



**Government of the Union of Myanmar**  
**Ministry of Forestry**  
**Forest Department**



## **Study on the Effect of Different Weeding Methods on the Growth of Teak Plantation**

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# ကျွန်းစိုက်ခင်းတွင်ပေါင်းသင်ရှင်းလင်းနည်းစနစ် အမျိုးမျိုးကိုစမ်းသပ်လေ့လာခြင်း

ဦးမင်းကိုကိုကြီး (B. Sc. (For.) (Rgn.), M.Sc. (ANU))

ဌာနမှူး

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လက်ထောက်ညွှန်ကြားရေးမှူး

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သစ်တောသုတေသနဌာန

## စာတမ်းအကျဉ်းချုပ်

၁၉၈၀-ခုနှစ်မှ စ၍ မြန်မာပြည်တွင် သစ်တောစိုက်ခင်းများကို ကျယ်ကျယ်ပြန့်ပြန့် စိုက်ပျိုးလာခဲ့ကြပါသည်။ ၎င်းစိုက်ခင်းများ အောင်မြင်နိုင်စေရန်အတွက် ဈေးသက်သက်သာသာနှင့် ထိရောက်သော ပြုစုပျိုးထောင်နည်းစနစ်များ ဖော်ထုတ်ပေးရန်လိုအပ်ပါသည်။ သို့ပါ၍ ပေါင်းသင်ရှင်းလင်းခြင်းနည်းများ ဖြစ်ကြသည့် ရိုးရိုးပေါင်းခုတ်နည်း အတန်းလိုက် ပေါင်းခုတ်နည်း စက်ဝိုင်းကွက်လိုက် ပေါင်းခုတ်နည်း စက်ဝိုင်းကွက်လိုက်ခုတ်ပြီး မြေတောင်မြောက်ပေါင်းခုတ်နည်းများနှင့် ပေါင်းခုတ်သည့် အကြိမ်အရေအတွက် အမျိုးမျိုးဖြစ်ကြသည့် ၃:၂:၂:၁။ ၃:၂: ၁:၀။ ၃:၃:၁:၀ နှင့် ၃:၂:၁:၁ များကို စမ်းသပ်လေ့လာခဲ့ပါသည်။ တွေ့ရှိချက်အရ အတန်းလိုက် ပေါင်းခုတ်ပေးခြင်းအားဖြင့် အကုန်အကျ အများဆုံးဖြစ်သော်လည်း ရှင်ပင်ရာခိုင်နှုန်းနှင့် ကြီးထွားမှုအကောင်းဆုံး ဖြစ်ကြောင်း တွေ့ရှိရပါသည်။ စက်ဝိုင်းကွက်လိုက် ပေါင်းရှင်းခြင်း နည်းစနစ်သည် ရှင်ပင်ရာခိုင်နှုန်း နှင့်ကြီးထွားမှုမှ ဒုတိယလိုက်ပြီး ကုန်ကျစရိတ်တွင် အသက်သာဆုံးဖြစ်ကြောင်း တွေ့ရှိရပါသည်။ စမ်းသပ်သည့် ပေါင်းခုတ်သည့် အကြိမ်အရေအတွက် အမျိုးမျိုး၏ အကျိုးသက်ရောက်မှုမှာ ခြားနား ခြင်းမရှိပါ၍ အကြိမ်အရေအတွက် အနည်းဆုံးဖြစ်သည့် ၃:၂:၁ ကို အသုံးပြုရန် အကြံပြုပါသည်။

# **Study on the Effect of Different Weeding Methods on the Growth of Teak Plantation**

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## **Abstract**

Vast areas of plantations are being established in Myanmar since 1980. Proper cultural operations are needed in order to maintain these plantations. Four weeding methods, i.e. blanket weeding, strip weeding, spot weeding, and spot weeding with soil working; and four weeding regimes i.e. 3:2:2:1:, 3:2:1:0, 3:3:1:0 & 3:2:1:1: were tested. Strip weeding gave the best survival and height growth, but was the most expensive were not significant among the different weeding regimes. Thus, 3:2:1, which has the least frequency was recommended.

