

CONTENTS

	Page
Acknowledgements	f
Abstract in Thai	g
Abstract in English	i
List of Tables	p
List of Figures	
CHAPTER 1	1
Introduction	1
1.1 Hypotheses	4
1.2 Objectives	4
CHAPTER 2	5
2.1 Tropical deforestation	5
2.2 The need for forest restoration on mines	6
2.3 Progress with min e-site rehabilitation	7
2.4 Direct seeding	8
2.5 Methods used in Forest restoration	9
2.6 Direct seeding as an alternative method to tree planting	12
2.7 Direct seeding for mine site rehabilitation	13
2.8 Success with direct seeding- Literature case studies	14
2.9 Soil Conditioners	15
2.9.1 Biosolids	15
2.9.2 Compost	16
2.10 Identifying gaps in the knowledge	16

	Page
CHAPTER 3	17
Methodology	17
3.1 Study sites description	17
3.2 Field Plots	17
3.3 Nursery	18
3.4 Species studied	20
3.5 Seed collection and storage	21
3.6 Treatment used in the experiment	27
3.6.1 Biosolids	27
3.6.2 Compost	28
3.6.3 Fertilizer	28
3.7 Germination trials in the nursery	28
3.8 Germination trials in the field	29
3.9 Data analysis	31
CHAPTER 4	33
4.1 Field results	33
4.1.1 Species effects	33
4.1.1.1 Seed germination	33
4.1.1.2 Median length of dormancy (MLD)	36
4.1.1.1.1 Establishment & mortality across all species	37
4.2 Effects of soil treatments	39
4.2.1 On germination	39
4.2.2 On dormancy	43

	Page
4.2.3 On seedling establishment	44
4.2.4 On growth	47
4.2.5 Suitability Score	52
4.3 Nursery result	52
4.3.1 Treatment effects	53
4.3.2 Species effect	59
CHAPTER 5	65
Discussion	65
5.1 Comparing species in the field	65
5.1.1 Germination, establishment and MLD across all species in the field	65
5.1.2 Comparing treatments in the field	67
5.1.3 Effect of treatment on seedling growth in the field	69
5.1.4 Suitability Score for the species in the field	71
5.2 Comparing species in the nursery and effectiveness of treatment	71
5.3 Possible practical application and future work	73
CHAPTER 6	76
Conclusions	76
REFERENCES I am not checking refs as it is different to what I normally use	77
APPENDIX A	88
APPENDIX B	95
APPENDIX C	99
CURRICULAM VITAE	105

LIST OF TABLES

	Page
Table 3-1 Flowering and fruiting months of the species studied	22
Table 3-2 Collection and sowing dates in the nursery and field	24
Table 3-3 Flowering and fruiting months of the species studied	25
Table 3-4 Seed characteristics	27
Table 3-5 Analysis of biosolids component	28
Table 4-1 Species mean across treatment of percent germination, MLD and seedling survival and establishment rates averaged across all treatments	34
Table 4-2 Treatment means across species of percent germination, MLD and seedling survival and establishment rates averaged across all 5 species	40
Table 4-3 Relative growth rate of five species in five treatments in the field	51
Table 4-4 Suitability score of two successful species in the field	52
Table 4-5 Treatment mean across species of percent germination averaged across all eight species	53
Table 4-6 Species mean across treatment of percent germination averaged across all three treatments.	60

LIST OF FIGURES

	Page
Figure 3-1 Average temperature (°C) and rainfall (mm) in Chiang Mai	18
Figure 3-2 Average temperature (°C) and rainfall (mm) in Lampang	19
Figure 3-3 (a) & (b) Two of the Study sites in Thailand	20
Figure 3-4 Schematic diagram of seedlings type	26
Figure 4-1 Percent germination in each treatment among species	35
Figure 4-2 Median length of dormancy (MLD) among species in the treatment	37
Figure 4-3 Establishment among species in each treatment	39
Figure 4-4 (A): Percent of germination in each species among treatment in the field	41
Figure 4-5 (B): Percent of germination in each species among treatment in the field	42
Figure 4-6 Median length of dormancy (MLD) of the species among treatments Int the field	44
Figure 4-7 Differences in establishment of the species among treatments	45
Figure 4-8 Differences in mortality of the species among treatments	46
Figure 4-9 Root collar diameter (RCD.mm) of five species among treatments a fler(a) 3rd Months and after (b) 1 year	48
Figure 4-10 Height (cm) of five species among treatments after (c) 3rd months aAnd(d) after 1 year	49
Figure4-11 Crown Width (cm) of five species among treatments (e) after 3rd Months and (f) after 1 year	50
Figure 4-12Percent germination of eight species among treatments	57

Page

Figure 4-13 median length of dormancy (MLD) of eight species among the
Treatments in the nursery

59

Figure 5-1 Field Plot at Mae Than Mine (Two years old)

69

Figure 5-2 Two year old plot at Muang Poon mine, Planted with saplings on 30
Cm of dumped top soi

79

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved