NOTE

LUPIN SOWING RATES FOR SAND DUNE STABILISATION AT POUTO FOREST

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INTRODUCTION

The procedure followed by the New Zealand Forest Service for reclamation of coastal sand dunes is as follows:

(1) Arrest sand on the foredune.
(2) Plant marram grass (*Ammophila arenaria* (L.) Link).
(3) Sow lupin seed (*Lupinus arboreus* Sims).
(4) Plant *Pinus radiata* (D. Don).

Cockayne (1911) made the first recommendation for including tree lupin in the planting succession, but did not specify seed sowing rates. Restall (1964) was the first to document the rate considered to be adequate at Woodhill Forest, and the specified 2-3 lb/ac (3 kg/ha) has been used as a guideline for 20 years. Berg and Smithies (1973) drew attention to the advantages of subsurface sowing as opposed to broadcast methods. Their trials at Woodhill and Aupouri Forests included rates of 5-45 kg/ha, and 5-6 kg/ha were considered to be satisfactory for rapid sand stabilisation. A machine developed in conjunction with their work sowed 2.2-5.0 kg seed/ha and, although no yield data were presented, they considered these rates sufficient to give an effective lupin cover. Wendelken (1974) reported general use of a high sowing rate (10-11 kg/ha) if seed was broadcast, less (rate unspecified) being required for subsurface sowing.

At Pouto Forest (Kaipara North Head: 36° 22'S, 174° 11'E), where exposure and nutrient deficiency (molybdenum and sulphur) retard the development of untreated lupin plants (Gadgil *et al.*, 1981), all lupin seed is now coated with molybdenum trioxide before sowing, and operational trials are in progress to determine the most cost-efficient means of applying sulphur. In 1980 concern was expressed about the high cost of seed (then $3.55/kg) combined with the heavy sowing rate (12 kg/ha) recommended before nutrient treatment was adopted as an operational procedure. It was hoped that the seed rate could be reduced if lupin growth was improved with molybdenum and sulphur treatment.

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METHODS

A small trial was carried out approximately 0.5 km south of Lake Kanono in the south-eastern part of Pouto Forest. Marram grass had been planted at 1.4 m spacing in 1981. Four rates (3, 6, 9, and 12 kg) of subsurface lupin sowing were tested, each replicated 3 times in a randomised block layout. Individual plot size was 12 × 12 m. In June 1982 lupin seed dusted with molybdenum trioxide (10 g MoO_3/kg seed) was sown in 8 equidistant rows between the 8 marram rows in each plot. A calibrated "Planet Junior" hand-propelled machine was used to deliver the seeds evenly along the rows at approximately 2.5 cm depth. Elemental sulphur (50 kg/ha) was hand-drilled at a distance of about 10 cm from each seed row. The fresh weight of all lupin plant tops in each plot was determined in April 1983.

RESULTS AND DISCUSSION

The trial was designed so that the rate of Mo per seed (directly applied) was held constant regardless of seed sowing rate. None of the plants developing from seed could have been defici-

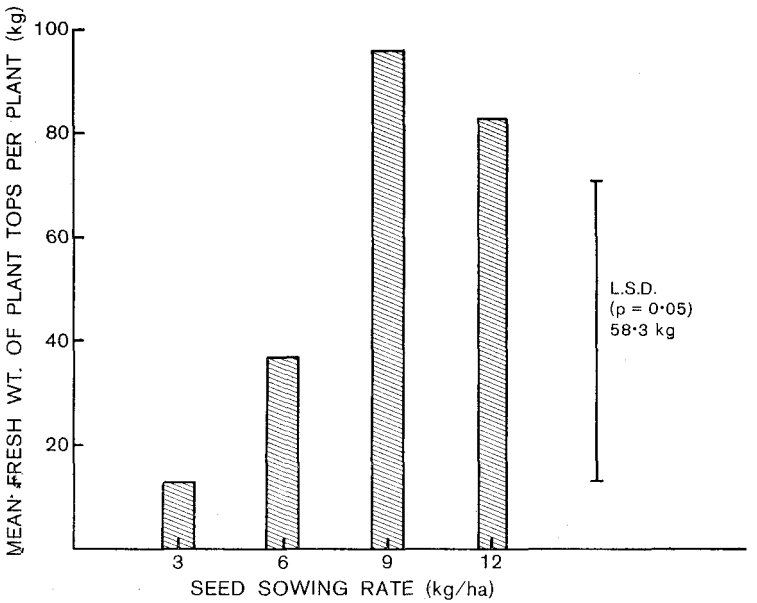

FIG. 1: *Effect of seed sowing rate on lupin productivity (plants 10 months old).*

ent in Mo during this first year of growth. The highest rate of Mo applied (0.12 kg MoO_3/ha) was unlikely to have had any toxic effect since a previous trial (A815/5) demonstrated a significant positive growth response to MoO_3 at a much heavier rate (3 kg/ha sidebanded to seed lines; Gadgil *et al.*, 1981).

Lupins germinated well, but seedling survival was uneven in all treatment plots. In spite of considerable inter-plot variability, lupin productivity after one season was found to be influenced by seed rate, total top growth per plot being greater at the 9 and 12 kg/ha sowing rates than at 3 kg/ha (Fig. 1). Yields from 9 kg seed/ha were significantly greater than those from 6 kg/ha, but those from 12 kg/ha were not.

Although the site was exposed, conditions were not atypical in any obvious way. Surviving lupin plants had grown well. The results show that lupin productivity (and thus the potential amounts of nitrogen fixed, seed produced, shelter provided, and organic matter incorporated into the ecosystem) was impaired by adverse site factors even when Mo and S had both been applied. A seven-fold improvement was achieved by increasing the seed sowing rate from 3 to 9 kg/ha, but 6 kg/ha was not sufficient to improve lupin productivity in all plots.

We suggest that the rates of 3-6 kg/ha originally recommended for Woodhill and Aupouri Forests are not necessarily adequate at Pouto for the achievement of maximum benefit from the sowing of lupins during sand dune stabilisation. A rate of 9 kg/ha is more likely to result in an even distribution of lupin plants during the first season.

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