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ESTABLISHMENT OF PERMENT PLOTS TO DEMONSTRATE THE EFFECT OF PROTCTED TEAK PLANTATIONS FROM THE TEAK DEFOLIATOR

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ABSTRACT

Permanent plots were established and maintained in a young teak plantation at Panayangode in the Nilambur Forest Division to demonstrate the impact of defoliation caused by the insect Hyblaea puera on growth of teak. Two plots, half a hectare each, were laid out in a plantation raised in 1993. One of the plots was left to natural insect defoliation and the other, protected against the teak defoliator whenever infestation occurred. Six-monthly measurements of height and GBH were taken of all trees in the two plots. Results of the first 5 - year period showed that in the protected plot there was 45 per cent increase in mean height and 19 per cent increase in GBH over the control. The two plots are being maintained for further observation.

1. INTRODUCTION

Teak *(Tectona grandis)* has been grown in Kerala since 1840 as forest plantation and covers over 78,000 ha at present. In recent times, private enterpreneurs and farmers have also shown interest in growing teak outside the forestry sector. One of the major problems while cultivating teak is the repeated attack by insect defoliators, almost every year.

Among 180 insects reported to feed on teak, the lepidopteran defoliators, *Hyblaea puera* and *Eutectona muchaerulis* are the most serious. An earlier study conducted by KFRI at Nilambur (Nair *et al.,* 1985) showed that the teak defoliator, *H. puera,* which causes defoliation during the early part of the growth season causes loss of about 40% of the potential volume increment in young plantations. The teak skeletoniser, *E. machaeralis* which is usually active during the later part of the year, had little impact on growth (Nair *et al.,* 1985). Trees protected against *H. puera* put forth an annual increment of 6.7m^3/ha compared to the mean annual increment of 3.7m^3/ha of unprotected trees, which amounts to a gain of 3m^3/ha annually. Theoretically, the protected trees can yield the same volume of wood in 26 years as unprotected trees would yield in 60 years, the normal rotation age, provided other inputs are given (Nair *et al.,* 1996). Thus, there would be substantial economic gain if control measures are adopted against the teak defoliator.

Though there is general awareness of the damage caused by teak defoliator attack, the impact of defoliation on growth of teak is not well appreciated. Therefore, control measures against the teak defoliator has so far not become part of the management practice. The present project was taken up to demonstrate the impact of defoliation caused by *H. puera* on growth of teak, by preserving two plots in a young plantation one left to natural insect defoliation and the other protected against the teak defoliator attack as and when it occurred. Though the project period covered only the initial five years of growth, we intend to continue the treatments and maintain the plots for longer periods in order to demonstrate the difference in growth over the years.

2. MATERIALS AND METHODS

2.1. **Study area**

Two permanent demonstration plots, half hectare each, were laid out in 1993, in a current year's teak plantation (planted in 1993, at an espacement of 2m X 2m) raised by the State Forest Department at Panayangode in Nilambur Forest Division (Fig 1.). One plot was left to natural defoliation and in the other plot appropriate measures were taken to control the teak defoliator as and when required. Between the two plots a 5 meter buffer zone was left to avoid possible border effect. The plots were laid out soon after the planting of teak in 1993. In each plot all the plants were numbered. The lay out of the experimental area is shown in Fig. 2.

2.2. **Maintenance of plots**

Any casuality due to animal/ human interference was noted and recorded. The two plots were also subjected to periodic weeding.

2.3. **Monitoring pest incidence**

To detect teak defoliator incidence, observations were made at fortnightly intervals, and more frequently when pest incidence was noticed in other areas. When the insect was present, information on the stage of the insect and damage caused, if any were recorded.

2.4. Measurements

Initial height of all the plants were measured in 1993. Thereafter height measurements were taken at 6-monthly intervals. From 1996 onwards, girth at breast height (GBH) (1.37m above ground) was also measureed. The significance of difference in height and GBH of trees between the plots were tested using analysis of covariance, using initial values taken in 1994 as co-variants. For calculating GBH,

all the trees which had the desired height (i.e. 1.37 m) to take the girth at breast height alone were considered.

Statistical analysis was carried out using measurements of all trees in the protected and unprotected plots, which were not replicated. However, these plots belonged to the same plantation and therefore comparable at the start of the experiment.

