

# **United Kingdom Falkland Islands Trust (UKFIT)**



## **1994 Newsletter and Technical Report**

Registered in England as a Charity Number 282786

## **Introduction.**

The Trust continues its support policy, started in 1981, for the Falkland Islands. There are three main areas of assistance; agricultural work; the development of agricultural marketing; and in the civic sector. Trustees, their consultants and representatives of the Falkland Islands Government in London met quarterly to review and coordinate activity, otherwise carried out by its members on a day-to-day basis. Mr Anton Livermore and Mr Ian Cox from the Islands attended the Trust's 71st meeting on 18 October 1994. The latter was welcomed in the new appointment of FIDC Commercial Representative in London.

## **Trustees.**

Mr Robin Lee, General Manager of Falkland Holdings Ltd., became a trustee in a domestic role as a Stanley resident. The appointment has been very helpful in representing local views, liaising with authorities and individuals in the Islands and pre-briefing before Trust meetings in London. Otherwise, there has been no change in the composition of trustees.

## **Consultants.**

The UKFIT Consultants, Mr David Stickland, and Dr Jim McAdam worked throughout the year on Trust projects. Jim McAdam undertook his annual working and inspection visit to the Islands in January 1994. Both consultants are planned to visit during 1995. UKFIT appreciates the expert and dedicated work carried out by consultants, both in the United Kingdom and in the Falkland Islands without whom the agricultural project work would be inoperable.

## **Agriculture.**

The Trust's main agricultural work consists of long term trials for the improvement of white grass for grazing using liquid kelp extract; continuing with the fifth year of the tree development; and establishing the first woodland at Port Howard. Additionally, a new requirement has arisen for long term research in Tussac Grass and Land Erosion; a project which is being planned as a joint exercise with the Department of Agriculture with joint funding.

## **White Grass Improvement.**

As the liquid kelp being manufactured by the Trust's 'digester' has a dual use in tree development, the equipment is being transferred from Stanley to Port Howard. It will then be operated by Mr Rodney Lee at his settlement but the product will be available elsewhere, as required. Production is based on bacterially activated aerobic digestion with modifications to the plant being developed. It is hoped to expand this work on a significantly larger scale once the relocation and operation of the digester has been consolidated.

## **Tree Development.**

Tree Development trials continued in their fifth year in four main sites, (Keppel Island, Fitzroy, Stanley, Port Howard), comprising some 1,800 trees. Within a series of experiments, to investigate planting technique, tree nutrition and artificial shelter, sitka spruce appears to do well on wet deep peat and lodgepole pine and willow on drier peaty sites. Pit planting will likely prove essential on all sites in the Islands with the benefits of kelp compost, added at the beginning, being felt in the second year. Survival by pit planting is at a Mean 90% level against 85% by other methods. A Eucalyptus variety trial and others are also running.

A Technical Report by Dr J H McAdam dated September 1994 on the result of trials is printed with this Report.

### **School Agriculture.**

The School is working on small agriculture research projects in support of the Trust's agricultural programme. A secondary objective is to create student interest in agriculture with the aim of making the subject a career. UKFIT has donated a hut to house the School's gardening tools as a Civic Support subject.

### **Marketing of Agricultural Produce.**

With Mr Stickland's initiative, UKFIT seeks to assist the income of farmers by developing overseas markets in sheep carcasses, organic wool, lanolin and other agricultural projects. There have been ongoing discussions with FIDC on the need for an abattoir to the European Union standards to provide the required base for acceptable exports. This initiative is now in the hands of FIDC/FIG but, once the abattoir is established, the subject can be developed practically by UKFIT working with FIDC. In the meantime, various market openings are being identified in Germany, the US and in African countries and progressed in conjunction with Mr Cox of FIDC.

### **Funding.**

UKFIT work is funded by income from capital. With the recent disadvantageous situation in the money markets, the reduction in interest rates has been serious. The Trust is grateful for continuing financial grants from the Falkland Islands Development Corporation (FIDC) for the tree development programme where progress is of such benefit to the Islanders. As already mentioned, FIDC is co-funding with UKFIT for the the new Tussac Grass/Erosion project. With the desire that other settlements should join in Trust programmes, it is encouraging that the first requests for advice are becoming current.

