



**EFFECT OF PRUNING AND PLANT GROWTH
RETARDANTS ON GROWTH AND DEVELOPMENT OF
CASHEW (*Anacardium occidentale* L.)**

BY

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M.Sc., (Ag.)

THESIS SUBMITTED TO THE
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IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF

**DOCTOR OF PHILOSOPHY
IN THE FACULTY OF AGRICULTURE**

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JUNE, 2005

CERTIFICATE

Mr. B. PRASANNA KUMAR, has satisfactorily prosecuted the course of research and that the thesis entitled “**EFFECT OF PRUNING AND PLANT GROWTH RETARDANTS ON GROWTH AND DEVELOPMENT OF CASHEW** (*Anacardium occidentale* L.) submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that the thesis or part thereof has not been previously submitted by him for a degree of any university.

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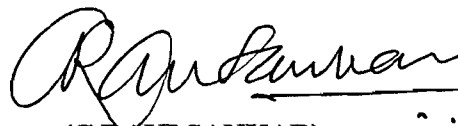


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Major Advisor

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This is to certify that the thesis entitled **“EFFECT OF PRUNING AND PLANT GROWTH RETARDANTS ON GROWTH AND DEVELOPMENT OF CASHEW (*Anacardium occidentale* L.)”** submitted in partial fulfillment of the requirements for the degree of **DOCTOR OF PHILOSOPHY IN AGRICULTURE** of the Acharya N.G. Ranga Agricultural University, Hyderabad is a record of the bonafide research work carried out by **Mr. B.PRASANNA KUMAR** under our guidance and supervision. The subject of the thesis has been approved by the Student’s Advisory Committee.

No part of the thesis has been submitted for any other degree or diploma. The published part has been fully acknowledged. All assistance and help received during the course of investigation have been duly acknowledged by the author of the thesis.



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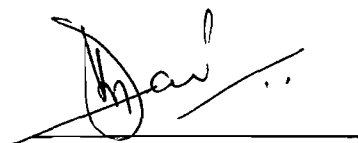
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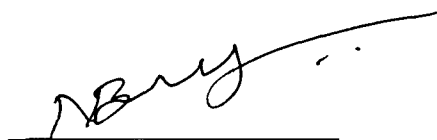
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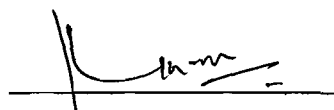
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HYDERABAD

Date: 1/6/05


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DECLARATION

I, **B. PRASANNA KUMAR**, hereby declare that the thesis entitled
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AND DEVELOPMENT OF CASHEW (*Anacardium occidentale* L.)”** submitted to
the Acharya N.G. Ranga Agricultural University for the degree of **DOCTOR OF
PHILOSOPHY IN AGRICULTURE** is a result of original research work done by me.
I further declare that the thesis or part thereof has not been published earlier in any
manner.

Date: 7/6/2005

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ABSTRACT

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Title of the thesis : **EFFECT OF PRUNING AND PLANT GROWTH RETARDANTS ON GROWTH AND DEVELOPMENT OF CASHEW (*Anacardium occidentale* L.)**

Degree : Doctor of Philosophy

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Discipline : Horticulture

Major Advisor : Dr. C. RAVISANKAR

University : Acharya N.G.Ranga Agricultural University

An investigation was conducted to study the growth and development of two distinct cashew varieties as influenced by techniques of pruning as well as application of plant growth retarding substances viz., paclobutrazol and alar during 2001-02 and 2002-03 at Cashew Research Station, Bapatla, Guntur district.

In response to pruning the vigorous variety BPP-4 performed better as compared to the off-season variety BPP-6 during both the years of study. The cashew when pruned the leader shoot in mid-July registered a reduction in incremental plant height, increased incremental stem girth, produced maximum number of shoots m^{-2} , increased number of panicles m^{-2} area of tree canopy, increased hermaphrodite flowers panicle^{-1} and thus resulted in higher nut yield tree^{-1} during both the years of study. However, pruning leader shoot in mid-September showed reduced incremental canopy spread and increased number of nuts reaching maturity m^{-2} area of the tree canopy. With regard to off-season variety BPP-6 the results showed that pruning of leader shoot in mid-July produced maximum shoot length, maximum number of nuts

per panicle and higher percentage of fruit set during both the years of study. Relatively the off-season variety BPP-6 recorded maximum number of flowering shoots m^{-2} and produced large sized nuts during both the years of study.

