"GROWTH PERFORMANCE OF ONE YEAR OLD *MELOCANNA BACCIFERA* (ROXB) NEES AND *DENDROCALAMUS LONGISPATHUS* (KURZ) FOR. ALONG WITH *GLYCINE MAX* L. MERRIL IN DEGRADED JHUMLAND"

THESIS

SUBMITTED TO THE NORTH-EASTERN HILL UNIVERSITY IN PARTIAL FULFILLMENT OF THE DEGREE OF MASTER OF SCIENCE IN FORESTRY.

BY

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SUPERVISOR'S CERTIFICATE

I certify that the thesis entitled "Growth Performance of one year old *Melocanna baccifera* (Roxb) Nees and *Dendrocalamus longispathus* (Kurz). For. Along with *Glycine max* L. Merril. in degraded jhumland" submitted by Mr. Charseng Ch. Marak for the partial fulfilment of Master of Science in Forestry of the North-Eastern Hill University, Shillong embodies the record of original investigation by him under my supervision. He has successfully completed all his papers and the thesis presented is worthy of being considered for the award of the M.Sc. Degree. The work has not been submitted by any other degree of any other University.

18/12/01

Dated Aizawl.
The _____2001

(Prof. L.K.JHA)
Supervisor.

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(CHARSENG CH.MARAK)

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CHAPTER – I
INTRODUCTION

INTRODUCTION

Located at the extreme Southern part of North-Eastern India, Mizoram has a total geographical area of 2.11 million ha. It is located between latitude 21° 57' and 24°N and longitude 92° 15' and 93° 29'E bordering Myanmar in the east and south and Bangladesh in the West.

The forest cover of Mizoram is estimated as 18,338 sq.km. representing 86.99% of the states geographical area. The dense forest was recorded to be 3,786sq.km. and open forest is 14, 552 sq.km. (Anon, 1999). According to Champion and Seth (1968) classification, the forest of Mizoram are broadly classified into three main categories:

1. Tropical wet Evergreen forest
2. Tropical Semi-evergreen forest, and
3. Montane sub-tropical pine forest.

Important tree species are *Dipterocarpus turbinatus, Artocarpus chaplasa, Terminalia myriocarpa, Michelia champaca, Gmelina arborea, Bombax ceiba, Mesua ferrea, Quercus sp, Pinus kesiya etc.*

Mizoram is endowed with a rich forest cover of dense bamboo thickets and high rising trees. It contributes 14% to the total bamboo growing stock of the country (Rai and Chauhan, 1998). The first record of nine bamboo species in Mizoram was recorded by Fisher (1938). Naithani (1986) has conducted a preliminary survey of bamboos and listed 18sp of bamboos occurring in Mizoram. The presence of 21 species of bamboo has been reported in the state. *Melocanna baccifera* and non-clump forming bamboo species constitute about 98% of the total growing stock in the state (Anon, 1997). Bamboo species are distributed between 40-1520m high and their distribution is somewhat restricted to about 1550m (Lalramnghinglova, 1997). *Melocanna baccifera* which formed the dominant species usually occurs associated with jhum lands. When the forest are burnt for jhuming the trees species are destroyed but the

bamboo rhizomes survives and in abandoned areas, the bamboo throw out new culms and occur as the first colonizer in the jhum land.

Bamboo has a widespread uses in the state viz, Construction purposes, agricultural implements, handicrafts, decoration items, tree guards and fencing, medicinal and food-stuffs etc. (Lalramnghinglova and Jha, 1995). In Mizoram people regard bamboo shoots as a great delicacy (Jha *et.al.*, 2000).

Jha and Laha (2000) estimated the availability of Bamboo shoots in the vegetable market of the state. Accordingly, non-clump forming species has a 50% share in the vegetable market whereas it covers 98% of the total growing stock in the state. The clump forming species contributes 50% share whereas it covers only 20% of the total growing stock. Thus there is a threat over the clump and non-clump forming species in the state. Besides, lack of proper management and shifting cultivation has degraded the bamboo wealth considerably (Lalramnghinglova and Jha, 1995). It is estimated that during 1987 to 1997 an area of about 0.38 million ha has been effected by shifting cultivation. Mizoram, along with Nagaland and Manipur accounts for about 65% of the total area under shifting cultivation in the North Eastern region (Anon, 1999). Locally called as 'lo', shifting cultivation has been identified as the main factor causing environmental degradation and destruction of forests (Satapathy *et.al.*, 1999; Lallianthanga, 1999). The New Land Use Policy (NLUP) launched by the Government of Mizoram has failed to put an end to the practice of jhuming nor bring out any perceptible improvement in the economic conditions of the villagers (Garbyal) 1999.

Thus there is a need for carefully designed agronomic research to reinforced and consolidate bamboo supplies in the state. The most common available species are *Melocanna baccifera, Dendrocalamus*

longispathus, Dendrocalamus hamiltonii, Bambusa tulda and Dendrocalamus giganteus.

In order to reclaim the degraded jhum land, two major species, viz., *Melocanna baccifera* and *Dendrocalamus longispathus* are selected for bamboo-based Agroforestry system. Efforts have been made on the cultivation of bamboo species along with the agriculture crops.

The objectives of the present study are as follows : -

(1) To study the monthly growth performance of the bamboo species with respect to : -
   (a) Height growth
   (b) Number of leaves
   (c) Number of culms
(2) Impact of fertilizer on the growth of bamboo species and on the crop (*Glycine max*).
(3) Yield of Soyabean (*Glycine max*) under different treatments in bamboo-based Agroforestry.

CHAPTER – II
REVIEW OF LITERATURE

REVIEW OF LITERATURE

The term "Agroforestry" was coined almost at the time of establishing the International Council of Research in Agroforestry (ICRAF) during 1977. It is a new word used in place of shifting cultivation or agrisilviculture or the Taungya system (Steward, 1981). Agroforestry has been defined in many ways depending upon its objectives and requirement (King, 1987, Nair, 1987, Sinclair 1988). But a typical Agroforestry system will allow economic and ecological interactions between woody and non-woody components and also to increase, sustain and diversify the total land output (Nair, 1989).

Bene *et . al.,* (1977) defines Agroforestry as a sustainable management system for land that increase over-all production, combines agricultural crops, tree crops and forest plants and or animals simultaneously or sequentially and applies management practices that are compatible with the cultural patterns of a local population. Sinha (1985) defines it as an integrated land used planning system following the principle of generating multiple resources from the same unit of land.

In North – Eastern hill region, Agroforestry in some form or the other has been practiced by farmers since an ancient times. Traditional Agroforestry practices prevailing in North – East hill region have been reviewed by Solanki (1999). Shifting cultivation, Taungya cultivation, inter cropping with plantation crops and home gardens are some common Agroforestry practices in this region. Pathak and Singh (1999) reported that diverse product based complex Agroforestry system has been adopted in Jhum land of different NEH States.

In Nagaland, farmers have learned to exploit the Nitrogen fixing capacity of *Alnus nepaliensis* by including it in the Agroforestry farming system (Neil, 1984). Dhyani and Chauhan (1990) also reveals that the system comprising of *Alnus nepaliensis*, pineapples and P*anicum*

maximum or *Setaria sphacelata* could be sustainable and productive on the hilly terrain.

Singh and Pradhan (1993) reported that agriculture crops like *Zea mays* and *Glycine max* are cultivated in association with *Artocarpus heterophyllus* in Assam, Manipur and Tripura. *Zea mays* is also inter cropped between the spaces of Mandarin plants in Manipur and Meghalaya.

Singh and Pazo (1981) reported that under hortiolericulture system, vegetables like potato, cabbage and beans are cultivated on the apple orchard in Sikkim. In Silvi pastoral system of Meghalaya, *Bauhinia sp and Symingtonia populnea* + congo grass and broom grass are cultivated with the edible biomass productivity of 23.7 t ha/year with the carrying capacity of 25 – 35 goats (Singh and Satapathy, 1998).

Emphatic efforts were also made to develop Seri-culture – based Agroforestry system in Assam. In this system *Morus alba* was planted along with guava and a pair of rows of pineapple and grasses on buns. It is an ideal system for silk production and additional income can be obtained from pineapple and Guava (Dhyani *et.al*, 1996).

Significant efforts have also been made to synthesized different Agroforestry system for low to mid hills of this region by ICAR Research Complex for NEH in last 15 years (Anon, 1997). This includes Silvi pastoral system for high hill slope; Agrisilvicultural system, sericulture based horti-pastoral system and sericulture based agricultural system for 38 – 45 slope % and agri-horticulture 15 – 30% slope (Anon, 1999)

In Mizoram, Agriculture department has developed it's own "contour trench farming" for Jhum area (Anon, 1995) . In this model land use system, top portion was maintained under undisturbed forest, middle portion under horticulture and down the hill, terraced rice cultivation with contour trenches which arrest soil from going out of the system area. The

most common and successful practice in Mizoram is inter cropping of *Oryza sativa* with *Tectona grandis*. This system has been found to be economically and ecologically sound (Lalramnghinglova and Jha, 1996)

The importance of introducing bamboo in farming system has been suggested by Tewari (1992). Bamboo resources are considered as a highly valued potential crop for Agroforestry system with short gestation period and recurring returns (Singh, 2000). Shanmughaval and Francis (1995) suggested that the marginal lands and areas not used for agricultural crops can be brought under bamboo plantation.

Inter cropping of crops with bamboo is mainly practiced by farmers in the middle hill of Nepal. In this system, different varieties of bamboos are planted along with food crops such as wheat, maize and paddy. Inter cropping of bamboo and tea with *Aleurites* species is being done in Vietnam (FAO, 1996). In Bangladesh, wide variety of fruit bearing, timber or fuelwood producing trees species and bamboo is grown in homesteads (Khaleque, 1987; Abidin and Quddus, 1991) In Thailand, trees and bamboo are often planted around agricultural fields as a living fence (Makarobhirom, 1991)

Bamboo is considered to be most suitable species for Agroforestry models in degraded lands on Indian contexts.Bamboo based Agroforestry models have been developed successfully on degraded land viz. Bamboo soyabean, Bamboo-moong,Bamboo-mustard, Bamboo-wheat at Jabalpur district of Madhya Pradesh (Bipin Bihar *et.al.*,2000).

Seshadri (1985) reported that inter cropping of Soyabean with *Dendrocalamus strictus* with the application of P (0,100 and 200 Kg P2O5/ha) is technically feasible and economically viable during the first 6 years and can be extended further in wider spacing of the bamboo culms.

Bamboos are grown around the farm boundaries in agricultural land. Crops like Maize and Millet are grown only on 2-3 years of plantation, thereafter shade effects the growth and yield of the crops. However, crops such as ginger, turmeric and large cardamom grows well in association of bamboos(Dhyani and Chauhan, 1989; Singh *et.al,* 1992).

Forage crops *viz*, Orchard grass, GoldenTimothy grass, Dinanath grass and fine style gives the yields of 11.90; 43.00, 10.00 and 16.25 tones/ha respectively when grown under the shade of bamboos in the hills of Eastern Himalayas (Singh *et.al.*,1992).

Bamboo plays a role in maintaining and improving the nutrient status of the soil. Singh *et.al.*,(1989) reported that in a relatively poor soil, Bamboo efficiently make use of the available nutrients and builds up relatively fertile soil around the clumps.