### **Liaison with the Department of Agriculture (DOA).**

UKFIT has constantly aimed to establish a close relationship with DOA and to overcome the constraint of working at a great distance. Various means are being developed to overcome this problem and ensure maximum benefit from the work of the two organisations. The Representative of the Falkland Islands Government Office and staff in London are a great help in this respect.

### **Civic Projects.**

Assistance to the Falkland Guides towards providing a base headquarters hut in Stanley was the chosen civic project for the year. UKFIT provided both a significant donation and an initiative with the Guide Association in the United Kingdom towards the funds required. As a result, £10,000 was raised in the United Kingdom by the Guides, to be added to the very sizable funds raised by the Islanders themselves.

### **Archives.**

Due to the technical agriculture data produced in the Trust, an archival section was established by Mrs Michelle Lovett. Data holdings will be published periodically for interested parties, apart from the routine publication of reports.

### **Cooperators.**

UKFIT Agricultural Projects are very dependent on the help of Falklanders on the Farms. In particular, the support of the following persons are mentioned with appreciation. Messrs. Rodney Lee: Tom and James McGhie; Sam and Carol Miller; Shirley Knight; Lyn and Tony Blake. UKFIT is grateful, also, to the Department of Agriculture for Northern Ireland which has provided valuable support on an ongoing basis. With the Trustees and

Consultants' widely dispersed and without a set office, the dedication and work of Mrs Doris Dodson, Administration Secretary is commended. Support by the Falkland Islands Association is also appreciated.

### **External Support.**

The Trust always welcomes financial support, or agricultural support in kind, to help develop its very worthwhile projects. The research and development work has a selective global application. This will be seen in the enclosed technical report on tree development. Any Corporate Organisation, Company or individual interested is requested to write to the Chairman or Administrative Secretary, c/o Falkland Islands Association, 2 Greycoat Place, Westminster, London, SW1 P13D or telephone 01715826380. An explanation as to how support can best be given will then be sent.

### **Historical.**

The Trust was established in June 1981 - nine months before the invasion of the Falkland Islands - to provide charitable support to the population in the agricultural, education and civic sectors. Projects have been supported by the Falkland Islands Development Corporation, Chartered Bank, and Dulverton Trust. The Trust has committed some £140,000 of its own funds to date in project development.

### **Trustees:**

**President:** Rt. Hon. Lord Strathcona and Mount Royal

**Chairman:** Major-General N<sup>st</sup> G Gribbon OBE

**Hon. Secretary:** Mr D G Ainslie

**Hon. Treasurer:** Mr J C Dodwell

Sir Rex Hunt CMG (Chairman FI Association)

Mr D L Clifton      Mr W J Turley

Capt. P M C Vincent (RN) CBE    Mr R Lee (Resident in FI)

### **Administration**

**Admin. Secretary:** Mrs D Dodson,

136 Kennington Lane, London SE11 4UZ (0171 5826380)

**Hon. Archivist:** Mrs M Lovett

### **Project Consultants:**

**Mr D Stickland**, Organic Farm Consultant and former Managing Director,  
Organic Farmers and Growers

**Dr J McAdam**, Applied Plant Service Division Department of Agriculture for Northern Ireland,  
Agronomist with Queens University of Belfast

# Tree Planting and Establishment in The Falkland Islands

Report on additional technical work (Year 4) of a project grant assisted by the Falkland Islands Development Corporation.

Technical Report prepared by Dr J H McAdam, Applied Plant Science Division, Department of Agriculture for Northern Ireland, Newforge Lane, Belfast BT9 5PX, NI. September 1994.

## Summary

To date the project has shown that, provided ground preparation and nutrition are attended to, trees can grow and be valuable in a wide variety of situations in the Falkland Islands. Individual tree shelters are beneficial in early establishment. There are varieties of willow and Eucalyptus which merit further trial and enhancement of local *macrocarpa* stocks may be possible.

