

TABLE OF CONTENTS

	Page
TABLE OF CONTENTS.....	i
LIST OF TABLES.....	iii
LIST OF FIGURES.....	v
LIST OF SYMBOLS AND ABBREVIATIONS.....	vii
INTRODUCTION.....	1
Objectives.....	3
LITERATURE REVIEWS.....	4
Timor Mountain Gum (<i>Eucalyptus urophylla</i> S.T. Blake).....	4
Natural distribution.....	4
Habitat and ecology.....	5
Botanical description.....	5
Silvicultural characteristics.....	6
Uses.....	9
Growth and yield characteristics.....	9
Provenance trials.....	14
Progeny testing.....	15
MATERIALS AND METHODS.....	18
The study area.....	18
Provenance trials.....	20
Seed sources.....	20
Experimental design and management of trials.....	22
Measurement of tree performances.....	24
Progeny test.....	24
Seed sources.....	24
Experimental design and management of test.....	24
Measurement of tree performances.....	28
Above-ground biomass study.....	28
Harvest index.....	29
Crown ratio (<i>k/d</i> ratio).....	29
Form quotients.....	29
Heritability estimates.....	30
RESULTS AND DISCUSSION.....	31
Provenance trials.....	31
Survival percentages.....	31
Growth performances.....	34
Height.....	34
Diameter at breast height (DBH).....	38
Diameter 10cm above-ground level (D10).....	41

TABLE OF CONTENTS (CONTINUED)

	Page
Stem forms.....	44
Bark types and thickness.....	44
Leaf characteristics.....	49
Leaf area.....	49
Leaf length.....	52
Maximum width of leaf.....	53
Stomata density.....	53
Performance ranking of Timor Mountain Gum provenances..	54
Progeny Tests.....	56
Above-ground biomass.....	56
Harvest index.....	57
Variation in taper and crown ratio.....	58
The relationship between above-ground biomass and growth characteristics.....	58
Biomass estimation.....	58
Growth characteristics of Timor Mountain Gum progenies....	59
Survival percentages.....	59
Height.....	62
Diameter at breast height (DBH).....	62
Diameter 10cm above-ground level (D10).....	62
Crown diameter.....	62
Stem forms.....	64
The relationship between growth characteristics.....	66
Heritability estimates.....	66
Performance ranking of Timor Mountain Gum families.....	67
CONCLUSION.....	70
RECOMMENDATIONS.....	73
LITERATURE CITED.....	75
APPENDICES.....	86
CURRICULUM VITAE.....	95

LIST OF TABLES

Table		Page
1	Natural seed sources of Timor Mountain Gum used in establishing the Timor Mountain Gum provenance trials.....	21
2	Plus tree of Timor Mountain Gum provenances tested in the progeny test at Lad Krating Plantation, Chachoengsao.....	25
3	Average survival percentages of Timor Mountain Gum at different ages in provenance trials at Lad Krating Plantation, Chachoengsao	32
4	ANOVA on the survival percentages of Timor Mountain Gum at different ages in provenance trials at Lad Krating Plantation, Chachoengsao	33
5	Average height of Timor Mountain Gum at different ages in provenance trials at Lad Krating Plantation, Chachoengsao.....	35
6	ANOVA of the average height of Timor Mountain Gum at different ages in provenance trials at Lad Krating Plantation, Chachoengsao	36
7	Average DBH of Timor Mountain Gum at different ages in provenance trials at Lad Krating Plantation, Chachoengsao.....	39
8	ANOVA of the average DBH of Timor Mountain Gum at different ages in provenance trials at Lad Krating Plantation, Chachoengsao	40
9	Average D10 of Timor Mountain Gum at different ages in provenance trials at Lad Krating Plantation, Chachoengsao.....	42
10	ANOVA of the average D10 of Timor Mountain Gum at different ages in provenance trials at Lad Krating Plantation, Chachoengsao	43
11	ANOVA of the stem forms and bark types of Timor Mountain Gum in 16 years-old provenance trials at Lad Krating Plantation, Chachoengsao.....	47
12	Mean average of the leaf area and leaf length of Timor Mountain Gum in provenance trials at Lad Krating Plantation, Chachoengsao.....	50
13	Average leaf maximum width and stomata density of Timor Mountain Gum in provenance trials at Lad Krating Plantation, Chachoengsao.....	51
14	ANOVA of the leaf characteristics of Timor Mountain Gum in provenance trials at Lad Krating Plantation, Chachoengsao.....	52
15	Scoring of each trait and ranking of Timor Mountain Gum provenances at Lad Krating Plantation, Chachoengsao.....	55

LIST OF TABLES (CONTINUED)