2.5. **Control of the teak defoliator**

Whenever an infestation was noticed in the protected plot, control measures were adopted. Either an insecticide (Ekalux 25 EC 0.5%) or a commercially available *Bacillus thuringiensis* preparation (Biobit 0.1%) was sprayed to control the pest. In general, two rounds of spraying were required per year.

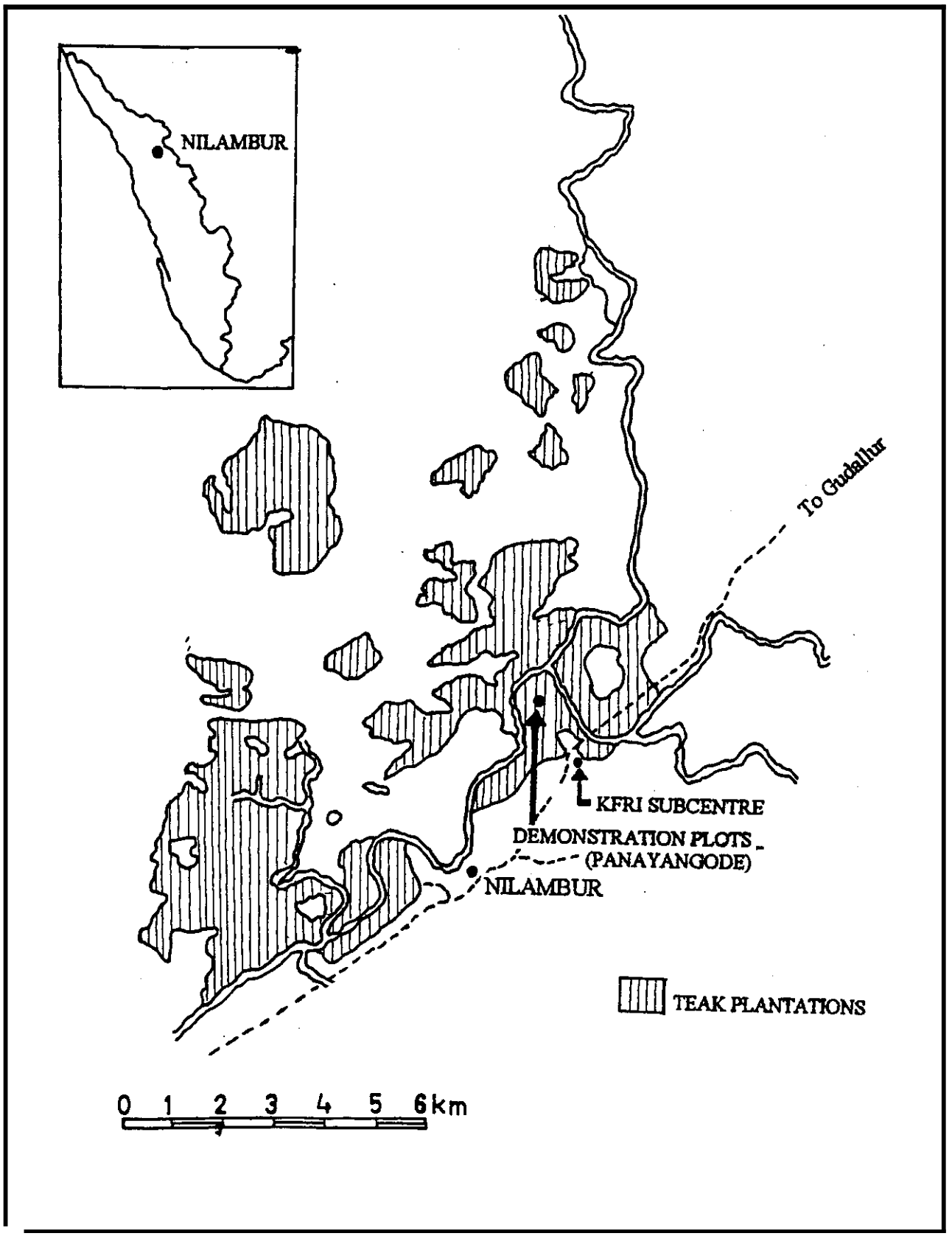

Fig. 1. Map showing the location of the demonstration plots at

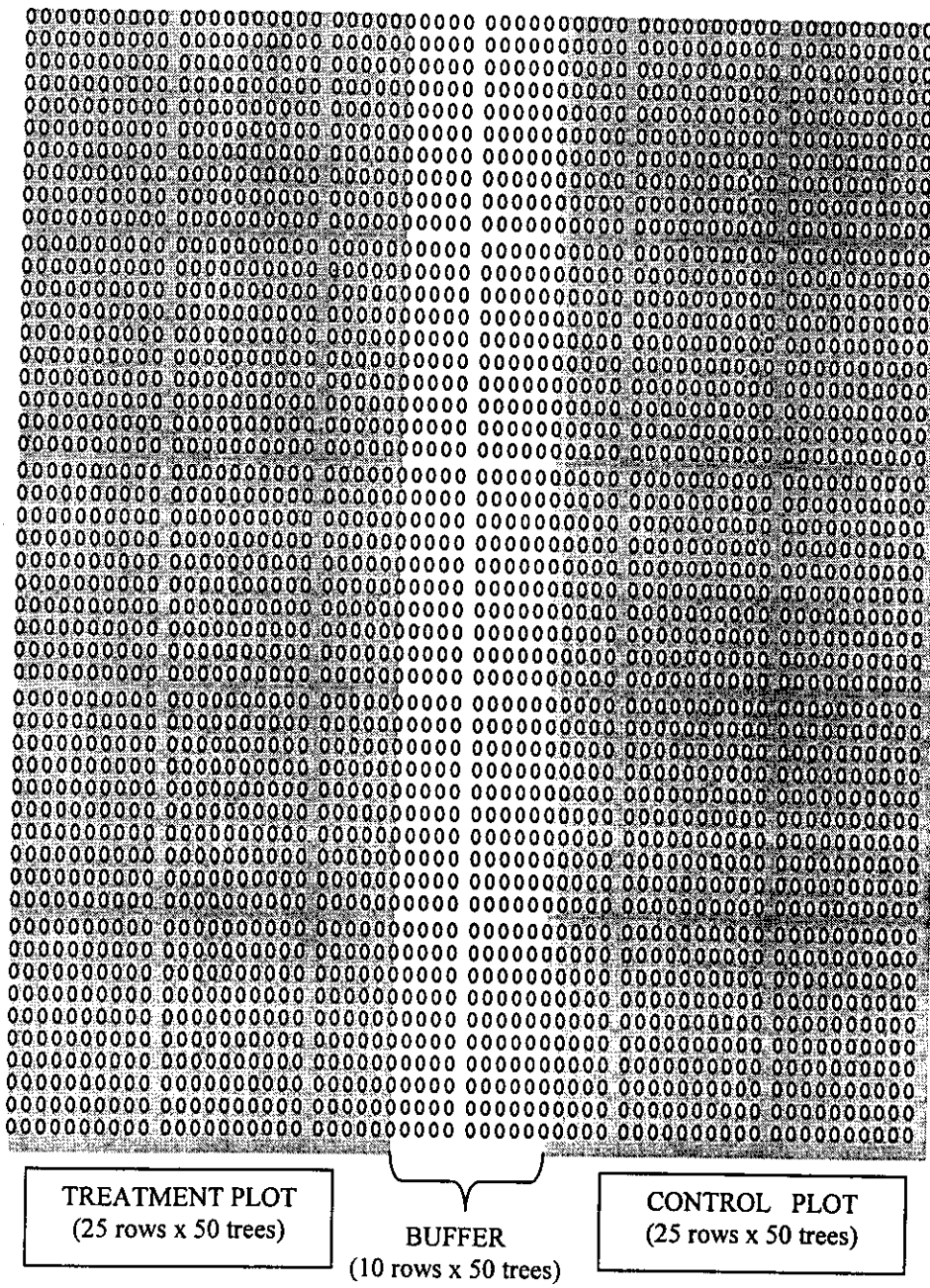

Fig.2 Plot chart of treatment and control plots

3. RESULTS AND DISCUSSION

3.1. **Pest incidence**

The data collected on pest incidence in the experimental area and control measures adopted are presented yearwise, from 1994 onwards.

Pest incidence in 1994

Regular observations on pest incidence were started from March 1994 onwards. From March to December 1994, i.e. over a 10-months period, no incidence of *H. puera* occurred in the two plots. Therefore, no control measure was needed. Weeding was carried out in both the plots.

Pest incidence in 1995

During 1995, defoliator incidence was noticed six times, as per details given in Table 1. The pest incidence was noticed during the months - May, August, September and October. In May and October, control operations were required twice in each month. The pest incidence observed during the year, conformed to the general pattern of Hyblaea infestation in other teak plantations at Nilambur.