Growing trees is a long process and these trials have been largely concerned with initial establishment. Further assessment work of a longer term nature will be required.

A series of experiments were planted to investigate aspects of tree planting and establishment in the Falkland Islands. Experiments have been planted at 3 sites to investigate planting technique, tree nutrition and artificial shelter, at two sites to aid provenance selection and an experimental woodland plantation has been established.

Results are presented for two sites (Stanley and Fitzroy) for three years and one site (Keppel) for four years. Some preliminary conclusions on tree planting in the Falklands can be made but caution must still be exercised in interpreting results in what is, by necessity, a long term project.

Sitka spruce appears to do well on wet, deep peat, Lodgepole pine on drier peaty sites. Provided trees survive the first year of establishment, subsequent chances of survival seem high. Pit planting will likely prove essential on all sites and is definitely essential on dry sites. Once trees which have been slit planted established, they seem to subsequently grow satisfactorily. The benefits of kelp compost added at planting are being felt in the second full year. The growth promotory benefits of applying liquid kelp extract as a foliar feed are starting to be seen on a nutrient-poor site. Paraweb netting did not have an immediate beneficial effect, but there is an indication that benefits may come later.

Improved New Zealand bred, varieties of *Cupressus macrocarpa* the tradition tree for the Falklands can grow faster and provide better shelter than local stock while still remaining a traditional feature of settlements etc. On first assessment they can be rapidly established in a more substantial shelter belt/farm woodland situation than on the small plot trials.

### 1. Background - the need for trees

Falkland Islanders have been interested in growing trees in Stanley and in the camp for

many years. Although it would be undesirable to clothe large areas in coniferous woodland, and tall forest giants will not be grown in the Falklands, there is a need for shelter for stock and gardens and to improve the visual appearance of Stanley.

Now that flocks are smaller and the national sheep flock is going to be substantially upgraded from improved stock imports, the need to reduce losses is all the more important. Strategically placed shelter around clippy pens or in ewe camps could be used over the critical times of lambing and shearing to make a very significant impact on lamb survival and on sheep recovery after stress.

Stanley is developing rapidly, and with new housing and small industries appearing there is a need to landscape the town. Trees are widely recognised as the most natural way to achieve this. With many new small settlements appearing, trees have a further shelter and landscape role. There is also an interest in erosion control and rehabilitation of eroded areas. Research has shown the erosion process to be a direct result of the windy climate.

Trees can form an important role in this context and further trials are necessary.

A wide range of reports and scientific papers were reviewed prior to commencing the programme (see Interim Technical Report - Year 1).

## **2. Introduction and Objectives**

The objectives of the project (commencing in 1990) were as follows:

1. To determine the most suitable method for planting and establishing trees on a range of camp types in the Falkland Islands.
2. To provide information on species suitability for various situations in the Falkland Islands.

It is assumed that, initially, results would be more applicable to strategic tree planting situations - in the agricultural context around settlements, paddocks, clipped-sheep pens etc and in the landscape context, around gardens and public places in Stanley.

This report follows on from two interim technical reports and one final report on the project and contains a summary of follow up work and a continuation of measurements from the trials reported in the earlier reports. Results following sampling and measuring are available from three trial sites. Following the absence of a permanent resident on Keppel Island, regrettably only minimal measurement and tree management was possible. A further measurement of the remaining trees was carried out in early 1994. Other experiments on varietal selection (Willows and Eucalyptus) and seed introduction and germination have been terminated with trials on provenances of *Macrocarpa*. All the field trials in connection with this project are now planted. However, as many of the trials are still in the establishment phase, detailed conclusions cannot be made at this stage. Available results are presented and conclusions drawn where practicable.