Tripathi and Singh (1993) reported that compared to the herb zone, there is an increase in organic carbon content by 15 – 17 %, total nitrogen by 7–11%, Available phosphorus by 25-29%, and exchangeable Potassium by 20-35% at 0-30cm soil content in the Bamboo zone ranged of *Dendrocalamus strictus.*

Under *Dendrocalamus* Bamboo in North Vietnam, soil physical conditions was found to be exceptionally good (Young, 1989). The same genus has been reported as an good accumulator of Potassium (Toky and Ramakhrishnan, 1992). In shifting cultivation systems in N.E. India, bamboo plays an important role in nutrient accumulation (Ramakhrishnan, in Press).

The importance of nutrients in boasting the growth and biomass production have been studied to a great extent (Adamson *et. al.*, 1978; Qui and Maoyi, 1987; Shi *et. al.*, 1987).

Suwanapinunt and Thaiutsa (1990) reported the significant increase on the yields of culms and shoots of *Thyrrostachys siamensis*,

Dendrocalamus asper and *Dendrocalamus strictus* by the application of 100, 100 and 200 Kg /ha of NPK fertilizer respectively.

Fu *et.al.*,(1991) reported that application of compound fertilizer of N.P.K. and Si in furrows at 375 kg/ha gave a yield increase of about 7.9 t/ha of culms.

Jha *et.al.*,(2001) reported that application of NPK fertilizer with nitrogen as Urea (60 kg ha^{-1}), phosphorus as single super phosphate (30 kg ha^{-1}) and Potash as muriate of Potash (40 kg ha^{-1}) enhanced markedly the number of culms / clump and diameter growth of *Dendrocalamus strictus.*

Patil and Patil (1987) observed that application of 200 kg N, 100Kg P_2O_5 and 100 kg K_2O /ha Per year in *Dendrocalamus* at 572 days as compared to 5.9 in the unfertilized control. Veda (1960) observed increased in the culm production by *Leleba multiplex* as compared to non-fertilized plot. Suzuki and Narita (1975) also reported that the number of sprout from the fertilized plot was 1.7 – 1.9 times higher than that of the control.

Increase in the dry matter production due to fertilizer application has been observed by many workers (Anon, 1957, 1958). Hsieh (1970) observed significant increase in the yield of bamboo (*Sinocalamus latiflorus*) in response to combined application of N.P & K. Patil and Patil (1987) reported that the total dry matter production at 572 days after planting increased from 4.0 tonnes /ha in the unfertilized control to 12.5 tonnes / ha after fertilizer treatment (100kg N, 50kg P_2o_5 and 50 k_2O /ha /year).

Toky *et.al.*,(1988) suggested that application of 55P @ 10.00 gm and 20.0 gm / pot increases both the growth and dry matter yield of 5 month old bamboo seedlings. He further stated that application of

phosphorus, better growth in bamboo seedlings may be obtained in short duration and healthy plantation stock could be made available.

Thomas (1988) reported that N,P and K application can boost the growth and biomass production in *Bambusa arundinacea* seedlings. Among the three elements, N has been found to exert the greatest influence.

According to Uchimera (1980), cultural operation such as the application of fertilizer should be done about a month before the sprouting commences. The standard fertilizer used per hectare of bamboo forest is about 70 kg of phosphorus and 80 Kg of K.

The above review of literature on Bamboo species indicates that although voluminous amount of work has been carried out on this species elsewhere, less or no work has been undertaken to introduce Bamboo in the farming system. The present study which is intended only for a 1-year period therefore focus, on the growth behavoiur of two major Bamboo species as well as performance of agriculture crop under Bamboo-based agrof orestry system in Mizoram.

CHAPTER – III
DERSCRIPTION OF THE STUDY SITE, CLIMATE AND METHODOLOGY

DESCRIPTION OF SITE

1. LOCATION :

The present study is carried out at the North-West part of Zemabawk, called as "Paite Veng", about 6km East of Aizawl, capital city of Mizoram. the study site stood at a height of about 780 metre above the main sea-level. The total area demarcated for the study is 288 sq. Metre. (Fig – 1).

2. CLIMATIC PARAMETERS : -

The climate in the study site is warm during summer and winter is moderately cold and relatively dry. The annual precipitation ranges from 2144mm – 2828mm.The mean temperature during summer (May to September ranges from 10° to 21°C and 5° to 10°C during winter (November to February). The period between March to May is characterised by wind and storms and heavy rainfall occur during June – September. [Fig – 2]

3.SOIL CONDITION: -

The soil of the study site is clay-loam, reddish to Black in colour. The soil is acidic in nature with P^H of about 5.42. The soil moisture content was 16.6%. The soil has a low organic carbon content of 0.353%. Nitrogen content was 0.014%. Phosphorus content was relatively low of 17.4 kg/ha. Potassium content was 147.0 kg/ha (Table – 1).

4.VEGETATION COVER: -

The vegetation cover of the experimental site is by weed species *viz, Imperata cylindrica, Ageratum conyzoides, Mikenia scandence etc.* The weed species cause hazard on the growth of Bamboo species as well as soybean by creating competition for sunlight, moisture and nutrients.

Fig.1 Location Map of Experimental Site.

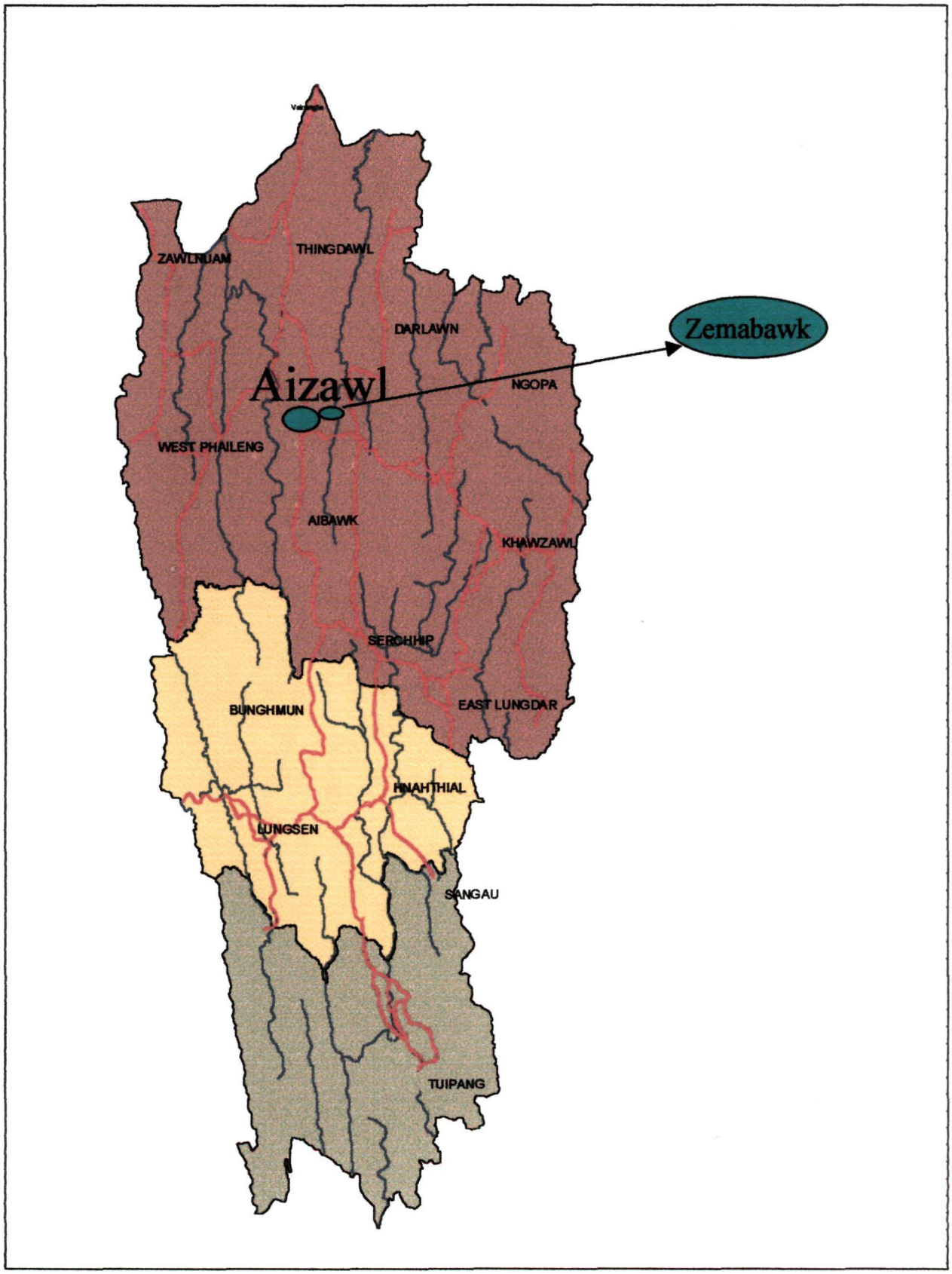
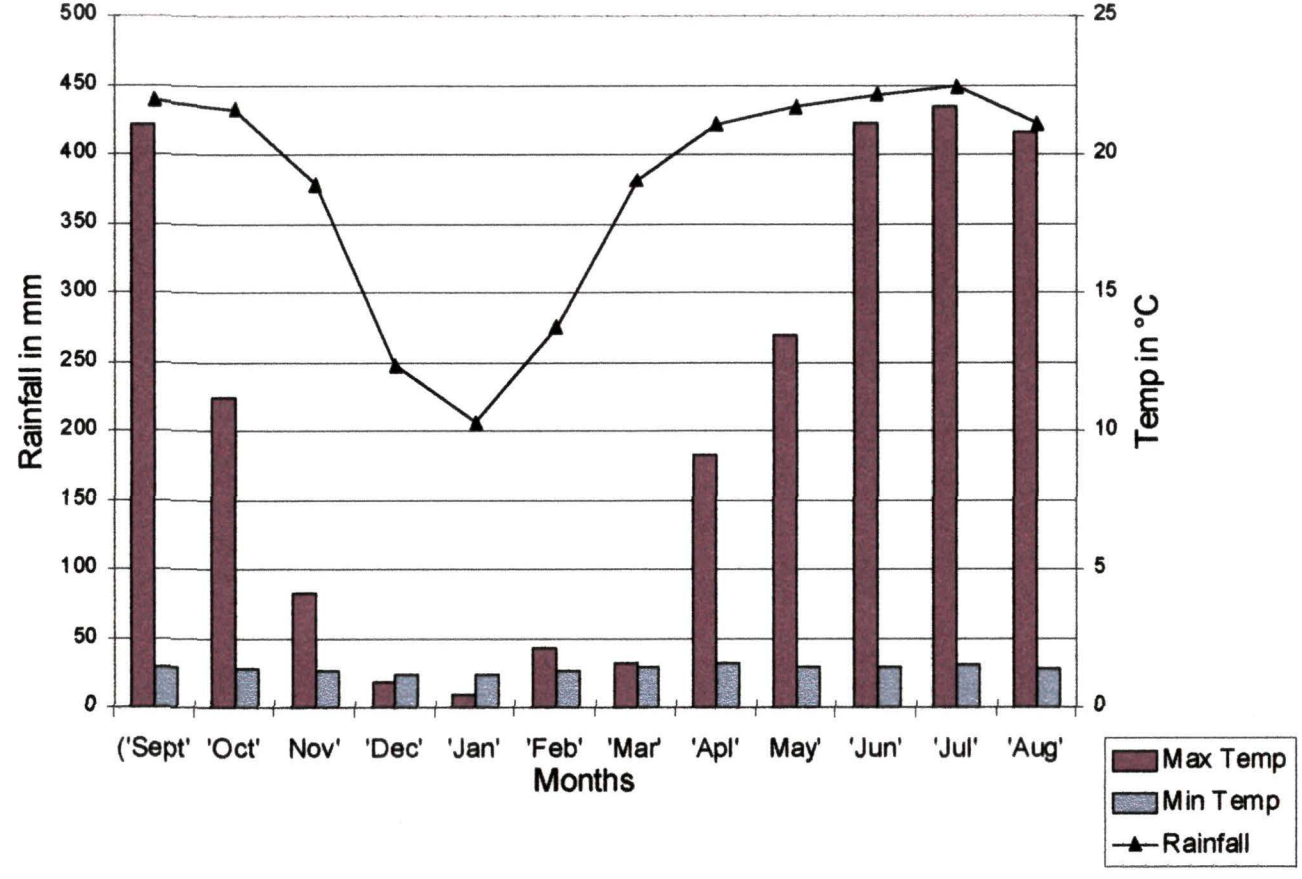