Table 1. *H. purea* incidence in the protected plot during the year

Month & date	Insect stage noticed	Treatment given
7 May95	Egg, 1st and 2nd instars	Ekalux 25 EC 0.5%
13 May 95	I st, 2nd, instars	Ekalux 25 EC 0.5%
26 Aug. 95	1st 2nd 3rd instars	Ekalux 25 EC 0.5%
23 Sep. 95	1st and 2nd instars	Ekalux 25 EC 0.5%
12 Oct. 95	1st and 2nd instars	Ekalux 25 EC 0.5%
29 Oct. 95	1st and 2nd instars	Ekalux 25 EC 0.5%

Pest incidence in 1996

In 1996, pest incidence was noticed twice and control measures were adopted (Table 2). The first attack occurred during the first week of May as in the previous year. The second occurred in the last week of October. On both occasions, the attack was effectively controlled by an one-time application of Ekalux 25EC.

Table 2 . *H. puera* incidence in the protected plot during the year 1996

Month date	Insect stage noticed	Treatment given
9 May 96	Ist and 2nd instars	Ekalux 25 EC 0.5%
29 Oct. 95	2nd instar	Ekalux 25 EC *0.5%*

Pest incidence in 1997

H. puera attack occurred twice during the year (Table *3)*. The first incidence occurred in May, and the second in June. On both the occasions, the pest was effectively controlled by applying a commercially available *B.t.* preparation, Biobit, through an one-time application @ 1 g of Biobit per litre of water. A Stihl sprayer (Mist blower) with AU 8000 sprayhead was used for applying the *B.t.* preparation (Fig. 3). A total of 54 litres of spray solution was required to cover 1119 trees in the protected plot.

Table 3 . *H. puera* incidence in the protected plot during the year 1997

Month & date	Insect stage noticed	Treatment given
12 May 97	1st instar	Biobit 0.1%
25 May 97	1st instar	Biobit 0.1%

In general, there was no uniformity in the incidence pattern of the teak defoliator in the experimental plot over the years. In one year (1994) there was no attack at all, but during the next year the pest incidence occurred 6 times. In the subsequent years, the pest outbreak occurred only twice during each year.

Fig. 3. Spraying at the protected plot using a Stihl sprayer with AU8000 spray head (12th May 1997).

3.2. Growth of trees

The height and GBH of trees in the two plots over the experimental period are given in Tables 4 and 5. The data on height and GBH were also subjected to statistical analysis which showed significant difference in mean height and GBH of trees in the protected plot over the control. The height measurements of trees were available for 3 years (1995,1996,1997), whereas GBH readings were taken only from the trees which had the desired height (i.e. 1.37 m) and confined to two years (1996 and 1997). In the protected plot there was about 45% increase in mean height and 19% increase in GBH over the control (Fig. 4a, b). At the end of the five year period, there was visible difference in growth between the two plots (Fig. 5a, b).

Table 4. Mean height of trees in the protected and unprotected plots

Category	Mean height (m)				Final % increment of protected over unprotected
	1994	1995	1996	1997	
Protected	0.37±0.01 (1147)	2.67±0.03 (1130)	3.99±0.04 (1129)	(1 119)	45.86
Unprotected	3.32±0.01 (1 141)	2.35±0.04 (950)	3.06±0.04 (944)	3.7520.50 (944)	

standard error of mean rounded off to two decimals
Figures in parentheses indicate the number of trees in the plot