## **3. Experimental programme**

a. Tree planting and establishment trials. The major thrust of the project was geared towards determining tree planting and establishment techniques on a range of sites. The key issues involved are planting technique, shelter provision and tree nutrition. An experiment was designed involving the following treatments:

- Tree species                      2 (Lodgepole pine and Sitka spruce - largely selected because of local availability)
- Planting technique             Slit plant (quick and simple - standard UK Forestry technique)  
Pit plant (as implied - small pit dug to disturb the soil)
- Nutrition                            No fertiliser; phosphate only; kelp compost (in the pit); foliar feed of locally produced kelp extract)

The experimental design incorporated all combinations of three treatments in a fully replicated (3 reps per treatment) design. Each treatment plot contains 5 trees, representing a total of 600 trees per site. The experiment was planted at 3 sites:-

- (i) Keppel Island                    -        hard, dry “diddle-dee” camp
- (ii) Fitzroy (Britannia)           -        soft whitegrass camp
- (iii) Stanley (Mkt garden)        -        impoverished, shallow, wet peat

The Keppel Island site was planted in August 1989 and the other two sites in August 1990.

b. Production of liquid kelp extract. One aspect of the experiment detailed above is an assessment of the value of locally produced liquid kelp extract. Previous trials (conducted by the UK FI Trust) had shown that bacterially activated, aerobic digestion is the simplest and cheapest way to produce kelp extract. Over the duration of the project, liquid seaweed extract was produced from the digester and was applied to some trees in the main establishment trial. It has not been possible to operate the digester during the 1993 season. The plant has now been shipped to Port Howard where it will be started up again to produce liquid kelp extract.

c. Macrocarpa provenance. *Cupressus macrocarpa* - locally known as ‘macrocarpa’ - is one of the most successful trees found growing in the Falklands and one which might be regarded as a ‘traditional’ component of the landscape (though it is of course not native to the Falklands). In exposed conditions however macrocarpa grows very slowly. The species also grows well in New Zealand where it is a valuable forestry tree and the Forest Research Institute of the Ministry of Forestry in New Zealand has, for many years, been selecting seed from and breeding ‘elite’ trees. These show rapid growth and good growth characteristics. To enhance the macrocarpa stocks in the Falklands and to see if these improved strains will do well locally, seed of the best selections from the macrocarpa bred in New Zealand were purchased. Seedlings from these have been raised at Stanley for comparison with ‘local’ macrocarpa (ex Hill Cove) and UK purchased (ex Forestry Commission seed). Seed germination was good and approximately 2,500 plants of all three types of macrocarpa were potted out. These have been further assessed and approximately 500 plants have been established in Phase 1 of a Farm Woodland trial Port Howard. A further 350 trees have been planted in Phase 2.

#### **4. Results**

a. Tree planting and establishment (Keppel Island, Fitzroy, Stanley) On all 600 trees at each site the following measurements have been made - tree height; a subjective assessment of general tree health (on a 0-5 scale); number of branches counted; foliage

samples taken for chemical analyses of leaf nutrient levels. Measurements have been taken as follows:

	1989 (Jun)	1990 (Jun)	1990 (Oct)	1991 (May)	1991 (Nov)	1992 (Jul)	1992 (Nov)	1994 (Jan)
Keppel	/	/	/	/		/		/
Fitzroy			/	/	/		/	/
Stanley			/	/	/		/	/

The effects of planting technique, shelter, foliar spraying and species on tree height, health and survival are presented in Tables 1-8. Data are presented for two sites in most cases.

However, since the trees on Keppel Island are no longer tended regularly (the island is now uninhabited) losses have increased. In July there were 250 trees still alive, a decrease in survival from 62% to 38% between May 1991 and July 1992 and these were measured. In January 1994 there were 101 trees still alive, twice as many Lodgepole pine (mean height 75cm) surviving than Sitka spruce (mean height 51cm) (Table 6). One tree was 180cm tall. Overall the Lodgepole pine has grown 25cm since 1992, the fastest growth of any site (Table 6).