## Contents

	Page
1. Introduction	1
2. Material and methods	1
3. Results	3
3.1 Survival	4
3.2 Height	4
3.3 Girth	5
3.4 Cost	5
4. Discussion	6
5. Conclusion	6
6. Appendices	
7. References	



## 1. Introduction

In Myanmar, plantations have been formed as early as in 1857 (Anon., 1989). These plantations were under a manageable scale up till 1978. However, in 1980, an ambitious plan was launched to establish plantations starting with a target of 33,000 acres and to reach a target of 90,000 acres. Accomplishment of this optimum target is a challenge for the forest Department, but fulfilling the required cultural operations for the annually accumulating plantation areas can be frightening.

Once the seedlings are planted in a plantation, it is very important to follow up with the required cultural operations in time. Weeding which can be defined as “the removal or cutting back of competing growth in seedling crops” is the most important cultural operation in the first few years of the life of a plantation. This is especially so for teak, which is a heavy light demander. According to Champion and Griffith (1960), regular and efficient weeding is one of the most important factors in the success of a plantation.

Different types of weeding methods and weeding regimes were applied in teak plantations both in India and in Myanmar (Kadambi, 1972). Most of them were prescribed, based on practical experience. In Myanmar, weeding is being carried out by slashing with a weeding knife over the whole area of the plantation. In Karala and Tamil Nadu, India, weeding is done by scraping with a mamooty, and in some other parts, they go as far as weeding and earthing up around plants (Kadambi, 1972). However, it has been found in Madras that scraping is as effective as soil working (Champion & Griffith, 1960).

In teak plantation, the amount of weeding needed depends on the growth of the species and on the density and vigor of the invading weeds and coppice shoots (Karmode, 1964). In Myanmar, weeding regime of 3:3:2:1 was adopted up till 1980. This was reduced to 3:2:2:1 in October 1980 and was further reduced to 3:2:1 in December 1988. Generally, weeding in plantations for India and Myanmar was said to be necessary up till the third year (Champion & Griffith, 1960; Kadambi, 1972). This to a certain extent, supported the latest weeding regime prescribed by the Forest Department in Myanmar ie. 3:2:1. However the effectiveness of the weeding frequency prescribed needed to be proved. Care should also be taken not to over economies, and everything should be done to promote regularity and quick closing of the canopy (Champion & Griffith, 1960).

In view of the increased planting scheme and the need for economical and effective weeding in the accumulated plantation areas, the authors decided to carry out a weeding trail that involve both weeding methods and weeding regimes. The project was initiated in 1985 and terminated in 1989.

## 2. Materials and Methods

The experiment was carried out in Coup III, Kabaung Unclassed Forests of Oktwin Township from 1985 to 1989.

Teak seedlings were planted at a spacing of 8½' x 8½' at the commencement of the monsoon in 1985. The plantation was divided into four blocks which was further sub-divided into 16 plots, each containing (5 x 7 plants) 35 plants.

Four weeding methods, namely :-

blanket weeding (A),

strip weeding (B),

spot weeding (C), and

spot weeding with soil working (D) were applied. Simultaneously, four weeding regimes were also applied to each of the above four weeding methods. They were as shown in the table below :

**Table I. Weeding regime.**

Weeding regimes				
	First year	Second year	Third year	Fourth year
(1)	3	2	2	1
(2)	3	2	1	0
(3)	3	3	1	0
(4)	3	2	1	1

Blanket weeding - The usual slash weeding method which is normally used in the district.

Strip weeding - Weeding carried out in 4 ft wide strips. The weeds were scrape clean with mamooty

Spot weeding - Weeding carried out in circles of 4 ft diameter. The weeds were scraped clean with mamooty.

Spot weeding with soil working  
-Weeding carried out in circles of 4 ft diameter. The weeds were scraped clean with mamooty and soil working was also carried out around the plant.

The weeds consist mainly of bamboos and other vegetative regrowths, Imperata grass (*Imperata cylindrica*) and bizat (*Eupatorium odoratum*).

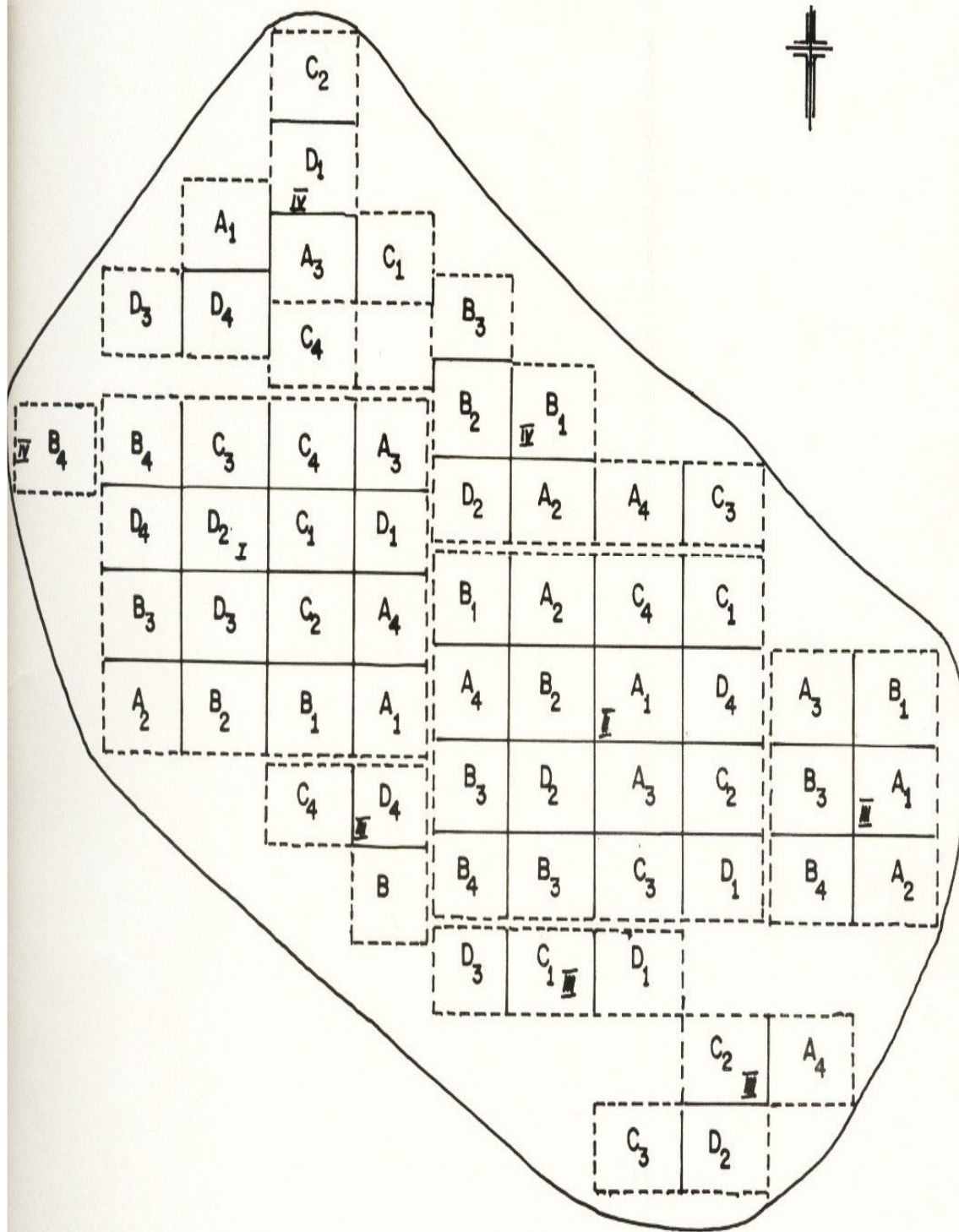
During weeding operations, time taken to complete each kind of weeding method in a total of 16 plots or 0.93 acres was also recorded in the first year. Time required to complete one acre of each weeding method was converted into "man power" by dividing with 8 hrs which is the working hours per day. This again is converted into "cost" by multiplying with Ks 15, the cost for daily labour. Height measurements were taken annually in March whereas girth measurements were assessed only in 1989.

Factorial experiment in randomized complete block design was carried out, and pair of treatments were randomly assigned to each plot as shown in Figure I.

Analysis of variance and LSD tests were carried out at the Computer section of the National Forest Management and Inventory Project.

Figure. I

Field lay out  
Weeding Trial (1985)





### 3. Results

The results of the effect of different weeding methods on survival percent and height growth were as shown in Table II & III and Figure II & III.

