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JULY-DECEMBER 1995 PROGRESS REPORT ON OBJECTIVE 1 OF THE SAND DUNE REVEGETATION PROGRAMME

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ABSTRACT*

The 1995 assessments planned for the eleven trials examining the relative performance of selected nitrogen-fixing plants on open sand dunes have been completed and growth data are being processed.

Two factors have necessitated the removal of experimental plants from some of the trials :

- (a) Concern expressed by some land managers about the perceived weed threat from *Acacia saligna* and *A. sophorae*.
- (b) Interspecies interference in spaced-plant trials.

Action taken in each trial is described and the current status of all trials is documented.

* Note: This material is unpublished and must not be cited as a literature reference.

JULY -DECEMBER 1995 PROGRESS REPORT ON OBJECTIVE 1 OF THE SAND DUNE REVEGETATION PROGRAMME

INTRODUCTION

By July 1995, a total of 11 field trials had been established under the Sand Dune Revegetation Research Programme, which is funded by the Foundation for Research, Science and Technology (FRST). These trials are located in areas of marram grass and/or spinifex, just behind the foredune, in five major sand dune areas on the west coast of the North Island. They are designed to determine the relative performance of selected nitrogen-fixing plants in the sand dune environment. The Programme aims to use the results of annual assessments in the trials as a basis for recommending species mixtures that could take over the role of *Lupinus arboreus* in sand dune revegetation. Descriptions of trial layout and earlier assessments of plant performance have been documented by Gadgil and Sandberg (1992); Lowe (1992); Gadgil, Douglas, Sandberg and Lowe (1993), Gadgil, Douglas, Knowles, Lowe, and Sandberg (1994) and Gadgil *et al* (1995).

This report gives an account of the work carried out under Objective 1 of the Sand Dune Revegetation Programme (CO4301) during the first half of the 1995-96 funding year.

DATA COLLECTION

Working progressively from the most northerly to the most southerly trials, the 1995 assessments were completed between 31 October and 13 December. The type of assessment differed according to trial age and purpose. Three types of assessment were made :

1. Spaced-plant trials established 1991-92

By November 1995, the six trials described as FR 165/1 (Ninety-mile Beach), FR 165/2 (Kawhia), FR 165/3 (Muriwai Beach), Santoft A, Santoft B and Santoft C, were 3.5-4 years old.

The effects of annual destructive harvesting combined with natural mortality meant that plant numbers were often too few for intensive measurements to be considered worthwhile. For some species/site combinations plant growth was too great to allow accurate measurement. In July 1995 it had been decided that although annual assessments should be continued in these trials, measurements should be confined to observations on overall persistence, health, and reproductive potential.

The following variables were measured or assessed in each plot of the above 6 trials :

Legume cover to the nearest 25% of the plot area*.

Vigour of original plants scored on a scale of 1-5 where 1 = moribund and 5 = robust.

Maximum distance of spread outside the plot boundary*.

Presence/absence of flowers or flower buds.

Presence/absence of seedpods.

Presence/absence of seedlings inside plot*.

Presence/absence of seedlings outside plot*.

Vigour of seedlings on a scale of 1-5 as above.

Presence/absence of dieback, regrowth, symptoms of disease etc.

* In the Santoft A and B trials, plot boundaries were not clearly defined and it was not possible to determine these particular variables.

2. Spaced-plant trials established 1993

In November 1995, the four trials in the FR 193 series were 2.5 years old. Intensive measurements in these trials were made in the same way as in November/December 1994 (Gadgil *et al* 1995).

3. Direct-seeding trials established June 1995

The two trials in the FR 253 series (FR 253/1 at Kawhia and FR 253/2 at Santoft) were 6 months old in December 1995. It was clear that in many instances seed had been blown outside the boundary of the plot in which it had been sown. To assess the relative success of the 8 species in terms of seedling establishment, the following variables were measured for each plot :

- Number of seedlings inside plot boundary
- Mean maximum height and mean maximum spread of seedlings inside plot (n = 10 where possible).
- Number of seedlings outside plot boundary
- Mean maximum height and mean maximum spread of seedlings outside plot (n = 10 where possible).
- Maximum distance of seedlings outside plot from nearest plot boundary
- Number of recognisable ungerminated seeds observed inside plot boundary.
- Number of recognisable ungerminated seeds observed outside plot boundary.
- Incidence of seedling chlorosis, dieback or disease.
- Marram grass cover (% plot area)
- Weed cover (% plot area).

PLOT MAINTENANCE

In November 1995, two private companies responsible for management of land near the above field trials expressed concern about the presence of certain species that they considered to be a weed threat. Although further observations would have yielded valuable information about relative persistence and reproductive dissemination at these sites, it was recognised that most of the required growth data had been collected. The continued presence of the plants would have prejudiced good relations with the managers. Removal of *Acacia saligna* and *A. sophorae* from appropriate sites was considered to be a necessary feature of responsible trial management. Accordingly all plants of these two species were removed from trials FR 165/1, FR 193/1 and FR 193/2 at Ninety-mile Beach, FR 193/3 at Muriwai Beach, and FR 193/4 at Santoft Beach.

Ernst

During the 1995 assessments in the FR 193 trial series it was observed that several species other than the acacias had grown beyond the mid-point between the planting rows and were beginning to interfere with each other. It was decided that whole rows of plants should be removed where interference was observed. Selection of the row to be removed was based on maximisation of the number of rows of individual species that would remain for comparison within and between sites. Where seedlings had originally been allocated to individual blocks on the basis of size, future inter-species comparisons would only be possible between rows with the same block numbers. This constraint did not apply to the following species for which size of seedlings was uniform across blocks and sites at time of planting : *Acacia saligna*, *Lathyrus latifolius*, *Lespedeza cuneata*, *Lotus corniculatus*, *L. pedunculatus*, *L. tenuis*, *Lupinus nootkatensis*, *Trifolium ambiguum*.