(i) Species selection (Table 6)

Lodgepole pine is clearly the best species for the Fitzroy and Keppel sites. At Fitzroy in 1992 both were approximately the same height with equal survivals. Over the next growing season the Sitka spruce did not grow and mortality was high (88-68%). Over the same period, Lodgepole pine grew, on average, 14cm and most plants survived. On Keppel, Lodgepole pines surviving were now 75cm tall.

Sitka spruce are performing best on the Stanley site in terms of overall survival, although both species have comparable growth rates. Growth rates of 17cm per season must be considered very acceptable, particularly as the corresponding figures for 1991-1992 were 7cm and 4cm respectively. Clearly the trees are now establishing and starting to grow well. As trees become better established there is evidence (from the remaining Keppel trees) that growth rates will increase.

(ii) Planting method

Individual trees remaining on Keppel could not be ascribed to individual treatments as time available on the island was limited. However, most of the survivors were clearly pit planted as three years after planting pit planted trees (Keppel site) were on average 21cm taller and were more healthy (but 0.9 units) than slit planted trees. Only 17% of trees planted by the slit method had survived at Keppel whereas 52% of those planted by the pit method were surviving at the end of year 3. On the Fitzroy and Stanley sites, those trees which were pit planted survived better and have grown significantly more than those slit planted (Table 1). Both sites are showing the same trends with mean growth (1992-1994) from slit planted trees being less on both Fitzroy (11.5 vs 15.5cm) and Stanley (9cm vs 15.5cm) sites. Percentage survival is also significantly better in pit planted trees than slip planted trees (by 11% in both 1992 and 1994) at the poorer Fitzroy site (Tables 1 & 2). This, along with superior survival of Lodgepole pine on this site has obvious economic implications. Slit planted trees which survived initially have now picked up slightly in terms of height and health on both sites (Table 2). Hence it seems that once



trees have an established root system, they can grow well and overcome the lack of a dug pit, but their initial chances of survival will be a lot worse if slit planted than if pit planted.

(iii) Fertiliser at planting

Slit planted trees benefited substantially from the application of phosphate fertiliser at planting (Table 3) on the Stanley site.

(iv) Foliar fertiliser application

Tree height and health are now apparently responding to liquid kelp extract in the Fitzroy site (Table 1). Although there has been only minimal effect following an application at both sites, the trees are probably not well enough established for any effect to be recorded.

(v) Shelter netting

Overall there is still not significant effect of shelter netting on tree survival height growth and health at any site (Table 5).

b. Tree shelters

By 1994, four years after planting, only one of the trees planted without tree shelters on this windy, exposed site were remaining. Trees protected by a tree shelter (square section plastic tube) were now 121cm tall. These trees have grown by 37cm over the two years since the last measurement (Table 7). Trees in the shelters were bushy, green and healthy and almost 80% were still surviving. Where tubes have been removed the trees are stable but have lost all their bottom leaves. The trial demonstrates clearly that tubes can help early establishment and growth of pine but may not be the best in the long term. (Table 7).

c. Macrocampa trial (Table 8)

Over 2,500 (2640) *Macrocampa* trees were raised from seed and pot planted ready for trials. Of the 3 varieties grown, growth of the plants from the New Zealand hybrid seed is better than from the other two varieties (Table 8). The plants will be grown on in pots for eventual planting out as part of an additional tree project.

## 5. Conclusions from establishment experiments

- Species selection may be site related, Sitka spruce preferring wet peaty sites and Lodgepole pine drier sites.
- Loss rates may have stabilised to an acceptable level (10%) after the first establishment year ie provided trees can survive the first year, their subsequent chances of survival seem high, although regular attention and maintenance is important.
- Pit planting is essential for adequate tree survival on dry, hard sites. No conclusion can be drawn from the wet sites. Once trees which have been slit planted have established they seem to subsequently grown satisfactorily.
- Where trees are pit planted, kelp compost should be used, its beneficial effects are carried into the second year after establishment and beyond.