**Table II. The effect of different weeding methods on survival percent.**

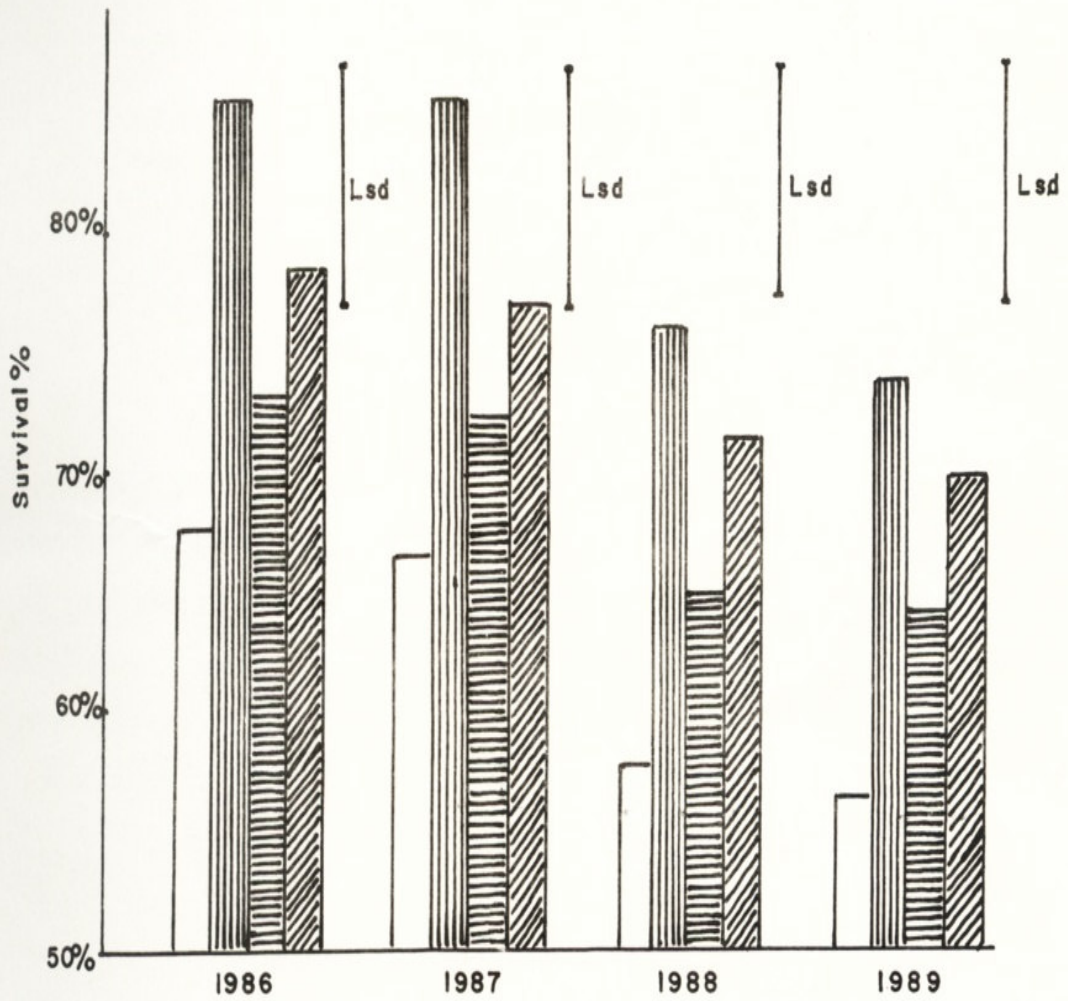
Weeding methods	Height (ft.)			
	1986	1987	1988	1989
Blanket weeding	67.8	66.4	57.7	56.3
Strip weeding	85.7	85.5	75.8	73.4
Spot weeding	72.9	71.9	64.8	63.9
Spot weeding with soil working	78.4	77.0	71.1	69.7

**Table III. The effect of weeding methods on height growth.**

Weeding methods	Height (ft.)			
	1986	1987	1988	1989
Blanket weeding	1.09	2.54	5.60	12.71
Strip weeding	1.28	3.02	5.76	12.69
Spot weeding	1.24	2.81	5.39	12.51
Spot weeding with soil working	1.19	2.71	5.33	13.12

Figure II

Survival %



Blanket weeding

Strip weeding

Spot weeding

Spot weeding with soil working

### 3.1 Survival

The results of the effect of different weeding methods on the survival of teak were found to be significantly different from the first to the fourth year that were assessed (Appendix I, II, III, IV). For simplicity, ranking of the different weeding methods affecting the survival of teak for each year are given below with lines linking those methods that were not significantly different.