Rows of interfering plants were removed from Trials 193/1, 193/3 and 193/4 on 19-20 December 1995. Plants were severed at ground level and their tops were removed from the experimental area.

STATUS OF SPACED PLANT TRIALS AS AT 1 JANUARY 1996

Plant removals described in the previous section have interfered with the original design of some of the trials and the nature of future comparisons will be restricted. The following list summarises the current status of each trial in the Sand Dune Revegetation Programme :

FR 165/1 (Ninety-mile Beach) - *Acacia saligna* and *A. sophorae* removed.

FR 165/2 (Kawhia) - Undisturbed.

FR 165/3 (Harakeke) - Undisturbed.

Santoft A - Abandoned due to poor survival of all species after 4 years.

Santoft B - Abandoned due to poor survival of all species after 4 years.

Santoft C - Undisturbed.

FR 193/1 (Ninety-mile Beach), FR 193/3 (Muriwai Beach), FR 193/4 (Santoft Beach) - Species/rows remaining for future assessment are shown in Table 1.

FR 193/2 - *Acacia sophorae* removed.

PROCESSING OF SAMPLES AND DATA

During the period 6 November - 24 December 1995 the harvested plant top material was dried to constant weight in forced-draught ovens at 70°C. Gas samples for the Acetylene Reduction Assay were analysed by gas chromatography as before (Gadgil *et al*, 1995). A start has been made on calculation of mean values needed for the statistical analysis of field data.

REFERENCES

- GADGIL, R.L., DOUGLAS, G. B., SANDBERG, A.M, and LOWE, A.T. (1993): 1992-93 reports on sand revegetation trials using nitrogen-fixing species. New Zealand Forest Research Institute Ltd Project Record No. 3586 (Unpublished).
- GADGIL, R.L., DOUGLAS, G.B., KNOWLES, F.B., LOWE, A.T., and SANDBERG, A.M., 1994 : 1993-94 reports on sand revegetation trials using nitrogen-fixing plants. New Zealand Forest Research Institute Ltd. Project Record No.4104 (unpublished).
- GADGIL, R.L., DOUGLAS, G.B., LOWE, A.T., BEESER, H.F., FOOTE, A.G., GRAHAM, J.D., and OLIVER, G.R., 1995 : 1994-95 reports on sand revegetation trials using nitrogen-fixing plants. New Zealand Forest Research Institute Ltd. Project Record No.4693 (unpublished).
- GADGIL, R.L. and SANDBERG, A.M, 1992: Replacement species for *Lupinus arboreus* in sand dune reclamation - second six-monthly report. New Zealand Forest Research Institute Ltd Project Record No. 3281 (Unpublished).

LOWE, A.T. (1992); Evaluation of the ability of N₂-fixing plants to supply nitrogen to marram grass during the primary phase of dune stabilisation. New Zealand Forest Research Institute Ltd Project Record No. 3325 (Unpublished).

Table 1. Status of plant rows in trials of the FR 193 series as at 21 December 1995.

+ = Plants present ; 0 = No survivors ; x = Plants removed ; NP = Not planted.

Block number	FR 193/1 (Ninety-mile Beach)						FR 193/3 (Muriwai Beach)						FR 193/4 (Santoft Beach)					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
<i>Acacia saligna</i>	0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
<i>Acacia sophorae</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
<i>Astragalus cicer</i>	0	0	0	0	0	0	+	0	0	+	0	+	+	+	+	+	+	+
<i>Chamaecytisus palmensis</i> A (3211/ 3218)	0	x	+	0	0	0	+	+	x	x	x	+	x	+	x	+	+	+
<i>Chamaecytisus palmensis</i> B (3573)	0	0	0	0	0	0	0	x	x	0	+	x	x	x	x	x	0	x
<i>Chamaecytisus palmensis</i> C (3820)	NP	NP	0	0	x	x	NP	NP	0	+	+	+	NP	NP	+	+	0	+
<i>Dorycnium hirsutum</i>	NP	+	0	+	+	+	NP	+	+	+	+	+	+	+	+	+	+	+
<i>Dorycnium pentaphyllum</i>	0	0	0	0	+	+	+	+	+	+	+	+	x	x	+	x	+	+
<i>Dorycnium rectum</i>	0	+	+	+	+	+	+	+	+	+	+	+	x	+	x	+	+	+
<i>Hedysarum coronarium</i>	0	0	0	0	+	+	+	+	+	+	+	+	0	+	0	0	+	+
<i>Lathyrus latifolius</i>	+	+	+	+	+	+	x	x	x	x	x	x	+	+	+	x	x	x
<i>Lespedeza cuneata</i>	0	0	0	0	0	0	+	0	0	0	+	0	0	0	0	0	0	0
<i>Lotus corniculatus</i>	0	0	+	0	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Lotus pedunculatus</i>	+	+	+	+	+	+	+	x	+	+	+	+	+	+	+	+	+	+
<i>Lotus tenuis</i>	0	+	+	+	+	+	+	+	+	+	+	+	+	+	+	x	+	x
<i>Lupinus nootkatensis</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Medicago arborea</i>	NP	+	0	0	0	+	NP	0	0	0	+	0	NP	+	+	x	+	+
<i>Sutherlandia frutescens</i>	NP	0	0	0	0	0	NP	0	0	0	0	0	0	0	0	0	+	0
<i>Teline stenopetala</i>	0	+	0	0	0	0	x	x	x	x	x	x	+	x	+	x	+	0
<i>Trifolium ambiguum</i>	0	0	0	0	0	0	+	0	+	0	+	0	+	0	+	0	0	0