Table		Page
16	Means and standard deviations of growth characteristics of Timor Mountain Gum progenies at Lad Krating Plantation, Chachoengsao.....	57
17	Means and standard deviations of the biomass partitioning according to different tree components of Timor Mountain Gum progenies at Lad Krating Plantation, Chachoengsao.....	57
18	Matrix correlations between above-ground biomass and growth characteristics of Timor Mountain Gum progenies at Lad Krating Plantation, Chachoengsao.....	57
19	The overall means and standard deviations of growth characteristics of Timor Mountain Gum progenies at Lad Krating Plantation, Chachoengsao.....	59
20	Average values of the growth characteristics of Timor Mountain Gum progenies at Lad Krating Plantation, Chachoengsao.....	60
21	ANOVA of the growth characteristics of Timor Mountain Gum progenies at Lad Krating Plantation, Chachoengsao.....	63
22	Matrix of trait-trait correlations between growth characteristics of Timor Mountain Gum at Lad Krating Plantation, Chachoengsao...	66
23	The scoring of each trait and ranking of Timor Mountain Gum families at Lad Krating Plantation, Chachoengsao.....	68

LIST OF FIGURES

Figures		Page
1	Flowering branch, illustration by the author, sample taken from Lad Krating Plantation, Chachoengsao.....	7
2	Three-years old Timor Mountain Gum stand at Lad Krating Plantation, Chachoengsao.....	7
3	The location of Chachoengsao province, Thailand.....	18
4	The location of TPC Lad Krating Plantation in Sanam Chaikhet District (8), Chachoengsao province.....	18
5	Location of provenance trials and progeny tests of Timor Mountain Gum in TPC Lad Krating Plantation, Chachoengsao.....	19
6	Climatic diagram of Lad Krating Plantation, Chachoengsao, Thailand.....	20
7	The location of the Lesser Sunda Islands in Southeast Asia.....	22
8	The natural distribution of seed sources of Timor Mountain Gum on the group of Lesser Sunda Islands.....	22
9	Experimental design of Timor Mountain Gum provenance trials established in 1988 at Lad Krating Plantation, Chachoengsao.....	23
10	Progeny tests of Timor Mountain Gum established in June 2002 at Lad Krating Plantation, Chachoengsao.....	26
11	Experimental design of Timor Mountain Gum progeny tests at Lad Krating Plantation, Chachoengsao.....	27
12	Survival percentages of Timor Mountain Gum at different ages in provenance trials at Lad Krating Plantation, Chachoengsao.....	31
13	Average height of Timor Mountain Gum at different ages in provenance trials at Lad Krating Plantation, Chachoengsao.....	37
14	Average DBH of Timor Mountain Gum at different ages in provenance trials at Lad Krating Plantation, Chachoengsao.....	38
15	Average D10 of Timor Mountain Gum at different ages in provenance trials at Lad Krating Plantation, Chachoengsao.....	41
16	The overall percentages of stem forms distribution of Timor Mountain Gum in provenance trials at Lad Krating Plantation, Chachoengsao.....	45
17	The percentages of stem forms distribution within the provenance of Timor Mountain Gum at Lad Krating Plantation, Chachoengsao	45
18	The overall percentages of bark types distribution of Timor Mountain Gum in provenance trials at Lad Krating Plantation, Chachoengsao.....	46
19	The percentages of bark types within provenances of Timor Mountain Gum at Lad Krating Plantation, Chachoengsao.....	46

LIST OF FIGURES (CONTINUED)

Figures		Page
20	Average thickness of each bark type of Timor Mountain Gum in provenance trials at Lad Krating Plantation, Chachoengsao.....	47
21	The overall percentages of stem forms of Timor Mountain Gum progenies at Lad Krating Plantation, Chachoengsao.....	64
22	The percentages of straight-stem trees of Timor Mountain Gum progenies at Lad Krating Plantation, Chachoengsao.....	65

LIST OF SYMBOLS AND ABBREVIATIONS

ACIAR	Australian Centre for International Agriculture Resource
ANOVA	Analysis of Variance
AusAID	Australian Agency for International Development
B	Boron
C	Carbon
Ca	Calcium
CSIRO	Commonwealth Scientific and Industrial Research Organization, Australia
Cu	Cuprum
D10	Diameter 10cm above-ground level
DANIDA	Danish International Development Agency
DBH	Diameter at Breast Height
DNMRT	Duncan's New Multiple Range Test
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization of the United Nations
Fe	Ferum
HI	Harvest Index
IUFRO	International Union of Forestry Research Organizations
K	Potassium
KUFF	Faculty of Forestry, Kasetsart University
LAI	Leaf Area Index
MAI	Mean Annual Increment
Mg	Magnesium
Mn	Manganese
MPTS	Multi-purpose Tree Species
N	Nitrogen
P	Phosphorus
RCBD	Randomized Complete Block Design
RFD	Royal Forest Department
S	Sulphur
SLA	Specific Leaf Area
SSO	Seedling Seed Orchard
TE	Trace Elements
TPC	Thai Plywood Company
USAID	United States Agency for International Development
Zn	Zinc