1986	1987	1988	1989
B     D     C     A	B     D     C     A	B     D     C     A	B     D     C     A

The results of the effect of different weeding methods on the survival of teak tended to form group that overlap. The results from 1986 to 1988 were consistent, with B tending to be the best and A the poorest. However, in 1989, A again appeared to be the poorest while the rest tended to group together.

### 3.2 Height

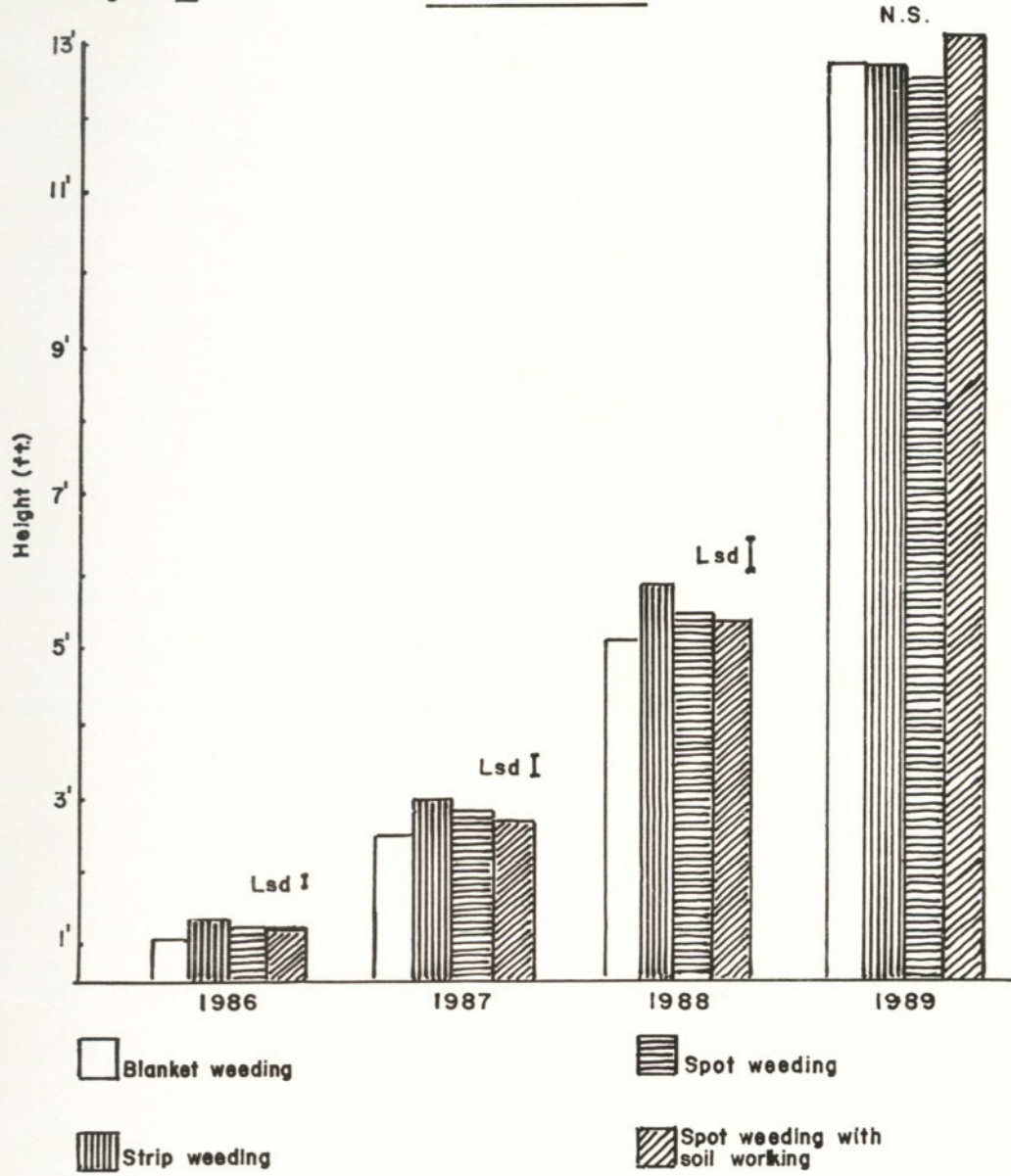
Height measurements were also significantly affected by the different methods of weeding. However, this was observed only in the first three years whereas the differences were not significant in the fourth year (Appendix V, VI, VII, VIII). Ranking of the different weeding methods affecting the height growth of teak for each year are given below with linking those methods that were not significantly different.