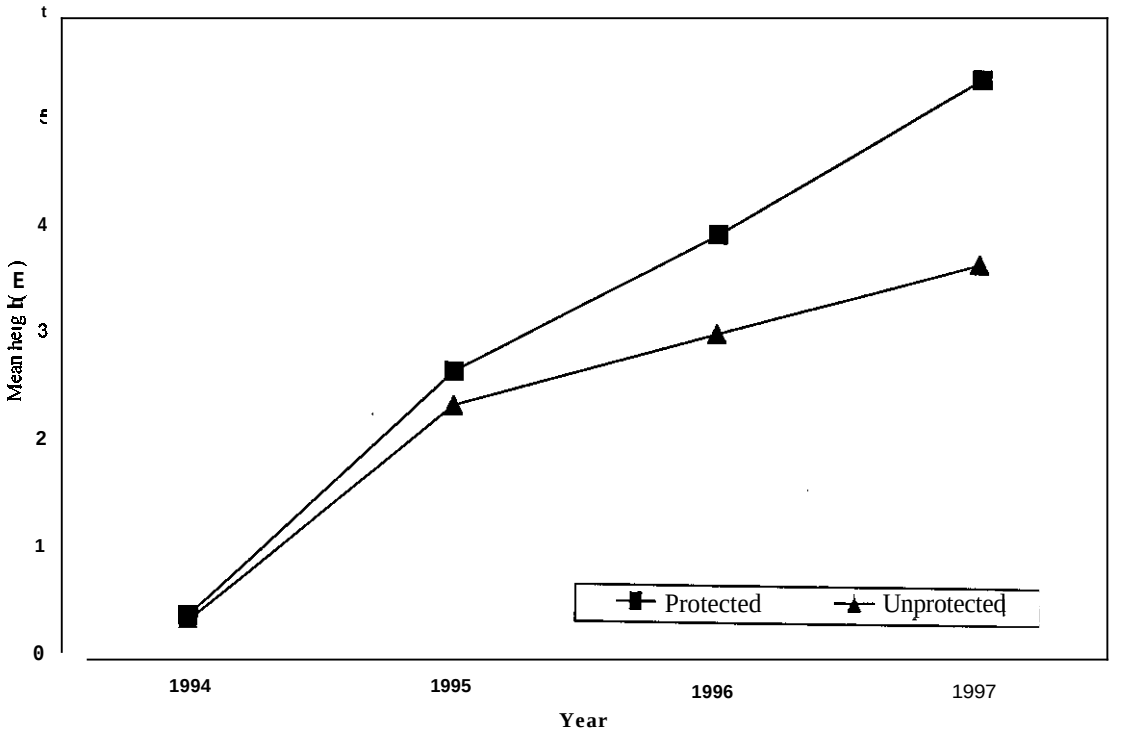

Fig.4a. Graph showing mean height of trees in the protected and unprotected plots

