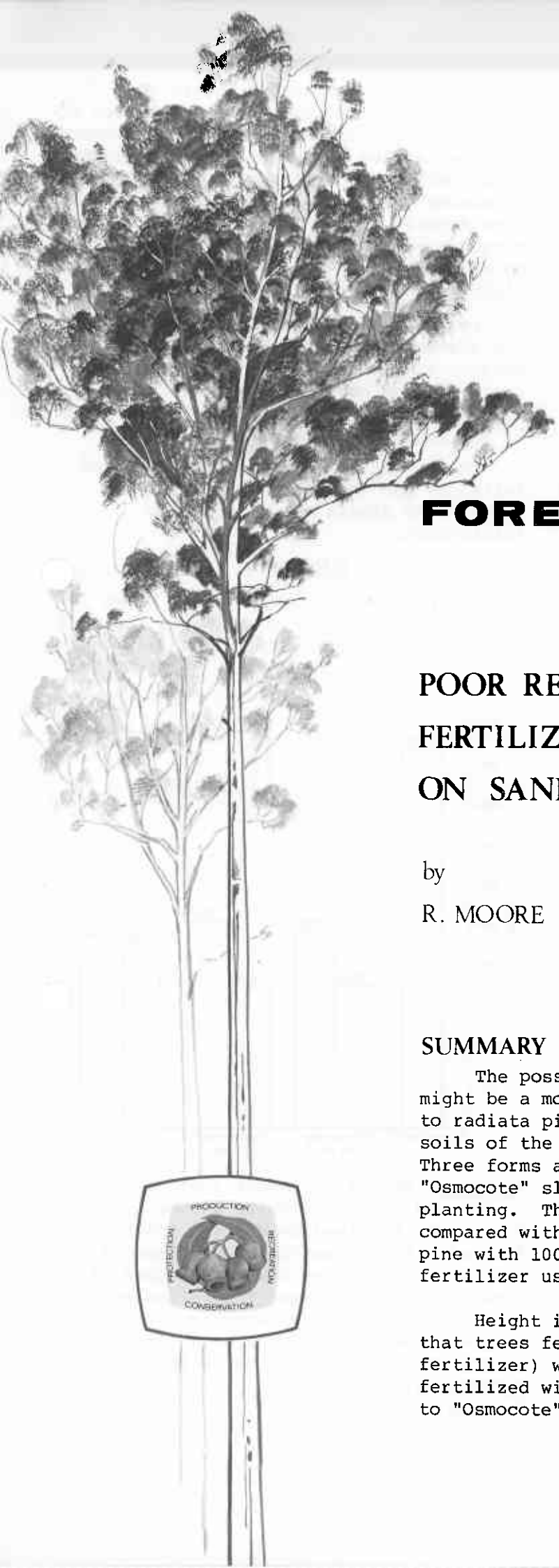

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FORESTS DEPARTMENT
OF WESTERN AUSTRALIA

POOR RESPONSE TO A SLOW RELEASE FERTILIZER BY YOUNG *Pinus radiata* ON SANDY SOIL

by

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SUMMARY

The possibility that slow-release fertilizers might be a more efficient way of supplying nutrients to radiata pine (*Pinus radiata* D. Don) on the infertile soils of the Donnybrook Sunkland was investigated. Three forms and two rates (10 g and 30 g per tree) of "Osmocote" slow-release fertilizer were applied at planting. The results of these treatments were compared with those obtained from fertilizing radiata pine with 100 g of "Agras No. 1" (the standard fertilizer used with pine on the Sunkland).

Height increment 18 months after planting showed that trees fertilized with "Agras" (an inorganic NP fertilizer) were significantly taller than trees fertilized with "Osmocote". "Agras" was also superior to "Osmocote" in terms of cost efficiency.

INTRODUCTION

A major plantation establishment project with *Pinus radiata* D. Don is being carried out by the Forests Department of Western Australia on the Donnybrook Sunkland. To ensure satisfactory growth on the generally infertile soils, essential elements must be applied. However, the high solubility of standard inorganic fertilizers results in large losses of nutrients, especially during winter when water tables rise and saturate the soil on many sites. A study area with a similar soil type and rainfall to the Sunkland had shown that the effect of "Agras 24:24" fertilizer lasts only two years (Moore, 1981).

The possibility of using a slow release fertilizer that supplies nutrients continuously over a long period of time was considered. A pilot trial was established to study the comparative efficiencies of the commercially available slow-release fertilizer "Osmocote" and the standard initial fertilizer "Agras", by relating height growth to fertilizer costs.

METHOD

The experiment was established in Compartment 5, Jarrahwood Plantation, on grey sandy loam. Prior to planting, the area was cleared, windrowed, disc-ploughed and mounded. In July 1979, one-year-old *P. radiata* seedlings were planted at a spacing of 2.5m x 3.5m (1140 stems per hectare).

The experimental design was a randomized block with seven fertilizer treatments and two replications. The treatments of application were as follows:

(i) "Agras No. 1" at 100g per tree;

(ii) "Osmocote (365 day)" at 10g per tree;

(iii) "Osmocote (365 day)" at 30g per tree;

(iv) "Osmocote (280 day)" at 10g per tree;

(v) "Osmocote (280 day)" at 30g per tree;

(vi) "Osmocote (100 day)" at 10g per tree;

(vii) "Osmocote (100 day)" at 30g per tree.

Each plot consisted of ten trees in a row. "Agras No. 1" (applied at 100g per tree), the standard fertilizer used with pine on the Sunkland, was used as a control. The rates of "Osmocote" selected for testing were based upon a consideration of fertilizer costs; the low rate of "Osmocote" (applied at 10g per tree) was cheaper than 100g "Agras" per tree, and the high rate of "Osmocote" (applied at 30g per tree) was considerably more expensive (Table 1). Fertilizers were placed in a shallow hole on either side of the tree soon after planting and covered with soil.

In November 1979, all trees received the standard plantation treatment of foliar sprays: a mixture of zinc sulphate (5 per cent w/v) and copper sulphate (0.2 per cent w/v*) at a rate of approximately 5.0 kg.ha^{-1} and 0.2 kg.ha^{-1} respectively.

The height of all trees was measured initially and then at 18 months after planting to assess the response to fertilizers.

RESULTS

The mean height increment of trees 18 months after application is shown for each of the seven fertilizers (Figure 1).

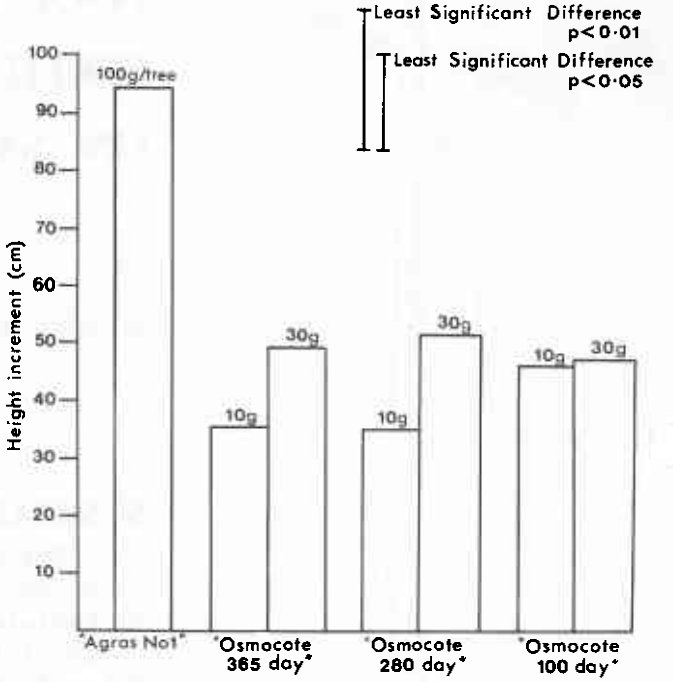

FIGURE 1: Height increment (cm) of *P. radiata* on infertile soils on the Donnybrook Sunkland in Western Australia following fertilization at the time of planting. Two rates and three types of "Osmocote" slow release fertilizer and a convential nitrogen/phosphorus fertilizer ("Agras") were used. The height increment is for the 18 month period following fertilization.

* weight per volume.