1986	1987	1988
B   C   D   A	B   C   D   A	B   C   D   A

In 1986, A tended to be the poorest, while the rest form a group. A again tended to be the poorest in 1987, while B tended to be the best. In 1988, B tended to maintain the superior position while the rest form a group.

Figure III

Height Growth



### 3.3 Girth

The results of the effect of different weeding methods on girth measurements were not significantly different. (Appendix IX). They were as given below.

<b>Weeding methods</b>	<b>Girth (inches)</b>
Blanket weeding (A)	8.77
Strip weeding (B)	9.11
Spot weeding (C)	8.75
Spot weeding with soil working (D)	9.25

### 3.4 Cost

The effects of adopting the different kinds of weeding methods on the cost were as given in Table IV and Figure IV. (Also see Appendix X).

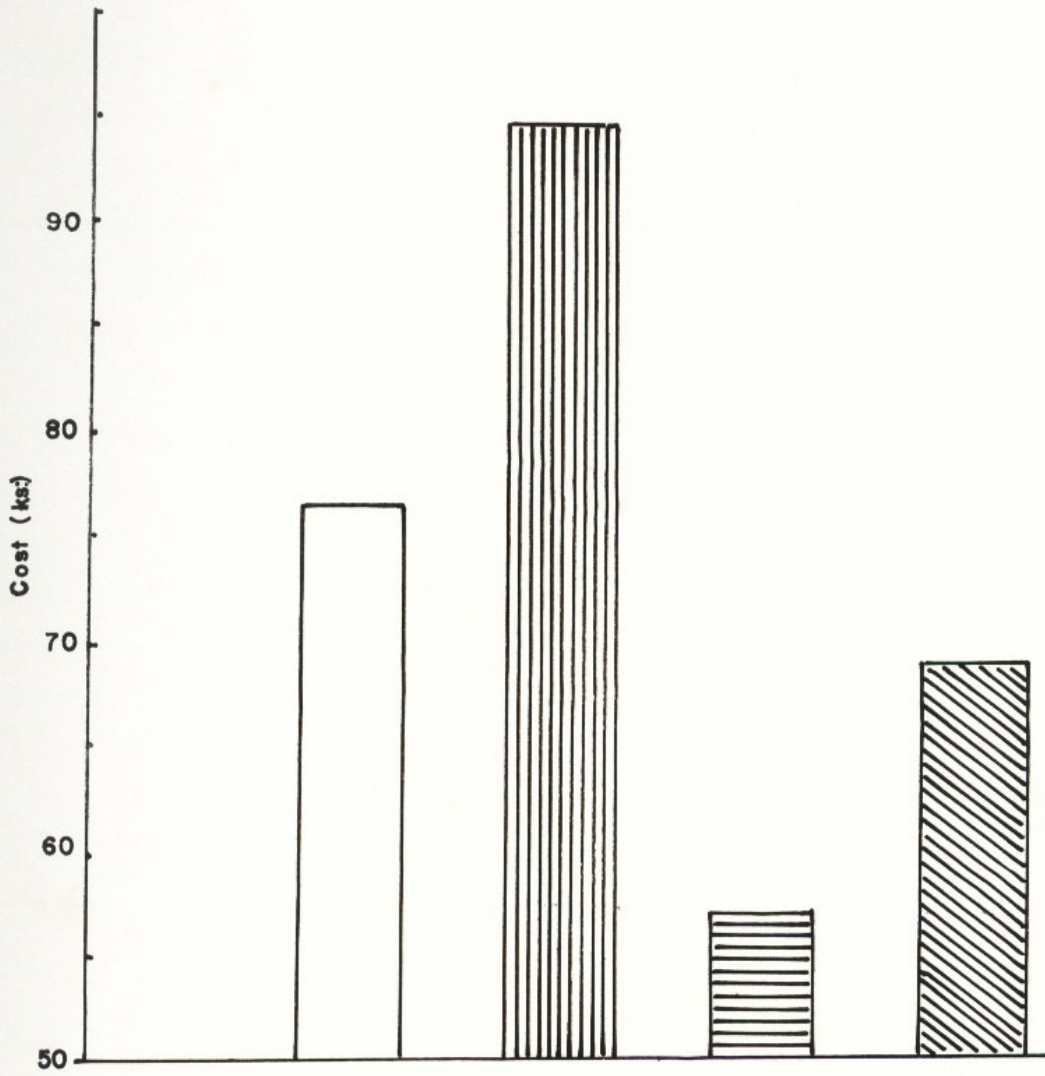
Table IV. Cost

<b>Weeding methods</b>	<b>Total assessment</b>		<b>Weeding per acre</b>		
	<b>area (acre)</b>	<b>Time taken (hours)</b>	<b>Time taken (hrs.)</b>	<b>Man power</b>	<b>Cost (Ks.)</b>
Blanket weeding	2.78	112.7	40.5	5.1	76.50
Strip weeding	2.78	139.9	50.3	6.3	94.50
Spot weeding	2.78	85.5	30.7	3.8	57.00
Spot weeding with soil working	2.78	102.3	36.7	4.6	69.00

It can be seen from Table V that the cost to carry out the strip weeding (94.50) is the highest whereas that required to carry out spot weeding (57.00) is the least. Blanket weeding (76.50) followed second and spot weeding with soil working (69.00) third.

Figure IV

Cost



 Blanket weeding

 Spot weeding

 Strip weeding

 Spot weeding with soil working

## 4. Discussion

From the results of both the survival and height growth, it is clear that the usual blanket weeding method is inferior to the other weeding methods tested. This can be due to either because the seedlings were partially protected from the wind and heat by the surrounding vegetation in the latter three methods, or because teak prefers the weeds to be scarped clean. When the weeds were scarped clean, competition was checked for a much longer period than in slash weeding.

The effects of the weeding methods on height in the first and the second year were very pronounced, especially the inferior effect of method A. However, A catches up with D and C in the third year and no differences were found in the fourth year. This indicated that any of the four weeding methods can be used in the fourth year. This can be due to the fact that the planted teak have overcome the weed competition and that weeding may not be crucial at this age. This result to a certain extent, supports the Forest Department latest prescription on weeding regime (3:2:1), which cuts down the weeding in the fourth year.

Four possible weeding regimes with different frequencies ie. (3:2:2:1=8), (3:2:1:0=6), (3:3:1:0=7) and (3:2:1:1=7) were tested. No significant effects were observed either on survival or height growth. This indicated that any of the weeding regimes can be used without affecting survival and height growth. Obviously, weeding regime with the least frequency ie. (3:2:1:0=6) should be selected. This is also supported by Champion & Griffith, (1960) and Kadambi (1972) who advocated that in teak plantation, weeding is necessary only up till the third year. Moreover, it also tallies with the latest prescription of the Forest Department.

The results of the effect of different weeding methods and weeding regimes supported each other by the fact that both indicated that weeding in the fourth year can be unnecessary.

Although strip weeding is silviculturally most desirable, the cost of weeding by this method is the highest as compared to the other three methods. (Table IV) However, if weight-age should also be given to cost, method C and D can be the most appropriate.

Block differences regarding survival, height and girth were also found to be significant (Appendices I to IX). However, differences in height were not significant in the fourth year, except for girth and survival. This indicated that teak is highly site selective especially in the first three years.

## 5. Conclusion

- (1) In teak plantations around Toungoo, either strip or spot weeding methods can be adopted.
- (2) If financial aspect has to be considered, spot weeding method would be suggested to be used.
- (3) Weeding regime of 3:2:1 can be used effectively in teak plantations around Toungoo area.