Fig. 2 Monthly records of meteorological data during the study period



SOIL CONDITIONS

Table - 1

SEASONS	SOIL pH	SOIL MOISTURE (%)	ORG. CARBON (%)	TOTAL NITROGEN (%)	AV P(kg/ha)	AV K(kg/ha)
Before Sowing	5.42	12.1	0.315	0.014	18.2	152.9
1-Month After Sowing	5.43	19.1	0.375	0.016	16.6	141.1
After Harvesting	5.41	18.6	0.369	0.013	17.4	147.0
Mean	5.42	16.6	0.353	0.014	17.4	147.0
S.E +m	0.004	1.84	0.015	0.00072	0.37	2.78

METHODOLOGY

The present study was conducted on one-year old Bamboo species of *Melocanna boccifera (Roxb)Nees* and *Dendrocalamus longispathus Kurz.* The layout follows the Randomizes Block Design (R.B.D) with two replicates having 16-subplots. Each replicate has the size of 144sq.mt. The size of each sub-plot is 6x3mt (18sq.mt). Distance between the consecutive sub-plot is 2 feet and between two replicates is 2 metre. The total area of the experimental plot was 288sq.mt.

Both the bamboo species are planted at 2x2 m and 3x3 m spacing. Fertilizer was applied in the form of Urea (@60gm / plant), Superphosphate (@40gm / plant) and Muriate of Potash (@40gm/plant) in three split doses at an intervals of three months. Four sub-plots in each replicates was restricted of fertilizer application. Soybean are sown around the bamboo species at 25x25cm spacing [Fig - 3]

Complete soil analysis was done at Department of Forestry NEHU, Aizawl at three different seasons *viz*, before sowing, one month after harvesting of crops. Soil nitrogen content was determined by Potassium-Permanganate method using Kjedahl digestion and Distillation method. Phosphorus content by Bray's No. 1. Method and potassium. Phosphorus content by Flame Photometer using Ammonium acetate Method (Normal). Organic carbon was determined by Walkey and Black Rapid Titration Method. Soil pH was measured by pH meter (Digital pH meter) and moisture content of the soil by the gravimetric methods using following formula : -

$$\text{Moisture (\%)} = \frac{FW-DW}{FW} \times 100$$

Where, FW= Fresh Weight

DW= Dry Weight

SAMPLING PROCEDURE :

The growth behavoiur of the selected bamboo species was studied from the month of September, 2000 to August, 2001. Growth parameters *viz*, height growth, number of leaves and number of culms was recorded at monthly interval. The data recorded from September, 99' to August, 2000 by the senior student was included in data presentation.

The data recorded was subjected to ANOVA (Analysis of variance) to see the monthly variation on the growth behaviour of the bamboo on a particular treatment. ANOVA was also used to compare the growth attributes under fertilized as well as unfertilized (control) plot. The data recorded on the yield of soybean during September 1999 to August was also included in the presentation.

FIELD LAYOUT

REPLICATION - 1

110	000	100	010
011	101	001	111

REPLICATION - 11

100	001	110	000
011	101	010	111

Fig 3 PLANOF LAYOUT OF THE EXPERIMENT

Design : RBD
Total Expermental Area: 288 Sq m.
Plot size : 6m x 3m

1.	Species:	*Dendrocalamus longispathus* (o)	*Melocanna baccifera* (1)
2.	Spacing:	2m (o)	3m (1)
3.	Fertilizers:	Without (o)	With (1)

CHAPTER – IV
RESULTS

RESULT

GROWTH PERFOMANCE OF *MELOCANNIA BACCIFERA*

1. HEIGHT GROWTH

Data recorded on height growth of *Melocanna baccifera* at monthly interval was found to differ significantly in all the treatments. Faster rate of growth was observed from the month of May to August. At the end of the experiment, maximum height of 230.85 cm was observed at 3 x 3 m fertilized plot (Table – 3), followed by 220.85cm at 3 x 3 m control unfertilized plot (Table – 4), 217.35 cm at 2 x 2 m fertilized plot (Table – 2) and 201.68 cm at 2 x 2 m control unfertilized plot (Table – 1).

There was no significant effect of fertilizer on the height growth. However mean height in case of fertilized plot was higher as compared to control plot. Accordingly, maximum (126.71 cm) average height was observed at 3 x 3 fertilized plot and least of 107.69 cm at 2 x 2 m control unfertilized plot (Table – 5)

2. NO. OF LEAVES

Maximum number of leaves (241.50) was observed under 2 x 2 m fertilized plot (Table-2) followed by 239.50 at 3 x 3 m fertilized plot (Table – 3), 235.75 at 2 x 2 m control unfertilized plot (Table – 1) and minimum of 219.5 at 3 x 3 m control unfertilized plot (Table – 4)

Monthly variation on the number of leaves emerged differ significant in all the treatments. Maximum leave emergence was found from the month of May to August.

Application of fertilizer does not have any influence on the leaves emergence. However, higher number of leaves was recorded under fertilized plot (Table – 5).

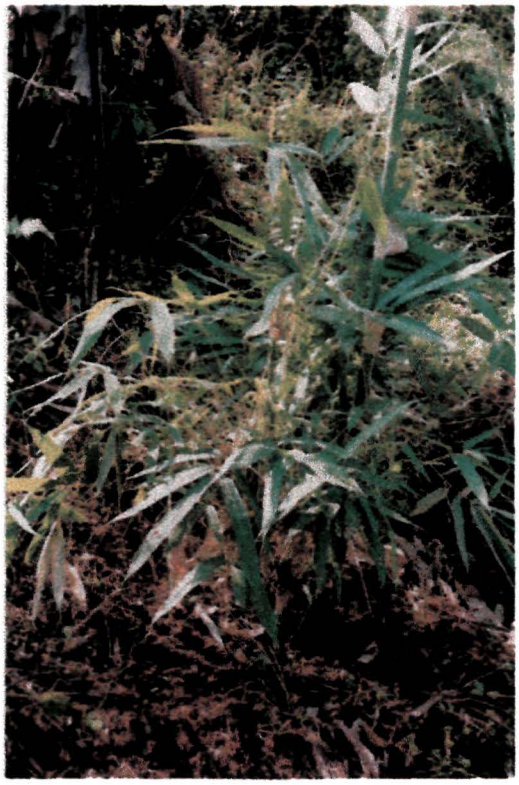


Plate No. 1: *Melocanna baccifera* under fertilized plot

Plate No. 2 *Melocanna baccifera* under control plot

Plate No. 3: *Dendrocalamus longispathus* under fertilized plot

Plate No. 4: *Dendrocalamus longispathus* under control plot

3. NUMBER OF CULMS

The results depicts application of NPK fertilizer has no desirable influence on the culms emergence of *Melocanna baccifera*. Accordingly higher number of culm was recorded at 3 x 3 m control unfertilized plot (1.28) and the least (0.87) at 2 x 2 m fertilized plot (Table – 6).

TABLE 1 : MONTHLY VARIATION IN PLANT HEIGHT (cm) AND NUMBER OF LEAVES OF *MELOCANNA BACCIFERA* AT 2 X 2 M CONTROL PLOT

MONTH	MEAN HEIGHT (cm)	NUMBER OF LEAVES
SEPTEMBER'99	18.5	2.50
OCTOBER	25.45	7.00
NOVEMBER	29.75	9.00
DECEMBER	38.50	11.50
JANUARY'00	45.50	14.50
FEBRUARY	51.25	16.00
MARCH	60.7	17.50
APRIL	71.35	20.50
MAY	76.40	21.00
JUNE	90.15	27.00
JULY	106.2	33.50
AUGUST	123.05	42.00
SEPTEMBER	126.95	53.50
OCTOBER	130.45	70.50
NOVEMBER	134.1	78.25
DECEMBER	137.78	81.50
JANUARY'01	140.73	85.00
FEBRUARY	145.93	89.00
MARCH	152.4	100.50
APRIL	158.3	115.25
MAY	163.4	135.50
JUNE	173.28	160.50
JULY	185.86	191.00
AUGUST	201.68	235.75
S.E ±	5.57	7.69
C.D AT 5 %	11.53	15.91

I – A ANALYSIS OF VARIANCE OF PLANT HEIGHT AS AFFECTED BY VARIATION IN REPLICATION AND MONTH

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	1462.47	1462.47	47.03**	4.2793
MONTH	23	139277.36	6055.53	194.77**	2.0050
ERROR	23	715.14	31.09		
TOTAL	47				

** SIGNIFICANT AT 5%

I – B ANALYSIS OF VARIANCE OF NUMBER OF LEAVES AS AFFECTED BY VARIATION IN REPLICATION AND MONTHS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	740.26	740.26	12.50**	4.2793
MONTH	23	183419.625	7974.76	134.77**	2.0050
ERROR	23	1361.11	59.17		
TOTAL	47				

** SIGNIFICANT AT 5%

TABLE – 2 : MONTHLY VARIATION IN PLANT HEIGHT (cm) AND NUMBER OF LEAVES OF *MELOCANNA BACCIFERA* AT 2 X2 M FERTILIZED PLOT.

