

ASSESSMENT OF LEGUME DEVELOPMENT IN PLOT 379,
CROHANE FOREST, THREE MONTHS AFTER SOWING

A report prepared for the
National Forester Fertiliser Cooperative.

R L GADGIL

P J ALLEN

A M SANDBERG

Report 27

March 1988

FRI/INDUSTRY RESEARCH COOPERATIVES

EXECUTIVE SUMMARY

Assessment of Legumes (Maku Lotus and perennial yellow lupins) sown immediately after thinning a 12 year old radiata pine stand has revealed an unexpected problem caused by the resident seed population. Nominal treatment effects may be confounded by the effects of resident lotus and clover. The extent of this confounding can be monitored by regular legume assessments.

FOREST RESEARCH INSTITUTE:

PROJECT RECORD NO. 1825

DIVISION: Forest Management and Resources

RESEARCH FIELD: Soils and Site Amendment

PROJECT NO. SSA 4

SUBPROJECT NO. R.F. ID.

WORK PLAN NO. 1540

FIELD EXPERIMENT(S) WN 379

TITLE : Assessment of legume development in Plot 379, Crohane Forest, three months after sowing

AUTHORS/S : R L Gadgil, P J Allen, A M Sandberg

DATE : March 1988

KEYWORDS: Thinning, legumes, *Pinus radiata*, *Lotus uliginosus*, *Lupinus arboreus*, *Trifolium repens*.

ABSTRACT

Development of lotus, lupins and clover was assessed in all plots of the trial, three months after sowing. Resident lotus (as opposed to sown "Maku" lotus) was present in 26 of the 27 plots, and clover in 13 plots.

Isolation of experimental treatment effects from the effect of resident lotus will not be possible unless plants are removed. The impracticability of this approach is discussed and it is recommended that resident lotus should be recognised as a basal factor common to all treatments in the trial.

Note: This material is unpublished and must not be cited as a literature reference.

ASSESSMENT OF LEGUME DEVELOPMENT IN PLOT 379, CROHANE FOREST,
THREE MONTHS AFTER SOWING

INTRODUCTION

WN 379 (FRI Workplan No.1540) is a 27-plot trial investigating the effects on radiata pine growth of application of the following treatments in a 12 year-old stand:

1. Normal extraction thinning (NT)
2. NT + oversowing with 'Maku' lotus
3. NT + urea
4. NT + lotus + urea
5. NT + oversowing with perennial yellow lupin
6. Whole-tree thinning, i.e. extraction thinning + slash removal (WT)
7. WT + urea
8. WT + lotus
9. No thinning

Lotus and lupin seed was sown 2 - 4 September 1987. Regular assessments of legume development are required to monitor progress of sown legumes and to check the validity of the treatment specifications. The study described here was carried out to assess legume development during the establishment phase.

METHODS

Each of the 27 experimental plots in the trial was examined by three assessors and the frequency ratings for lotus, lupins and clover were determined by consensus. Categories (Kershaw,1964) were:

Abundant (A)

Frequent (F)

Occasional (O)

Rare (R)

Nil (-)

Uneven legume development was described by the word "locally" (L) and by inclusion of an estimate of the percentage of the plot area covered. In areas where lotus or lupin development was recorded as A or F, height measurements were made on 20 plants selected at random.

In each lupin plot, three 3 x 1.5 m areas were selected at random and used to make seedling counts.

Where legume development was uneven, trees likely to be influenced by legumes were identified by number.

RESULTS

It is clear from Table 1 that lotus was well represented in one or more of the replicated plots of every treatment, and that clover was present in about half of the plots. Lotus was frequent in 7 of the 9 plots sown with lotus. In two of the sown plots (both replicates of the NT + lotus + urea treatment), lotus was rare or occasional.

Two of the three plots sown with lupin contained lotus (F or LA), and a substantial amount of clover was also present in Plot 21. Mean numbers of lupin plants per m² (with standard deviation) were: 12.2 (8.4) in Plot 7; 14.0 (8.0) in Plot 17; and 6.2 (7.6) in Plot 21.

Lotus heights in excess of 10 cm were associated with the F rating and flowering was observed in several plots. The presence of young lotus seedlings was recorded in all plots sown with lotus, but only in one unsown plot (Plot 3).

DISCUSSION

Since seed had been sown only 3 months previously, it was concluded from height measurements that most of the measured lotus had developed from resident buried seed. None of the treatments was free from lotus. Unless steps are taken to eliminate plants from plots designated for lotus-free treatments, lotus will have to be considered as a standard basal component of the trial. It will not be possible to isolate the effects of NT, WT, urea or lupins from the lotus effect. Clover is a smaller problem, but it is almost certain to reduce the observable differences between treatments.