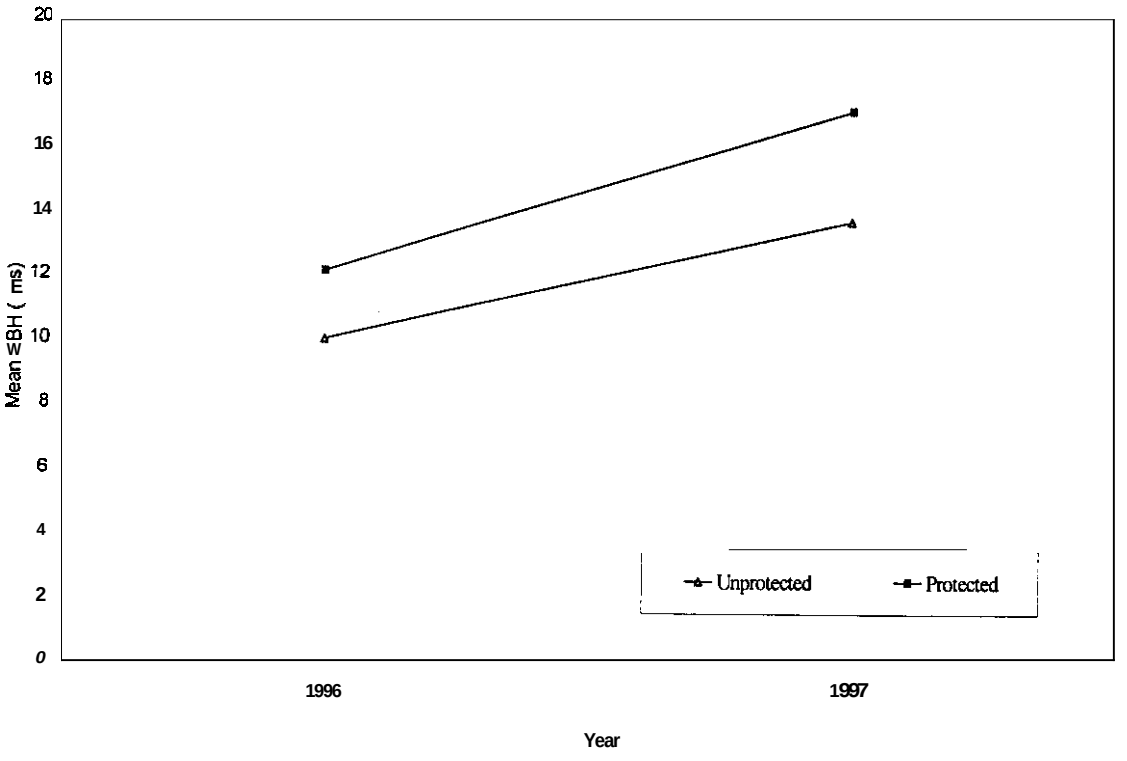

Fig. 4b. Graph showing mean GBH of trees in the protected and unprotected plots

Table 5. Mean GBH of trees in the protected and unprotected plots

Category	Mean GBH (cm)		Final % increment of protected over unpotected
	1996	1997	
Protected	12.12±0.11 (987)	17.21±0.I4 (1028)	19.32
Unprotected	10.0±0.10 (685)	13.75±0.13	

± standard error of mean rounded off to two decimals
figures in parentheses indicate the number of trees in the plot

In the experimental area, the site factors were more or less similar and sufficient guard rows were left in between the plots to reduce the interference between the treatments. In the protected plot, insecticidal application depended on the number of pest infestations during each year and no other treatment was given. Thus the difference in height and GBH achieved is explainable as only due to the control of the teak defoliators.

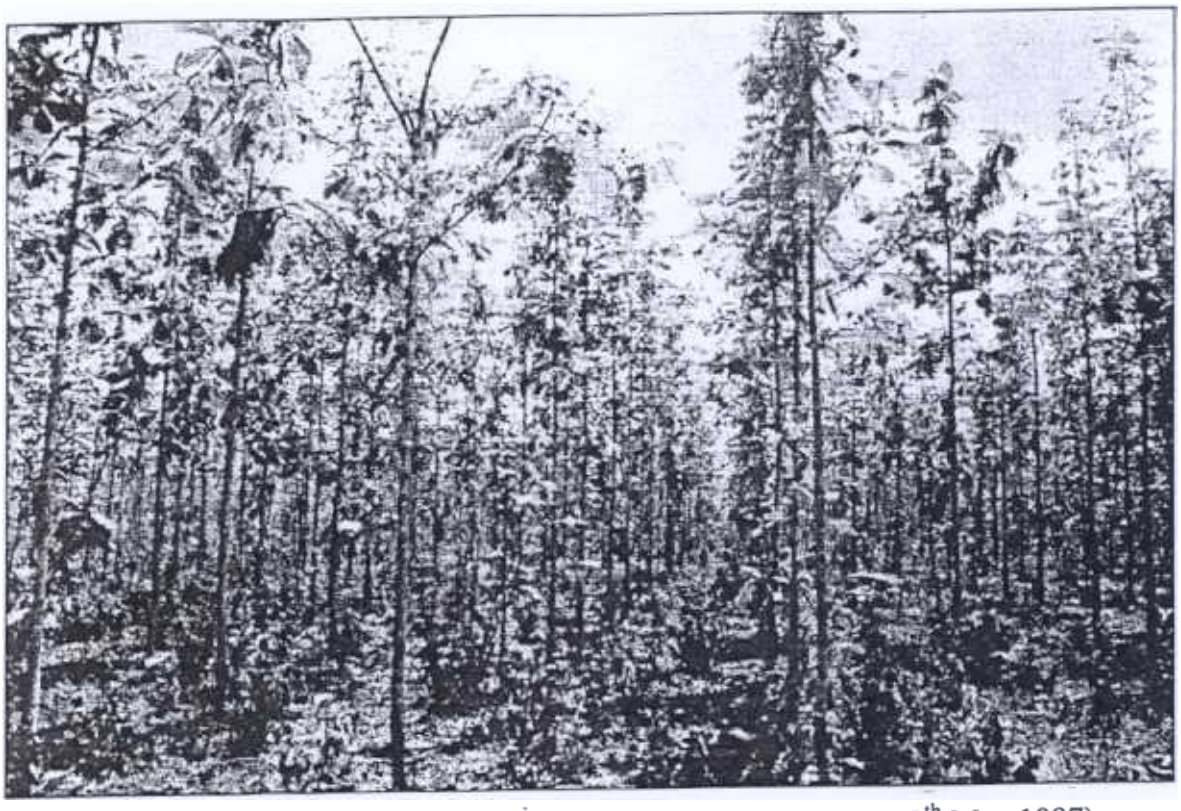

Fig.4a A view of the plot protected against the teak defoliator (12th May 1997)

Fig.4b A view of the plot not protected against the teak defoliator (12th May 1997)

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