MONTH	MEAN HEIGHT (cm)	NUMBER OF LEAVES
SEPTEMBER '99	15.45	2.50
OCTOBER	24.10	5.50
NOVEMBER	33.20	5.50
DECEMBER	43.65	7.50
JANUARY'00	51.35	13.00
FEBRUARY	64.55	17.50
MARCH	74.30	23.00
APRIL	82.55	27.00
MAY	88.90	31.00
JUNE	104.85	42.50
JULY	119.45	50.50
AUGUST	128.45	59.00
SEPTEMBER	132.35	71.00
OCTOBER	138.00	79.75
NOVEMBER	140.85	83.00
DECEMBER	144.12	85.75
JANUARY'01	136.6	88.75
FEBRUARY	149.45	92.00
MARCH	152.67	106.50
APRIL	157.0	123.50
MAY	167.85	139.540
JUNE	181.82	164.00
JULY	199.55	198.25
AUGUST	217.35	241.50
S.E ±	4.19	16.13
C.D AT 5 %	8.66	33.37

2 – A ANALYSIS OF VARIANCE OF PLANT HEIGHT AS AFFECTED BY VARIATION IN REPLICATION AND MONTHS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	653.794	653.794	37.23**	4.2793
MONTH	23	145721.99	6335.738	360.82**	2.0050
ERROR	23	403.87	17.559		
TOTAL	47				

** SIGNIFICANT AT 5%

2 – B ANALYSIS OF VARIANCE OF NUMBER OF LEAVES AS AFFECTED BY VARIATION IN REPLICATION AND MONTHS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	3588.02	3588.02	13.78**	4.2793
MONTH	23	188882	8212.26	31.55**	2.0050
ERROR	23	5986.48	260.28		
TOTAL	47				

** SIGNIFICANT AT 5%

TABLE – 3 : MONTHLY VARIATION IN PLANT HEIGHT (cm) AND NUMBER OF LEAVES OF *MELOCANNA BACCIFERA* AT 3 X 3 M FERTILIZED PLOT

MONTH	MEAN HEIGHT (cm)	NUMBER OF LEAVES
SEPTEMBER '99	19.75	1.50
OCTOBER	27.35	3.50
NOVEMBER	34.50	5.50
DECEMBER	40.70	9.00
JANUARY'00	50.8	11.50
FEBRUARY	62.7	15.00
MARCH	71.8	17.00
APRIL	80.7	19.00
MAY	98.05	22.50
JUNE	118.05	29.50
JULY	135.2	35.50
AUGUST	149.6	42.50
SEPTEMBER	154.0	52.00
OCTOBER	157.85	65.50
NOVEMBER	160.3	78.50
DECEMBER	161.65	88.25
JANUARY'01	163.8	94.50
FEBRUARY	167.4	102.75
MARCH	169.45	114.75
APRIL	173.4	128.25
MAY	181.25	147.50
JUNE	196.9	173.50
JULY	207.8	200.50
AUGUST	230.85	239.50
S.E ±	4.43	8.01
C.D AT 5 %	9.165	16.58

3 – A ANALYSIS OF VARIANCE OF PLANT HEIGHT AS AFFECTED BY VARIATION IN REPLICATION AND MONTHS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	644.60	644.60	32.80**	4.2793
MONTH	23	180180.05	7833.91	398.69**	2.0050
ERROR	23	451.94	19.64		
TOTAL	47				

** SIGNIFICANT AT 5%

3 – B ANALYSIS OF VARIANCE OF NUMBER OF LEAVES AS AFFECTED BY VARIATION IN REPLICATION AND MONTHS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	513.52	513.52	7.9**	4.2793
MONTH	23	209960.48	9128.71	142.12**	2.0050
ERROR	23	1477.48	64.23		
TOTAL	47				

** SIGNIFICANT AT 5%

TABLE – 4 : MONTHLY VARIATION IN PLANT HEIGHT (cm) AND NUMBER OF LEAVES OF *MELOCANNA BACCIFERA* AT 3 X 3 m FERTILIZED PLOT

MONTH	MEAN HEIGHT (cm)	NUMBER OF LEAVES
SEPTEMBER '99	14.8	3.0
OCTOBER	18.85	6.0
NOVEMBER	21.0	9.0
DECEMBER	24.75	13.0
JANUARY'00	27.95	15.5
FEBRUARY	36.85	16.5
MARCH	44.65	22.0
APRIL	54.45	28.5
MAY	67.25	36.5
JUNE	95.7	45.5
JULY	116.3	54.5
AUGUST	132.45	63.5
SEPTEMBER	140.7	70.5
OCTOBER	147.42	80.0
NOVEMBER	151.5	87.5
DECEMBER	154.75	92.0
JANUARY'01	157.05	94.5
FEBRUARY	162.15	99.75
MARCH	166.3	108.5
APRIL	172.3	122.0
MAY	181.2	142.0
JUNE	190.3	163.0
JULY	200.85	189.0
AUGUST	220.85	219.50
S.E ±	3.98	6.42
C.D AT 5 %	8.24	13.29

4 – 'A' ANALYSIS OF VARIANCE OF PLANT HEIGHT AS AFFECTED BY VARIATION IN REPLICATION AND MONTHS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	326.30	326.30	20.53**	4.2793
MONTH	23	209069.10	9089.96	572.05**	2.0050
ERROR	23	365.58	15.89		
TOTAL	47				

** SIGNIFICANT AT 5%

4 – B ANALYSIS OF VARIANCE OF NUMBER OF LEAVES AS AFFECTED BY VARIATION IN REPLICATION AND MONTHS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	3969.42	3969.42	96.08**	4.2793
MONTH	23	167787.37	7295.10	176.53**	2.0050
ERROR	23	950.20	41.31		
TOTAL	47				

** SIGNIFICANT AT 5%

TABLE – 5 : VARIATION IN PLANT HEIGHT (cm) AND NUMBER OF LEAVES OF *MELOCANNA BACCIFERA* UNDER DIFFERENT TREATMENT

TREATMENT	MEAN HEIGHT (cm) [a]	NUMBER OF LEAVES [a]
T_1 (2 X 2 M FERTILIZED PLOT)	114.94	72.96
T_2 (2 X 2 M CONTROL UNFERTILIZED)	107.69	67.42
T_3 (3 X 3 M FERTILIZED PLOT)	125.57	70.72
T_4 (3 X 3 M CONTROL UNFERTILIZED)	112.51	74.23
SE ±	5.99	11.20
C.D. AT 5 %	19.06	35.65

a = Average of 24 months

5 – 'A' ANALYSIS OF VARIANCE OF PLANT HEIGHT AS AFFECTED BY VARIATION IN REPLICATION AND TREATMENTS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	10.39	10.39	0.26^{NS}	10.128
MONTH	23	342.53	114.17	2.95^{NS}	9.28
ERROR	23	115.75	38.58		
TOTAL	47				

NS = NON SIGNIFICANT

5 – 'B' ANALYSIS OF VARIANCE OF NUMBER OF LEAVES AS AFFECTED BY VARIATION IN REPLICATION AND TREATMENTS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	0.33	0.33	0.0026^{NS}	10.128
MONTH	23	53.45	17.81	0.14^{NS}	9.28
ERROR	23	376.68	125.56		
TOTAL	47				

NS = NON SIGNIFICANT

TABLE – 6 : VARIATION OF CULMS IN *MELOCANNA BACCIFERA* UNDER DIFFERENT PLANT TREATMENT CONDITION

TREATMENT	No. OF CULMS[a]
T_1 (2 X 2 M FERTILIZED PLOT)	0.83
T_2 (2 X 2 M CONTROL UNFERTILIZED)	0.97
T_3 (3 X 3 M FERTILIZED PLOT)	0.99
T_4 (3 X 3 M CONTROL UNFERTILIZED)	1.28
SE ±	0.28
C.D. AT 5 %	0.92

a = Average of 24 months

6 – 'A' ANALYSIS OF VARIANCE OF NUMBER OF CULMS AS AFFECTED BY VARIATON IN REPLICATION AND TREATMENTS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	0.0384	0.0384	0.457^{NS}	10.128
TREATMENT	3	0.21855	0.07285	0.86^{NS}	9.28
ERROR	3	0.252	0.084		
TOTAL	7				

NS = NON SIGNIFICANT

GROWTH PERFOMANCE OF *DENDROCALAMUS LONGISPATHUS*

1. HEIGHT GROWTH

The monthly variation in plant growth of D*endrocalamus longispathus* differ significantly in all the treatments. The rate of growth in height increases with the increase in time period. It is evident that maximum height (273.845 cm) was found in 3 x 3 m fertilized plot (Table – 10), followed by 262.72 cm in 2 x 2 m fertilized plot (Table-8), 220.15 cm at 2 x 2 m control unfertilized plot (Table – 7) and 216.05 cm at 3 x 3 m control unfertilized plot (Table-9).

Application of NPK fertilizer has been found to enhance the rate of height growth in *Dendrocalamus longispathus*. Accordingly, maximum average height (142.50 cm) was found in 3 x 3 m fertilized plot and least at 3 x 3 m control unfertilized plot (Table-11). Height difference between fertilized and control plot was 13.37 cm at 2 x 2 m and 34.23 cm at 3 x 3m spacing.

2. NO. OF LEAVES

The monthly variation on the number of leaves emerged was found to differ significantly in each treatment. Maximum number of leaves (278.50) was observed at 3 x 3m fertilized plot (Table – 10) followed by 254.50 at 2 x 2 m fertilized plot (Table- 8), 214.75 at 2 x 2 m control unfertilized plot (Table-7)and 195 at 3 x 3 m fertilized plot (Table – 9).

There was no significant variation in leaves emergence as the result of fertilizer application accordingly, influence of fertilizer was found in-significant for fertilized plot as compared to control unfertilized plot. However higher number of leaves was recorded under fertilized plot (Table- 11)

3. **NUMBER OF CULMS**

Fertilizer application have been found to influence the emergence of culms in *Dendrocalamus longipathus*. Subsequently, comparatively higher number of culms was observed under fertilized plot. The maximum (1.035) number of culms was found in 3 x 3m fertilized plot and least (0.705) Culms in 2 x 2 m control and 3 x 3 m control plot respectively (Table – 12)

TABLE – 7 : MONTHLY VARIATION IN PLANT HEIGHT (cm) AND NUMBER OF LEAVES IN *DENDROCALAMUS LONGISPATHUS* AT 2 X 2M CONTROL PLOT

MONTH	MEAN HEIGHT (cm)	NUMBER OF LEAVES
SEPTEMBER '99	14.75	1.50
OCTOBER	21.40	3.50
NOVEMBER	30.55	6.00
DECEMBER	40.75	8.50
JANUARY '00	48.85	10.00
FEBRUARY	56.65	13.50
MARCH	65.65	16.00
APRIL	76.35	19.00
MAY	89.75	20.50
JUNE	104.75	24.50
JULY	125.75	29.00
AUGUST	153.45	32.00
SEPTEMBER	158.30	40.50
OCTOBER	163.47	53.00
NOVEMBER	167.95	58.50
DECEMBER	171.80	67.50
JANUARY '01	174.80	78.25
FEBRUARY	178.80	88.50
MARCH	185.15	102.00
APRIL	188.60	114.75
MAY	197.40	137.25
JUNE	206.50	163.25
JULY	214.10	192.0
AUGUST	220.15	214.75
S.E ±	6.96	10.30
C.D AT 5 %	14.41	21.31

7– 'A' ANALYSIS OF VARIANCE OF PLANT HEIGHT AS AFFECTED BY VARIATION IN REPLICATION AND MONTHS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	512.54	512.54	10.55**	4.2793
MONTH	23	212276.1525	9229.39	19.0116**	2.0050
ERROR	23	1116.56	48.54		
TOTAL	47				

** SIGNIFICANT AT 5%

7 – B : ANALYSIS OF VARIANCE OF NUMBER OF LEAVES AS AFFECTED BY VARIATION IN REPLICATION AND MONTHS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	550.13	550.13	5.18**	4.2793
MONTH	23	178598.37	7765.14	74.59**	2.0050
ERROR	23	2440.5	106.10		
TOTAL	47				