**Appendix I. Analysis of variance for survival Oktwin (1986)**

Source of Variation	d.f	Sum of Squares	Mean Squares	F
Block	3	3158.9	1053.0	5.228**
Technique	3	2817.8	939.3	4.663**
Regime	3	666.6	222.2	1.103 NS
Technique x Regime	9	772.2	85.8	0.426 NS
Residual	45	9063.4	201.4	
Total	63	16478.9	261.6	
L S D = 10.1				

**Appendix II. Analysis of variance for survival Oktwin (1987).**

Source of Variation	d.f	Sum of Squares	Mean Squares	F
Block	3	3244.8	1081.6	5.215**
Technique	3	3139.5	1046.5	5.047**
Regime	3	585.0	195.0	0.940 NS
Technique x Regime	9	688.5	76.5	0.369 NS
Residual	45	9330.8	207.4	
Total	63	16988.6		
L S D = 10.3				

**Appendix III. Analysis of variance for survival Oktwin (1988)**

Source of Variation	d.f	Sum of Squares	Mean Squares	F
Block	3	1742.9	581.0	3.076**
Technique	3	2961.3	987.1	5.226**
Regime	3	460.5	153.5	0.813 NS
Technique x Regime	9	811.0	90.1	0.477 NS
Residual	45	8500.4	188.9	
Total	63	14476.0	229.8	
L S D = 9.8				

**Appendix IV. Analysis of variance for survival Oktwin (1989)**

Source of Variation	d.f	Sum of Squares	Mean Squares	F
Block	3	1730.7	576.9	2.914*
Technique	3	2690.5	896.8	4.529**
Regime	3	521.3	173.8	0.877 NS
Technique x Regime	9	819.7	91.0	0.460 NS
Residual	45	8911.0	198.0	
Total	63	14672.9	232.9	
L S D = 10.1				



**Appendix V. Analysis of variance for height Oktwin (1986)**

Source of Variation	d.f	Sum of Squares	Mean Squares	F
Block	3	0.44797	0.14932	4.853**
Technique	3	0.30172	0.10057	3.269*
Regime	3	0.01547	0.00516	0.168 NS
Technique x Regime	9	0.48016	0.05335	1.734 NS
Residual	45	1.38453	0.03077	
Total	63	2.62984	0.04174	
L S D = 0.125				

**Appendix VI. Analysis of variance for height Oktwin (1987)**

Source of Variation	d.f	Sum of Squares	Mean Squares	F
Block	3	6.1467	2.0489	15.676**
Technique	3	1.9405	0.6468	4.950**
Regime	3	0.0180	0.0060	0.046 NS
Technique x Regime	9	1.6152	0.1795	1.373 NS
Residual	45	5.8808	0.1307	
Total	63	15.6011	0.2476	
L S D = 0.258				

**Appendix VII. Analysis of variance for height Oktwin (1988)**

Source of Variation	d.f	Sum of Squares	Mean Squares	F
Block	3	10.3867	3.4622	12.608**
Technique	3	4.0567	1.3522	4.925**
Regime	3	0.1038	0.0343	0.125 NS
Technique x Regime	9	3.1352	0.3484	1.267 NS
Residual	45	12.3558	0.2746	
Total	63	30.0373	0.4768	
L S D = 0.374				

**Appendix VIII. Analysis of variance for height Oktwin (1989)**

Source of Variation	d.f	Sum of Squares	Mean Squares	F
Block	3	7.358	2.453	2.198 NS
Technique	3	3.159	1.053	0.944 NS
Regime	3	1.823	0.611	0.547 NS
Technique x Regime	9	9.863	1.096	0.982 NS
Residual	45	50.225	1.116	
Total	63	72.463	1.150	

**Appendix IX. Analysis of variance for height Oktwin (1989)**

<b>Source of Variation</b>	<b>d.f</b>	<b>Sum of Squares</b>	<b>Mean Squares</b>	<b>F</b>
Block	3	7.0030	2.3343	3.825*
Technique	3	3.0017	1.0006	1.640 NS
Regime	3	0.1955	0.0652	0.107 NS
Technique x Regime	9	8.4739	0.9415	1.543 NS
Residual	45	27.4595	0.6102	
Total	63	46.1336	0.7323	

**Appendix X. Time required to carry out each weeding method**

<b>Weeding methods</b>	<b>Time required to carry out weeding (hrs.)</b>			<b>Total (hrs.)</b>
	First weeding (0.93 ac)	Second weeding (0.93 ac)	Third weeding (0.93 ac)	
Blanket weeding	33.3	41.3	38.1	112.7
Strip weeding	57.7	41.1	41.2	139.9
Spot weeding	24.2	30.6	30.7	85.5
Spot weeding with soil working	38.5	40.0	23.7	102.2

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