- The growth promoting benefits of liquid kelp extract are starting to be shown on a nutrient-poor site.
- The benefits of paraweb netting as a minimal shelter provision are still not demonstrated.
- Although tree shelters considerably enhance growth, survival and performances of trees and are useful when small numbers of trees are being planted, when the shelters are removed trees lose many leaves and may not recover well.

## **6. Woodland Plot at Port Howard**

Almost five hundred *Macrocarpa* of New Zealand and Falkland Islands origin were planted using the pit and kelp technique at Port Howard. Minimal shelter was provided. Survival over the first year is acceptable (90%) and mean tree height is 49cm (Table 9). These trees will be closely monitored.

## **7. Advice**

Five farmers have been given on-site advice on tree planting.

## **8. Further work**

- a. It is important to continue the programme of maintenance and measurement on the two tree establishment and Port Howard woodland sites. Tree growth can be a slow process so the ongoing nature of the work initiated by the Trust and funded by FIDC must be built on.
- b. Additional trials using hedging plants, well proven for windy, coastal climates, will commence in 1995. Rehabilitation of cut-over peat banks on Stanley Common is planned. It is hoped to integrate some of the trials with a programme of erosion control planned by the Department of Agriculture.

## **Acknowledgements**

The Trust is grateful to Rodney Lee, Lionel Fell, Tom and James McGhie, Department of Agriculture, Falkland Islands, Sam and Carol Miller, Tim Miller and to FIDC for financial assistance. Foliar analyses and computer services were provided by the Department of Agriculture for Northern Ireland.

# TECHNICAL DATA

Table 1: The effect of planting technique, fertiliser at planting and kelp extract spray on tree height, health and survival (both species) at the Fitzroy and Stanley sites, January 1994.

Kelp Extract Planting Technique	Fertiliser	SITE			
		Fitzroy		Stanley	
		Applied	Zero	Applied	Zero
<b>a. <u>Height (cm)</u></b>					
Slit	Zero	32.1	32.8	40.7	40.4
Slit	Phosphate	34.8	29.9	59.1	66.5
Pit	Zero	39.8	35.6	48.2	44.6
Pit	Phosphate	38.2	34.8	54.4	56.3
Pit	Kelp Compost	41.1	39.8	47.5	50.1
Mean		37.2	34.6	50.0	51.5
sem			2.76		2.61
<b>b. <u>Health</u></b>					
Slit	Zero	2.8	2.6	3.3	3.3
Slit	Phosphate	2.9	2.5	4.3	4.6
Pit	Zero	2.9	2.4	3.9	3.8
Pit	Phosphate	2.7	2.8	3.9	4.1
Pit	Kelp Compost	3.0	2.8	4.0	4.0
Mean		2.9	2.6	3.9	3.9
sem			0.17		0.30
<b>c. <u>% Tree survival</u></b>					
Slit	Zero	67	55	78	75
Slit	Phosphate	72	72	75	70
Pit	Zero	80	85	75	87
Pit	Phosphate	77	75	72	72
Pit	Kelp Compost	77	82	80	72
Mean		74	74	76	75
sem			7.1		6.3

Table 2: The effect of planting type on tree height and health for comparable fertiliser levels at planting (for both species) at two sites (Stanley and Fitzroy) in November 1991 and January 1994, three years and 2 years after planting respectively.

Planting Type		SLIT	PIT	MEAN
a. <u>Tree height (cm)</u>				
Stanley	Mean (May 1991)	23.7	24.6	24.2
	Mean (Nov 1991)	27.2	27.2	27.2
	Mean (Jan 1994)	51.7	50.2	50.8
Fitzroy	Mean (Nov 1991)	23.9	29.0	26.5
	Mean (Jan 1994)	32.3	38.2	35.9
b. <u>Tree health</u>				
Stanley	Mean (May 1991)	3.7	4.0	3.8
	Mean (Jan 1994)	3.9	4.0	3.9
Fitzroy	Mean (Nov 1991)	2.5	3.2	2.9
	Mean (Jan 1994)	2.7	2.9	2.8

Table 3: The effect of fertiliser at planting and planting technique on tree growth and health (both species) from two sites (Fitzroy and Stanley) in January 1994.