** SIGNIFICANT AT 5%

TABLE – 8 : MONTHLY VARIATION IN PLANT HEIGHT (cm) AND NUMBER OF LEAVES OF *DENDROCALAMUS LONGISPATHUS* AT 2 X 2 M FERTILIZED PLOT

MONTH	MEAN HEIGHT (cm)	NUMBER OF LEAVES
SEPTEMBER '99	16.3	0.5
OCTOBER	25.25	2.50
NOVEMBER	31.40	4.50
DECEMBER	45.85	5.50
JANUARY '00	59.65	8.00
FEBRUARY	70.05	9.50
MARCH	79.3	11.00
APRIL	87.35	12.50
MAY	100.55	15.50
JUNE	115.70	21.00
JULY	138.65	27.50
AUGUST	161.05	35.50
SEPTEMBER	168.85	45.00
OCTOBER	173.25	57.75
NOVEMBER	178.75	67.00
DECEMBER	181.90	75.50
JANUARY '01	186.25	83.25
FEBRUARY	190.25	92.50
MARCH	198.65	106.50
APRIL	207.45	119.50
MAY	218.20	146.75
JUNE	232.20	173.75
JULY	246.95	198.00
AUGUST	262.72	254.50
S.E ±	6.51	7.02
C.D AT 5 %	13.46	14.54

8 – 'A' ANALYSIS OF VARIANCE OF PLANT HEIGHT AS AFFECTED BY VARIATION IN REPLICATION AND MONTHS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	7.96	7.96	0.18^{NS}	4.2793
MONTH	23	256955.45	11171.97	263.60**	2.0050
ERROR	23	974.94	42.38		
TOTAL	47				

NS = NON SIGNIFICANT
** SIGNIFICANT AT 5%

8 – B ANALYSIS OF VARIANCE OF NUMBER OF LEAVES AS AFFECTED BY VARIATION IN REPLICATION AND MONTHS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	270.75	270.75	5.48**	4.2793
MONTH	23	224762.32	9772.27	197.81**	2.0050
ERROR	23	1136.25	49.40		
TOTAL	47				

** SIGNIFICANT AT 5%

TABLE – 9 : MONTHLY VARIATION IN PLANT HEIGHT (cm) AND NUMBER OF LEAVES *OF DENDROCALAMUS LONGISPATHUS* AT 3 X 3 M CONTROL PLOT.

MONTH	MEAN HEIGHT (cm)	NUMBER OF LEAVES
SEPTEMBER '99	17.9	1.50
OCTOBER	30.4	4.0
NOVEMBER	35.7	6.50
DECEMBER	41.85	9.50
JANUARY '00	46.30	12.50
FEBRUARY	51.05	14.50
MARCH	56.3	18.00
APRIL	63.85	22.50
MAY	74.20	25.50
JUNE	95.70	33.50
JULY	113.05	39.00
AUGUST	129.10	45.50
SEPTEMBER	139.25	49.00
OCTOBER	151.66	56.00
NOVEMBER	159.60	66.50
DECEMBER	162.75	74.00
JANUARY '01	165.65	78.00
FEBRUARY	167.50	83.50
MARCH	170.35	94.00
APRIL	174.15	107.75
MAY	181.00	124.00
JUNE	192.70	143.50
JULY	202.45	167.50
AUGUST	216.05	195.50
S.E ±	14.769	16.06
C.D AT 5 %	30.557	33.24

9 – 'A' ANALYSIS OF VARIANCE OF PLANT HEIGHT AS AFFECTED BY VARIATION IN REPLICATION AND MONTHS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	3040.40	3040.40	13.93**	4.2793
MONTH	23	182832.71	7949.24	36.44**	2.0050
ERROR	23	5017.24	218.14		
TOTAL	47				

NS = NON SIGNIFICANT
** SIGNIFICANT AT 5%

9 – B ANALYSIS OF VARIANCE OF NUMBER OF LEAVES AS AFFECTED BY VARIATION IN REPLICATION AND MONTHS

S.V	Df	SS	MSS	F - RATIO	F - VALUES AT 5%
REPLICATION	1	10.08	10.08	0.89^{NS}	4.2793
MONTH	23	135345.92	5884.60	524.47**	2.0050
ERROR	23	258.17	11.22		
TOTAL	47				

NS = NON SIGNIFICANT
** SIGNIFICANT AT 5%

TABLE 10 : MONTHLY VARIATION IN PLANT HEIGHT (cm) AND NO. OF LEAVES IN *DENDROCALAMUS LONGISPATHUS* at 3x3 m FERTILIZED PLOT.

MONTH	MEAN HEIGHT	NO. OF LEAVES
September '99	17.25	2.50
October	25.25	4.50
November	37.35	6.50
December	47.60	7.50
January 2000	56.25	9.50
February	66.15	11.50
March	75.00	13.50
April	82.30	16.00
May	91.45	18.00
June	112.55	23.00
July	137.90	26.00
August	161.45	33.50
September	167.85	40.00
October	176.30	47.50
November	179.67	56.75
December	184.05	67.25
January 20001	189.70	81.50
February	194.95	99.50
March	199.45	120.75
April	213.80	145.50
May	230.05	174.0
June	243.00	205.75
July	257.00	239.50
August	273.845	278.50
	6.88	28.07
C.D at 5%	14.235	58.07

10. A. : ANALYSIS OF VARIANCE OF PLANT HEIGHT AS AFFECTED BY VARIATION IN REPLICATION AND MONTH

S V	DF	SS	MSS	FRATIO	F VALUE AT 5%
REPLICATION	1	11.86	11.86	0.24^{NS}	4.2793
MONTH	23	282311.98	12274.43	258.65**	2.0050
ERROR	23	1091.45	47.45		
TOTAL	47				

NS: Non-Significant
**** : Significant at 5%**

10. B. ANALYSIS OF VARIANCE OF NUMBER OF LEAVES AS AFFECTED BY VARIATION IN REPLICATION AND MONTH

S V	DF	SS	MSS	FRATIO	F VALUE AT 5%
REPLICATION	1	6188.02	6188.02	7.8 **	4.2793
MONTH	23	300746.48	13075.93	16.59 **	2.0050
ERROR	23	18122.48	787.93		
TOTAL	47				

**** : Significant at 5%**

TABLE 11 : VARIATION IN PLANT HEIGHT (CM) AND NO. OF LEAVES IN *DENDROCALAMUS LONGISPATHUS* UNDER DIFFERENT TREATMENT CONDITIONS

TREATMENTS	MEAN HEIGHT [a]	NO. OF LEAVES [a]
T_1 (2X2m FERTILIZED PLOT)	140.68	65.55
T_2 (2X2m CONTROL UNFERTILIZED PLOT)	127.31	62.25
T_3 (3X3m FERTILIZED PLOT)	142.50	72.01
T_4 (3X3m CONTROL UNFERTILIZED PLOT)	118.27	61.33
S.E.±	5.31	6.78
C.D. AT 5%	16.92	21.58

a = Average of 24 months

11. A. ANALYSIS OF VARIANCE OF PLANT HEIGHT AS AFFECTED BY VARIATION IN REPLICATION AND TREATMENT

S V	DF	SS	MSS	FRATIO	F VALUE AT 5%
REPLICATION	1	64.01	64.01	2.26^{NS}	10.128
MONTH	3	792.19	264.06	9.33 **	9.28
ERROR	3	84.85	28.28		
TOTAL	7				

**** : Significant at 5% ; NS = Non- Significant**

11. B. ANALYSIS OF VARIANCE OF NUMBER OF LEAVES AS AFFECTED BY VARIATION IN REPLICATION AND TREATMENT

S V	DF	SS	MSS	FRATIO	F VALUE AT 5%
REPLICATION	1	154.44	154.44	3.35^{NS}	10.128
MONTH	3	140.38	46.79	1.01^{NS}	9.28
ERROR	3	138.05	46.01		
TOTAL	7				

N.S. = NON SIGNIFICANT

TABLE 12: NUMBER OF CULMS IN *DENDROCALAMUS LONGISPATHUS* UNDER DIFFERENT PLANT CONDITIONS

TREATMENTS	NO. OF CULMS [a]
T_1 (2X2m FERTILIZED PLOT)	1.015
T_2 (2X2m CONTROL UNFERTILIZED PLOT)	0.705
T_3 (3X3m FERTILIZED PLOT)	1.035
T_4 (3X3m CONTROL UNFERTILIZED PLOT)	0.705
S.E.±	0.084
C.D. AT 5%	0.268

a = Average of 24 months

ANALYSIS OF VARIANCE OF NUMBER OF CULMS AS AFFECTED BY VARIATION IN REPLICATION AND TREATMENT

S V	DF	SS	MSS	FRATIO	F VALUE AT 5%
REPLICATION	1	0.08	0.08	11.267**	10.128
MONTH	3	0.2052	0.0684	9.63**	9.28
ERROR	3	0.0214	0.0071		
TOTAL	7				

** SIGNIFICANT AT 5 %

YIELD OF SOYABEAN

A. Melocanna baccifera + Soyabean.

There was no significant variation in the yield of Soybean (Kg/ha) between fertilized plot and control plot. Higher yield (2284.37kg/ha) was however harvested under fertilized plot, where as the yield of soybean was 2061.37 kg/ha under control plot (Table – 13)

B. Dendrocalamus longispathus + Soyabean.

The yield of Soyabean was higher in the fertilized plot as compared with the control plot. The yield of Soyabean under fertilized plot was 2231.37 kg/ha, where as yield of 2069.0 kg/ha was harvested in control plot. However, effect of fertilizer was not significant. Thus there was no significant variation between the treatments (Table – 14)

TABLE 13 : YIELD OF SOYABEAN (kg/ha) UNDER EACH TREATMENT COMBINATION WITH *MELOCANNA BACCIFERA*

TREATMENTS	MEAN YIELD (kg/ha)
T_1 FERTILIZED	2284.375
T_2 CONTROL	2061.375
S.E.±	37.24
C.D. AT 5%	NS

TABLE 14 : YIELD OF SOYABEAN (kg/ha) UNDER EACH TREATMENT COMBINATION WITH *DENDROCALAMUS LONGISPATHUS.*

TREATMENTS	MEAN YIELD (kg/ha)
T_1 FERTILIZED	2231.375
T_2 CONTROL	2069.0
S.E.±	70.22
C.D. AT 5%	NS

CHAPTER – V
DISCUSSION

DISCUSSION

The present study which aims at evaluating the growth performance of bamboo species along with the crop shows a substantial variation in growth from month to month. Climatic factors particularly rainfall seems to plays an important role in influencing the growth of bamboo species consequently, the rate of growth in bamboo species was slower from the month of November to April where minimum rainfall was received during the experimentation year. The rate of growth becomes faster from the month of May to August where appreciable amount of rainfall was received [Fig - 4-7]

Thus, soil moisture availability seems to plays a crucial role in influencing the growth activity of the bamboo species. This finding are in accord with a findings of Kondas (1981) who reported that the periodicity of rhizome activity of Indian bamboo fall in June to August. Banik (1988) who also observed that culm emergence in 5 bamboo species took place from May to October with maximum intensity in July. Maximum number of culms emergence was reported during July in *Dendrocalamus longispathus* and August is *Melocanna baccifera* (Banik, 1993).