TABLE 1

Fertilizer costs per tonne and per tree at three different rates of application.			
Fertilizer	Cost per tonne ($)	Rate of Application (g/tree)	Cost per tree (c)
"Agras No. 1"	197	100	20
"Osmocote 365 day"	1716	10 30	17 51
"Osmocote 280 day"	1452	10 30	14 42
"Osmocote 100 day"	1452	10 30	14 42

Analysis of the height data showed that the response to "Agras" was significantly better ($P = 0.01$) than the response to all forms and rates of "Osmocote". There were no significant differences in height growth for different rates and forms of "Osmocote".

Cost data for fertilizers are presented in Table 1. The figures concern materials only (labour and plant costs being excluded). An efficiency rating for each fertilizer was calculated using height data and cost of fertilizer applied per tree.

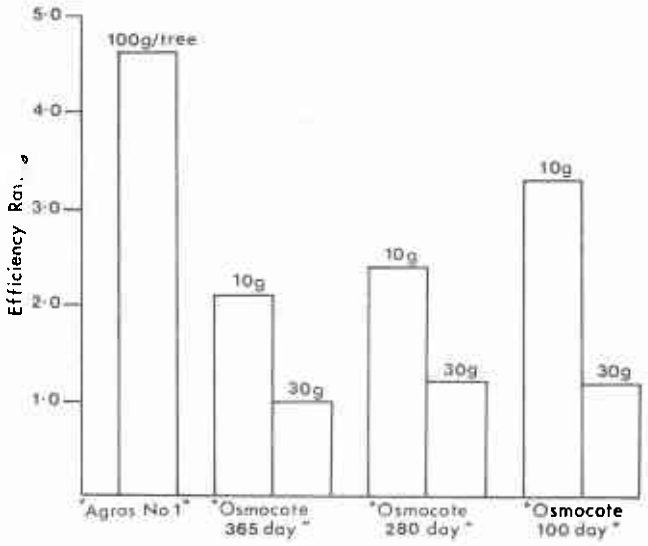

FIGURE 2: Efficiency rating of "Agras" (conventional NP fertilizer) compared with two rates and three forms of "Osmocote" slow release fertilizer. The efficiency rating is calculated by dividing height increment (cm) by fertilizer cost per tree (cents).

Figure 2 shows the rating for each fertilizer. A high rating indicates a more efficient fertilizer. The efficiency of "Agras" is clearly better than all the slow-release fertilizers used.

DISCUSSION

The experiment showed that height increment was significantly better for "Agras" than for all rates and forms of "Osmocote" slow-release fertilizer. "Agras" was also superior in terms of cost effectiveness. Therefore "Agras" is the better initial fertilizer to use on pine on the Donnybrook Sunkland.

The comparatively poor performance of "Osmocote" confirmed the findings of Bengston (1976). In his review of fertilizers used in forestry, Bengston reported that the majority of tests with slow release N fertilizers had poor results. In commenting about a similar lack of success with slowly released P materials, he stated that in nearly all studies, superphosphate, especially triple superphosphate, produced the best growth.

The small amount of N and P in "Osmocote" could possibly explain its poor performance. The comprehensive initial fertilizer studies by Woods (1976) found that 70g of N and 3.9g of P must be applied to each tree at planting, to maximize growth in the first year. According to the distributors (C.H. Bailey and Son), 30g of "Osmocote" (the highest level tested)

contains 5.4g N and 0.63g P, whereas 100g of "Agras" contains 18.0g N and 7.9g P. Thus, the amount of "Agras" applied (100g) contains more than three times the amount of N and 11 times the amount of P than in the highest level of "Osmocote" applied (30g).

Evidently the amount of essential elements in "Osmocote" is not sufficient to produce good growth of pine. Furthermore, the cost of 30g of Osmocote is more than double the cost of 100g of Agras, making Agras also the most cost-efficient fertilizer.

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CORRIGENDUM TO RESEARCH PAPER 71

In Research Paper 71 the fertilizer costs per tree given in Table 1 were incorrect. The correct cost should be 1/10th of that shown, e.g. the cost of 100 g of "Agras No. 1" should be 2.0 cents and not 20 cents, and 10 g of "Osmocote 365 day" should be 1.7 cents and not 17 cents.

The error appears again in Figure 2 where, because of the original mistake in the fertilizer costs, the efficiency ratings of the fertilizers are shown as 1/10th of their true value.