Site	Planting Technique	Fertiliser at Planting		
		Zero	Phosphate	Kelp Compost
a. <u>Height and Growth (cm)</u>				
Stanley (1989-1994)	Slit	40.5	62.8	
	Pit	46.4	55.3	48.8
Fitzroy (1989-1994)	Slit	32.5	32.3	
	Pit	37.7	36.5	40.8
b. <u>Health</u>				
Stanley	Slit	3.3	4.4	
	Pit	4.4	4.1	4.0
Fitzroy	Slit	2.7	2.7	
	Pit	2.6	2.8	2.9

Table 4: The effect of planting method on tree survival at Stanley and Fitzroy in November 1991 and January 1994.

Planting Method	Site	% Survival since planting (Nov 1991)		% Survival (Jan 1994)	
Slit plant	Stanley	85		77	
	Fitzroy	85		61	
	Mean	85		68	
Slit plant & fertiliser	Stanley	82		73	
	Fitzroy	88		72	
	Mean	85		72	
Pit Plant	Stanley	93		81	
	Fitzroy	98		83	
	Mean	96		82	
Pit & fertiliser	Stanley	82		72	
	Fitzroy	93		76	
	Mean	88		74	
Pit & kelp compost	Stanley	83		76	
	Fitzroy	93		79	
	Mean	88		78	

Table 5: The effect of artificial sheltering on tree growth, health and survival at Fitzroy, Stanley and Keppel Island, three and five years after planting respectively and on tree height increment in the fourth full year of growth, Keppel Island.

	Keppel		Stanley		Fitzroy	
	Sheltered	Unsheltered	Sheltered	Unsheltered	Sheltered	Unsheltered
Tree height (cm)	52.4	62.8	51.5	50.1	34.4	37.4
Tree health	-	-	3.9	3.9	2.7	2.7
Tree survival (%)	17	29	70	81	76	72
Growth 92.94 (cm) Keppel	10.0	20.3				

Table 6: The response of Sitka spruce and Lodgepole pine at Keppel, Stanley and Fitzroy

<b>Sitka Spruce</b>	<b>Lodgepole Pine</b>	
<u>Height (cm)</u>		
Stanley (1994)	56.3	45.3
Fitzroy (1994)	26.9	44.9
Keppel (1994)	50.8	75.4
<u>Growth</u>		
Stanley (91-90)	17	17
Keppel (91-90)	16	25
Fitzroy (1992-1994)	0	14
<u>Actual survival</u>		
Stanley (Jan 1994)	93	58
Keppel (1991)	59	64
Keppel (1992)	39	41
Keppel (1994)	11	23
Fitzroy (1994)	68	80
<u>Loss rate (% per year)</u>		
Stanley (94-90)	1	9
Fitzroy (94-90)	7	2

Table 7: The effect of tree support and protection at planting on height and survival of Lodgepole pine four seasons after planting (the change over the past year in each parameter measured is shown in brackets).

	<b>Tree Support/Protection</b>		
	<b>No Protection</b>	<b>Stake Only</b>	<b>Stake &amp; Tree Shelter</b>
Height (cm)	88	-	121.1 (+37)
% Survival	7 (-20)	0	80 (-7)

Table 8: The size of transplants of *Cupressus macrocarpa* grown from 3 seed sources

Seed Source	Forestry Commission	NZ Hybrid	Local (Falkland Is)
Height (cm)	34.0	29.8	44.1
Stem diameter (mm)	6.2	5.1	7.9

Table 9: Details of rows of *Macrocarpa* trees planted in the woodland at Port Howard

Row	No of Trees	% Dead	Mean Height (cm)	Mean Health
1	78	11	52.03	4.2
2	83	5	47.1	3.9
3	57	12	54.9	4.0
4	77	9	52.9	3.9
5	78	14	50.7	4.0
6	81	6	52.7	4.0
7	15	-	44.7	3.7
8	12	25	39.2	3.7
Total	481	10	49.3	3.9