Improvement in growth behaviour of bamboo species have been recorded by the application of NPK fertilizer over control. NPK fertilizer application significantly influenced the high growth in *Dendrocalamus* [Fig. 9]. Similarly Patil and Patil (1987) observed that application of the fertilizer in *Dendrocalamus strictus* enhanced the height growth as compared to control plot. Lakshamana (1987) also reported with the application of 0.5kg of 15;15;15NPK/clump, the average rate of growth in *Bambusa arundinacea* was higher as compared to the control plot . However, fertilizer application failed to gave response for height growth in *Melocanna* and *baccifiera* [Fig. 8]

Leaves emergence seems to be effected by the soil moisture availability than fertilizer application. consequently, variability in number of leaves emerged was highest during the month of August where maximum rainfall was received. The results on number of leaves shows no significant variation between fertilizer and control in both the bamboo species [Fig. 4-7]

Average number of culms was higher under fertilized plot in *Dendrocalamus longispathus*, which differs significantly on comparison to control plot [Fig. 9]. This may be due to application of fertilizer (NPK). The present results is in accordance with the findings of Patil and Patil (1987) who recorded higher number of culms in *Dendrocalamus strictus* with the application of synthetic fertilizer. Ferrer (1949) also observed higher number of new shoots of bamboo in fertilized clump than in the control. In *Melocanna baccifera*, fertilizer application failed to gave response for the culm emergence. Accordingly, average number of culm was higher in unfertilized plot [Fig. 8]

Better yield of soyabean was obtained in fertilized plot in both the bamboo species. In *Dendroclamus longispathus*, the mean yield of 2231.375 kg/ha was obtained in fertilizer though there was no remarkable increase in the yield of soyabean. [Fig. 10-11]

Although it was not possible to know exactly how nutrients were utilized/uptake by plants, but there are certain indications that application of fertilizer can enhanced the growth of bamboo species and the yield of soyabean.

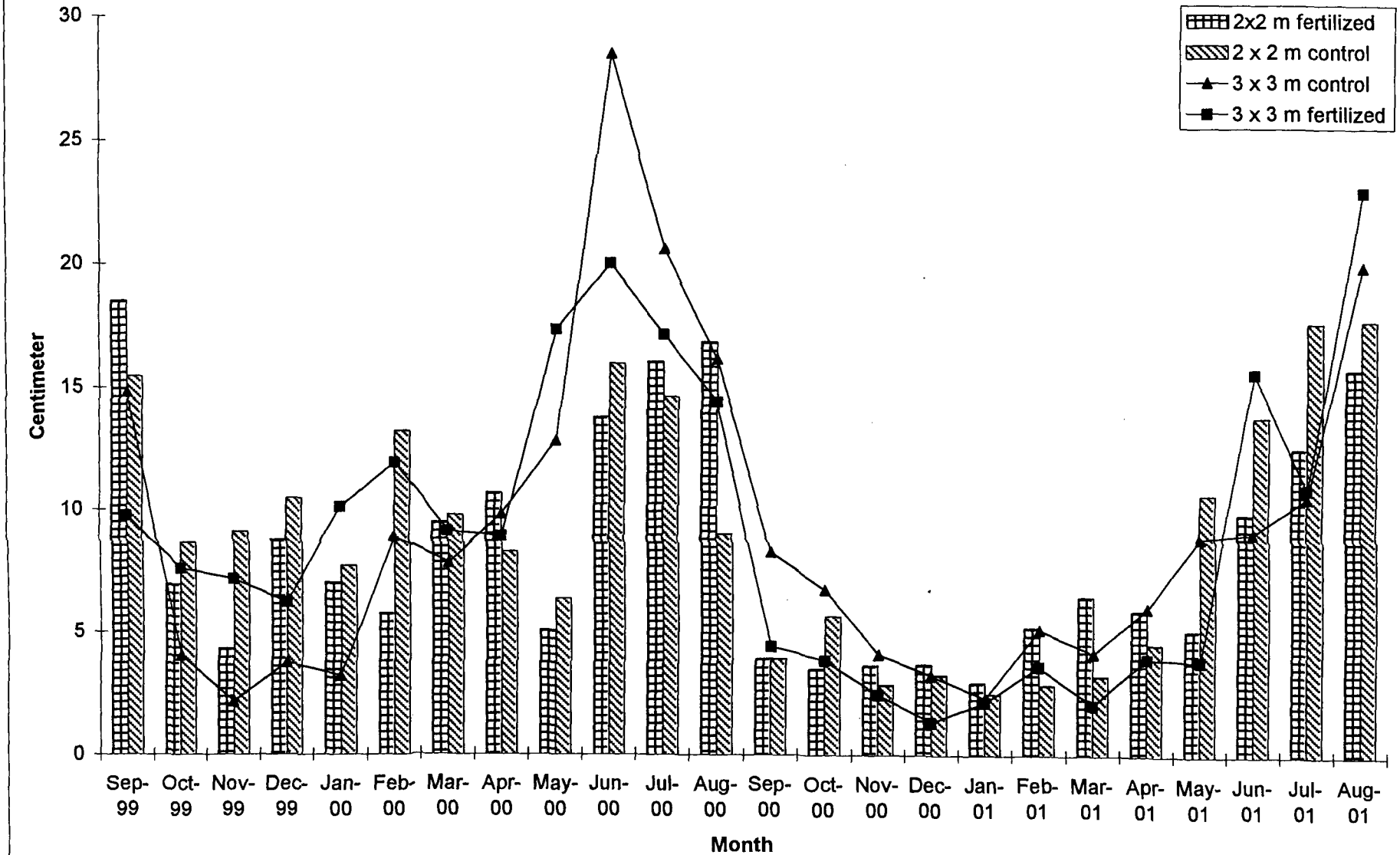

2x2 m fertilized
2 x 2 m control
3 x 3 m control
3 x 3 m fertilized
Centimeter
30
25
20
15
10
5
0
Sep-99
Oct-99
Nov-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
May-00
Jun-00
Jul-00
Aug-00
Sep-00
Oct-00
Nov-00
Dec-00
Jan-01
Feb-01
Mar-01
Apr-01
May-01
Jun-01
Jul-01
Aug-01
Month

Figure 5 **Monthly Variation in No. of Leaves of** *Melocanna Baccifera* **at 2 x 2 m & 3 x 3 m spacing**

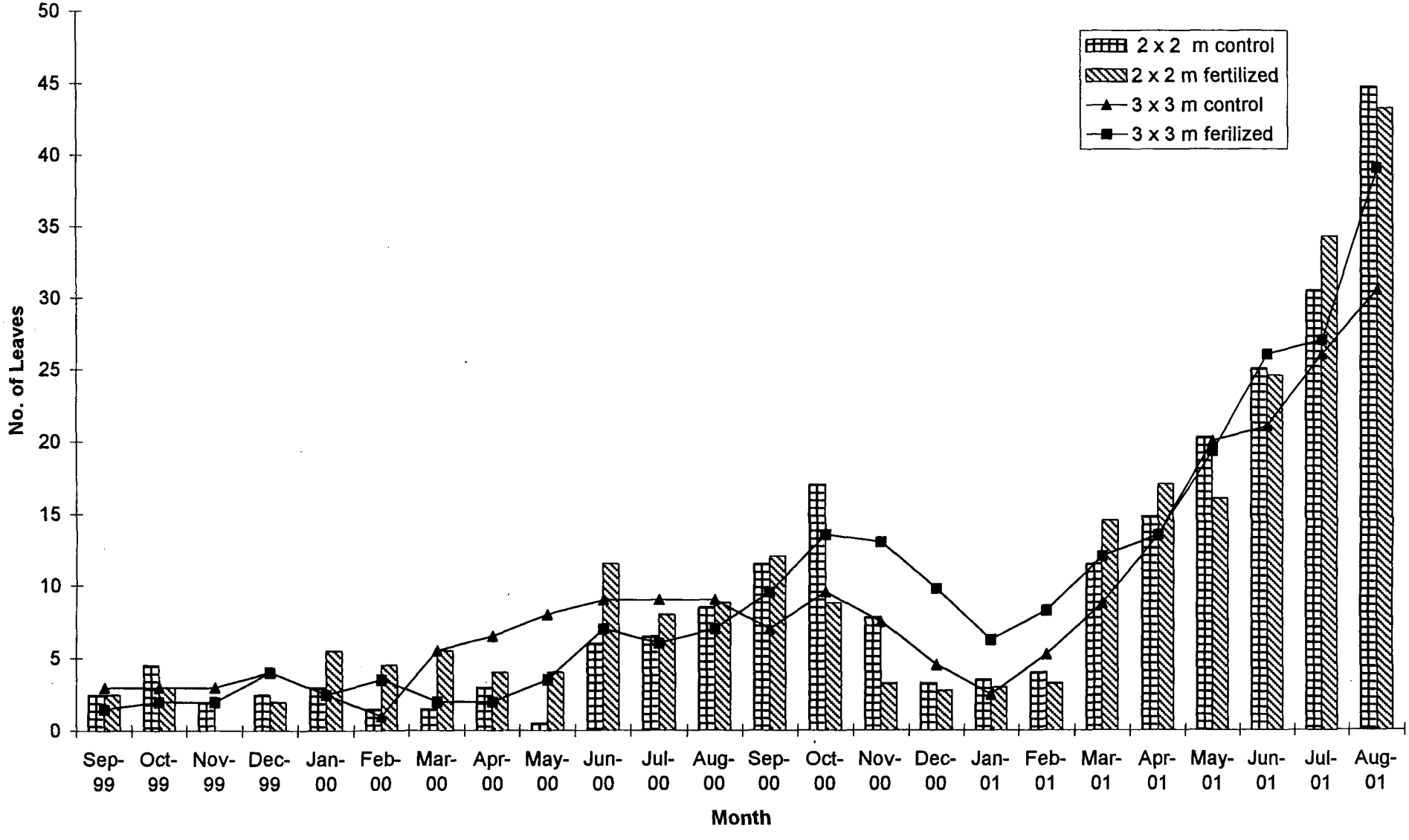


Figure 6 Monthly Variation in height Growth of *Dendrocalamus Longispathus* at 2 x 2 m & 3 x 3 m spacing