Removal of lotus and clover at this stage of the trial raises certain problems:

1. Hand removal or herbicide spraying would leave residues which could influence tree growth.
2. In nominal lotus treatments, separation of resident from sown lotus would be virtually impossible.
3. Herbicide removal of lotus and clover would damage lupin plants.
4. Monitoring and annual retreatment for lotus and clover removal would be necessary due to seed 'hardness' i.e. ability to remain viable in the soil for long periods.
5. The significance of any herbicide effect on understorey species other than legumes would be difficult to assess.

If no action is taken, all nominal treatments will have a "+ lotus" component. Providing that future lotus development is reasonably even, recognition of this factor may be the simplest solution to the problem. Clover effects will be an unplanned additional contribution to uncontrolled variation.

Although difficulties caused by legume growth from buried seed at the Crohane site were not foreseen, this is not the first recorded instance of wild lotus development following the thinning of a mid-rotation stand (Gadgil et al., 1986). In planning future oversowing trials, it would be wise to allow for the possibility of legume growth from resident seed, perhaps even to the extent of incorporating a survey of buried seed before an experimental site is selected.

ACKNOWLEDGMENTS

This work is supported by Carter Holt Industries Ltd. through the National Forest Fertiliser Cooperative.

REFERENCES

- GADGIL, R.L., CHARLTON, F.J.L., SANDBERG, A.M., and ALLEN, P.J., 1986: Relative growth and persistence of planted legumes in a mid-rotation radiata pine plantation. *Forest Ecology and Management* 14: 113-24.
- KERSHAW, K. A., 1964: *Quantitative and Dynamic Ecology*. Elsevier Publishing Co. Inc.,

TABLE 1: ASSESSMENT OF LEGUME DEVELOPMENT IN PLOT WN 379 CROHANE FOREST, DECEMBER 1987

Treatment	Plot No.	Legume frequency rating (with % cover if local)			Legume height (cm)		Trees with adjacent legumes (individual identification numbers)		Comments
		Lotus	Lupins	Clover	Lotus	Lupins	Lotus	Lupins	
Normal thinning	9	R	-	-	-	-	-	Dense slash	
	10	LF 20	-	R	20.3 (10.2)	6, 13, 14, 15, 17, 18	-	-	
	19	F	-	-	23.0 (10.8)	All	-	Log skid across corner	
Normal thinning + lotus	8	F	-	-	22.0 (14.5)	All	-	-	
	11	F	-	R	35.8 (15.6)	All	-	-	
	25	F	-	-	8.5 (3.3)	All	-	-	
Normal thinning + urea	1	F	-	F	30.5 (13.1)	All except nos 11, 12, 16, 17, 15, 17	-	-	
	16	LF 10	-	R	25.4 (8.7)	-	-	Dense slash	
	22	0	-	R	-	-	-	-	
Normal thinning + lotus + urea	2	R	-	-	-	-	-	Dense slash. Browsing	
	13	F	-	R	29.8 (12.9)	All	-	-	
	27	0	-	-	-	-	-	-	
Normal thinning + lupin	7	LA 30	F	R	39.8 (17.7)	9, 10, 12, 13, 14, 15, 16, 18	All	-	
	17	-	F	R	9.8 (5.3)	-	All	Dense slash	
	21	F	F	LF	25.0 (12.4)	9.8 (4.7)	All except nos 17, 18, 19	Log skid through plot	
Whole tree thinning	3	LF 30	-	F	11.0 (3.8)	4, 12, 13, 14, 15, 19	-	-	
	18	F	-	LF	19.0 (5.0)	All	-	Log skid. Dung patches	
	23	LF 10	-	-	12.5 (8.7)	2, 4, 5, 7	-	-	
Whole tree thinning + lotus	4	F	-	-	16.5 (8.0)	All	-	-	
	12	F	-	-	16.8 (6.7)	All	-	-	
	20	F	-	LF	13.8 (5.8)	All	-	Log skid	
Whole tree thinning + urea	5	LF 30	-	-	15.0 (7.3)	2, 3, 4, 5, 6, 7, 8, 9, 14, 17, 18, 19	-	-	
	15	0	-	R	-	-	-	-	
	26	R	-	-	-	-	-	-	
Unthinned	6	LF 10	-	-	16.5 (6.3)	3, 5, 10, 20	-	Light well. Dung patches	
	14	0	-	-	-	-	-	-	
	24	LF 80	-	-	25 (8.1)	1, 2, 4, 5, 7, 8, 9, 10, 16, 19, 20, 29, 31, 32, 33, 34, 35, 43, 44, 45, 46, 50, 52, 53, 54	-	Blackberry, grasses	