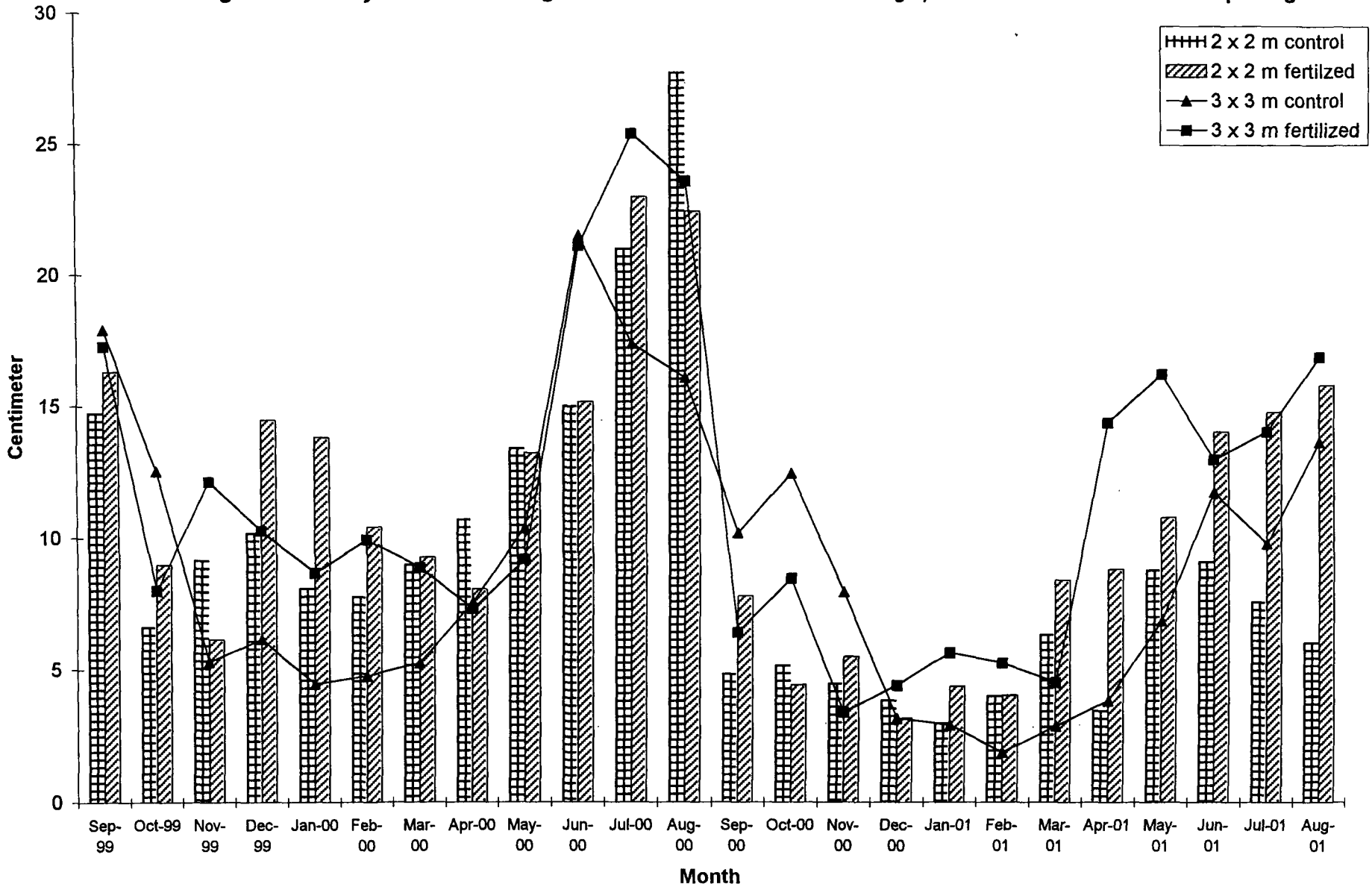


Figure 7 **Monthly Variation in No of Leaves of *Dendrocalamus Longispathus* at 2 x 2 m & 3 x 3 m spacing**

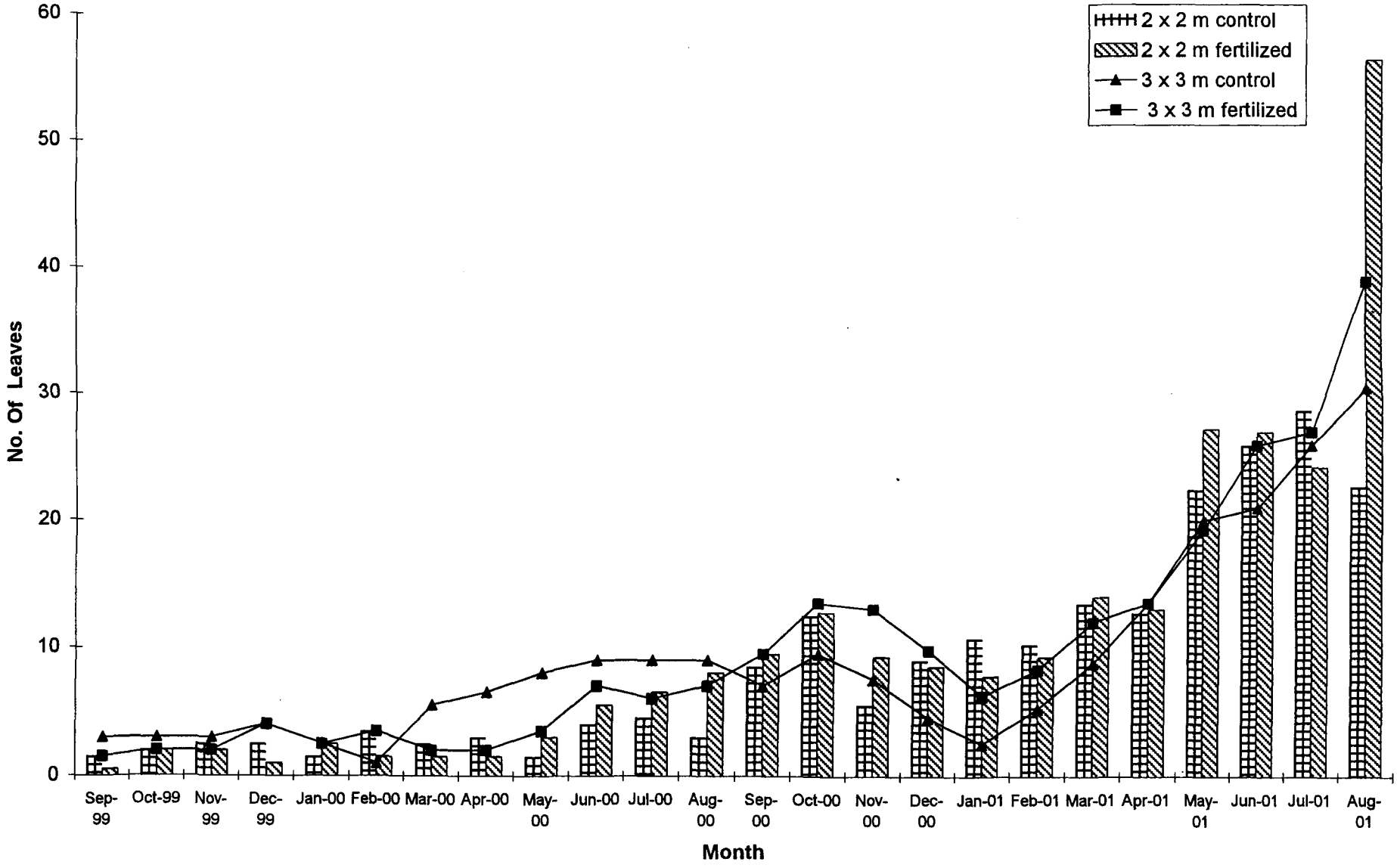


Figure 8 **Response of NPK in the height growth, No of Leaves and Culm emergence under different treatment of** *Melocanna Baccifera*

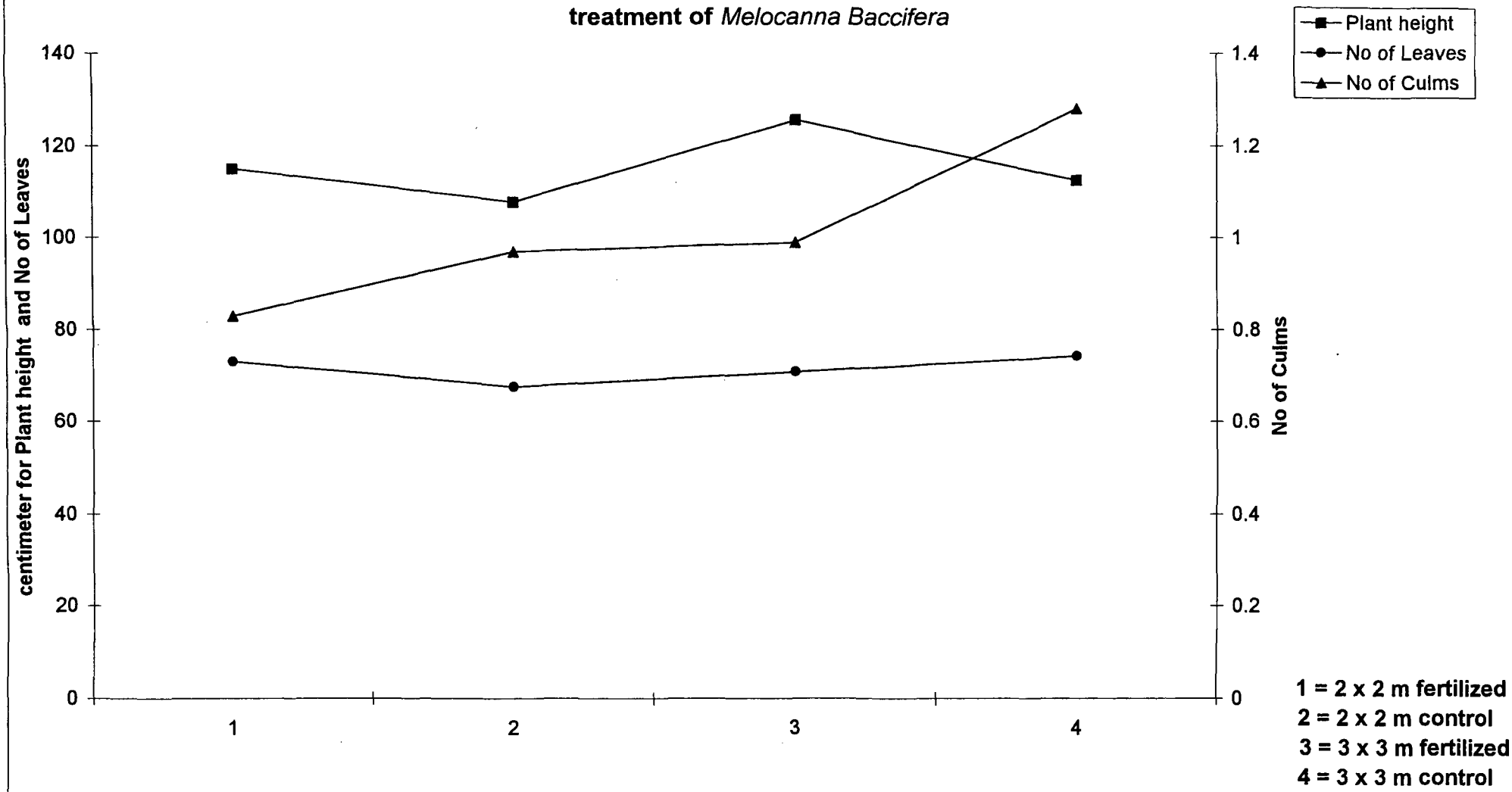


Figure 9 **Response of NPK in the height growth, No of Leaves and Culm emergence under different treatment of** *Dendrocalamus Longispathus*

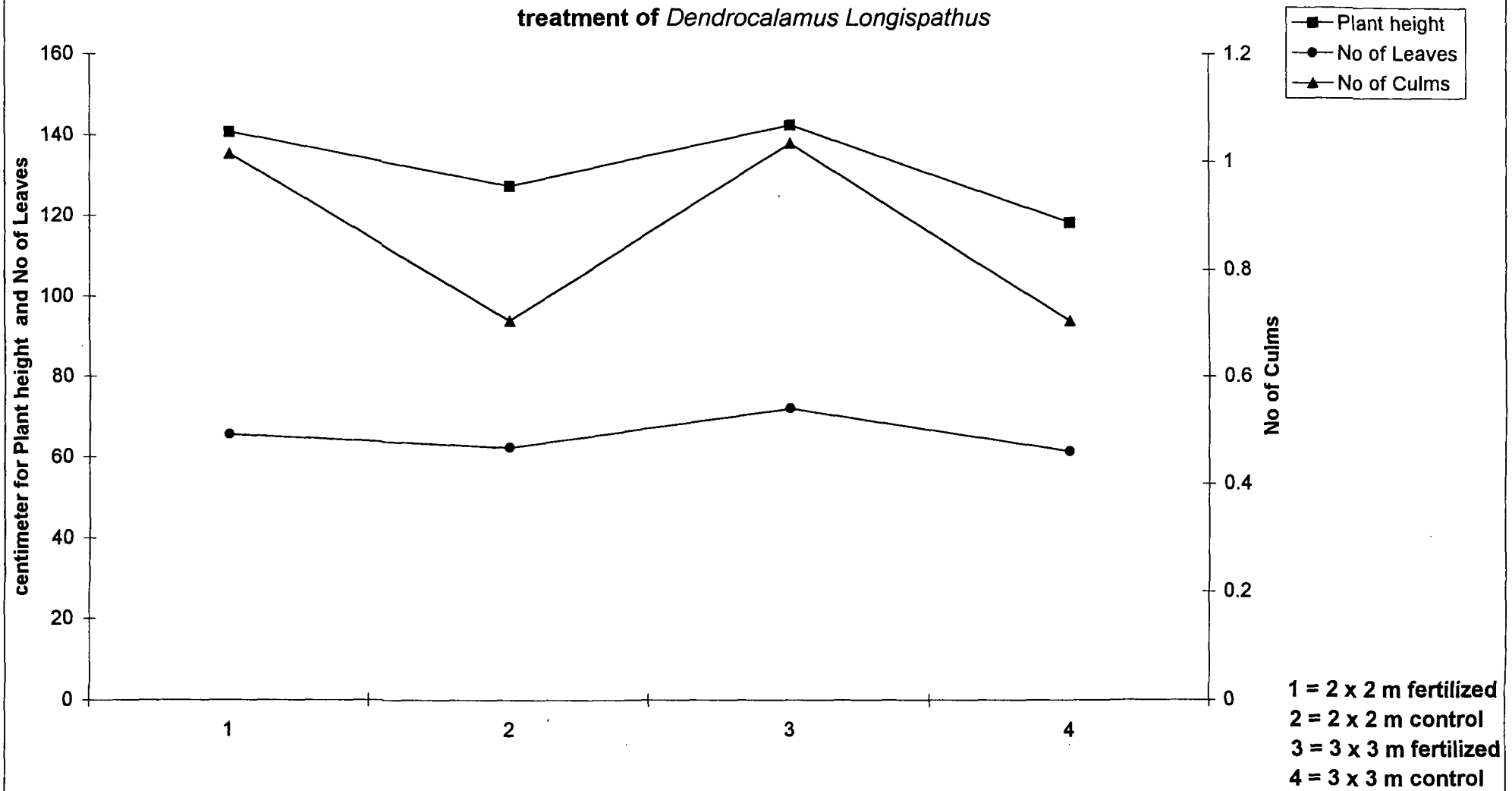


Figure 10 **Yield of Soyabean (Kg/ha) under fertilized and control plot of** *Melocanna Baccifera*

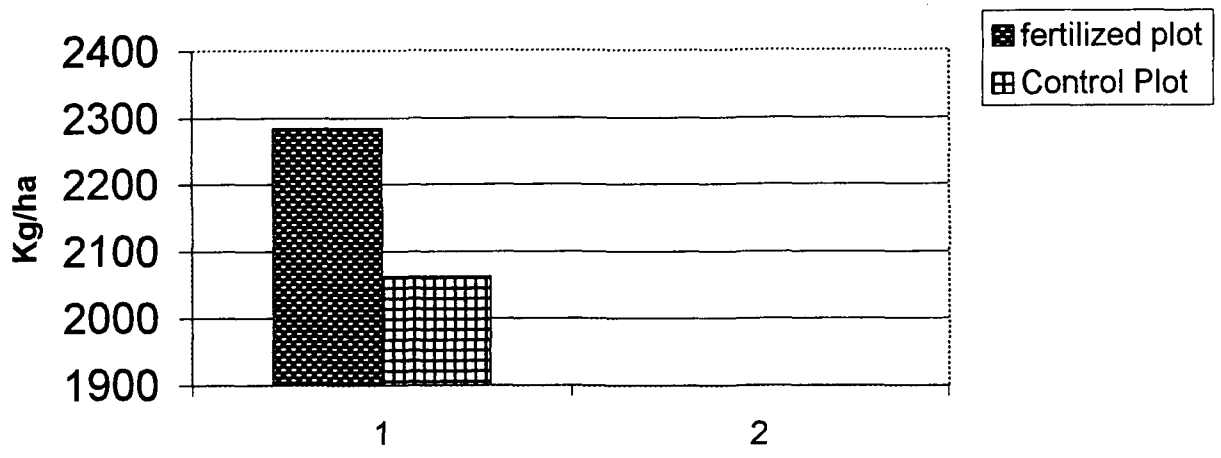
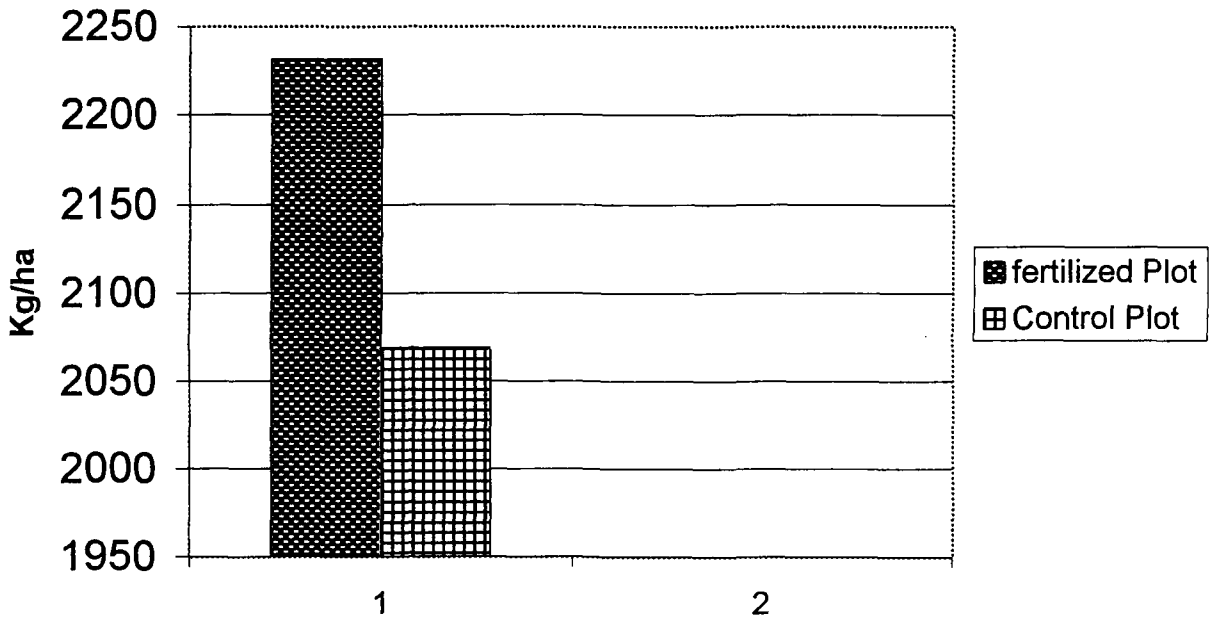


Figure 11 Yield of Soyabean (Kg/ha) under fertilized and control plot of *Dendrocalamus Longispathus*



CONCLUSION

CONCLUSION : -

From the above investigation, it has been found that the intercropping of soyabean with bamboo species are feasible and can give better results in comparison to pure bamboo stands. The monthly growth rate of *Melocanna baccifera* and *Dendrocalamus longispathus* shows significant variation. The application of fertilizer (NPK) also had a significant influence on the growth of bamboo species. The results also indicates that growth performance of bamboo species was better in 3x3m than 2x2m spacing. Larger spacing gave a better scope for intercropping since shade effect and root competition would be less. Better yield of soyabean in *Melocanna baccifera* which is a non-clump forming species gives the indication that there was no discernable affect of root system on the growth of crop.

In view of continuous deforestation and jhum cultivation causing deflection in bamboo resources of Mizoram, bamboo-based Agroforestry may be a viable option to check the above problem. Bamboo has a multiple uses in this part of the country. Jha (1999) studied domestic consumption of bamboo shoots and estimated the weekly availability in the market as 2,91,436 numbers. Further, great emphasize have been made upon the need for domestication and commercialization of various NTFPs which bear the potential of generating income and employment. Thus domestication of bamboo as an Agroforestry crop can address both ecological and economic problem in this region.

Due to limited time of investigation, clear picture on important aspects such as nutrient requirement, crop management, biomass production etc. could not be drawn. Furthermore, [redacted] to establish it as an Agroforestry crop, more local research is needed; in particular that related to the agronomical and socio- economic aspects of the crop.

SUMMARY

SUMMARY :

The study was conducted on one year old Bamboo species *viz, Melocanna baccifera (Roxb) Nees* and *Dendrocalamus longispathus Kurz.* It was carried out at Zemabawk, about 6km East Aizawl, the capital city of Mizoram, which is situated at an altitude of 780m above sea-level. The climate was hot and humid during summer and cold dry during winter. The total area of the site was about 288sq. mt. The layout follows the Randomized Block Design (RBD) with two replicates. Each replicates have 8 different sub-plots. The size of each sub-plots was 18 sq. mt (6x3m). Two different spacing of 2x2m and 3x3m was used for both the bamboo species and only one spacing of 25x25cm was maintained for soyabean. Fertilizer (NPK) was applied in four different sub-plot in each replication.

Various growth attributes such as height, number of leaves and number of culms were recorded at monthly interval as also the yields of Soyabean. The data was subjected to ANOVA (analysis of variance) to see the monthly variation on the growth in height and number of leaves. ANOVA was also used to see the effect of fertilizer on height growth, number of leaves and number of culms.

The important findings of the present investigation were as follows:

1. Growth behaviour of bamboos vary significantly from month to month showing maximum rate of growth during monsoon.
2. Higher rate have been observed under fertilized plot as compared to control in both the bamboo species.
3. The number of culm in *Dendrocalamus longispathus* increases significantly under fertilized plot as compared to control. No such effect have been observed in *Melocanna baccifera* as compared to *Dendrocalamus longispathus.*
4. Yield of Soyabean was higher under fertilized plot in comparison control in both the bamboo species.

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