In a study of the response of cashew varieties to the soil application of paclobutrazol with different concentrations from 2 g a.i. to 8 g a.i.tree⁻¹, the vigorous variety BPP-4 recorded an increasing trend of the characters viz., incremental stem girth, chlorophyll-a and chlorophyll-b contents, number of flowering shoots m^{-2} area of the tree canopy, hermaphrodite flowers panicle⁻¹, percentage of fruit set, number of nuts reached maturity m^{-2} , number of nuts panicle⁻¹, nut weight and nut yield tree⁻¹ with increasing concentrations of paclobutrazol during both the years of study. However, the other characters viz., incremental plant height, incremental canopy spread, shoot length, number of leaves m^{-2} , leaf area shoot⁻¹, number of non-flowering shoots m^{-2} , and sex ratio of male to hermaphrodite flowers were found to be decreasing with increasing concentrations of paclobutrazol during both the years of study. The varieties of BPP-4 and BPP-6 recorded statistically maximum nut yield tree⁻¹ during both the years of study through increased number of shoots m^{-2} , number of panicles m^{-2} , relatively shorter duration of flowering, increased number of nuts that reached maturity m^{-2} and number of nuts panicle⁻¹. The off-season variety BPP-6 due to its genetic nature produced bold and heavy nuts during both the years of study. However, it could not record maximum nut yield tree⁻¹ compared to the vigorous variety BPP-4 during both the years of study. Between the two years of study the off-season variety BPP-6 recorded slightly improved yield only during normal rainy year of 2001-02.

In another trial carried out to study the effect of Alar spray concentrations, the vigorous variety BPP-4 responded well during both years of study by producing maximum nut yield tree⁻¹ through number of panicles m⁻², number of nuts that reached maturity m⁻² after spraying either 500 ppm triple spray or 1000 ppm double spray. The other off-season variety BPP-6 responded reasonably during prolonged dry year 2002-03 by showing the reduced incremental plant height, mean canopy spread, increased number of shoots m⁻², chlorophyll-a and chlorophyll-b content, flowering shoots m⁻² and number of hermaphrodite flowers panicle⁻¹. The variety BPP-6 recorded maximum nut weight, it fallen to produce increased yield.

In correlation study the cashew nut yield tree⁻¹ registered significantly positive association with the plant height increment, number of panicles m⁻² area of the tree canopy, number of hermaphrodite flowers panicle⁻¹, number of fruits panicle⁻¹ and number of nuts that reached maturity m⁻² and non-significant positive correlation with number of fruits per panicle and nut weight. Nut yield tree⁻¹ was found to be having a non-significant negative association with canopy spread increment.

From the results of the above three experiments conducted during both the years of study, it is concluded that soil application of paclobutrazol at 6 g a.i. tree⁻¹ was found to be beneficial under local agro-climatic conditions of Bapatla. The growth retardant paclobutrazol although showed better performance of cashew tree with reduction in growth and increased productivity, it is felt necessary to study further the response of cashew to interval of application in years. To control the excessive vegetative growth, pruning of leader shoot from mid-July to mid-August was found to be next alternative.

LIST OF SYMBOLS AND ABBREVIATIONS

AIAT	Assessment Institute of Agricultural Technology
%	Per cent
a.i	Active ingredient
@	At the rate of
BPP	Bapatla
BLA	Bapatla-Accession
C/N	Ratio of carbon and nitrogen
CNSL	Cashew Nut Shell Liquid
CD	Critical difference
cm	Centimeter ~~re~~
cv.	Cultivar
°C	Degree Celsius
DMSO	Di-methyl Sulphoxide
<i>et al</i>	Co-workers
EC	Emulsified concentrate
Fig.	Figure
GA	Gibberellic Acid
G	Gram
Ha	Hectare
i.e.,	That is
kg	Kilogram
KNO ₃	Potassium Nitrate
L	Litre
LAI	Leaf Area Index

Contd..

Max.	Maximum
M	Meter
Min.	Minimum
ml	Milli litre
mg	Milli gram
mm	Milli meter <i>for</i>
NS	Non-significant
®	Registered
RBD	Randomized Block Design
RH	Relative Humidity
SADH	Succinic Acid de hydrogenase
S Em	Standard Error of Mean
viz.,	Namely

Introduction

CHAPTER I

INTRODUCTION

Cashew tree (*Anacardium occidentale* L.) is an important commercial plantation crop in the country and is occupying an area of 7.80 lakh ha with a production of 5.35 lakh tons during the year 2003-04. Among the cashew growing states of India, Andhra Pradesh ranked second in area of 1.36 lakh ha. and second in production of 95 thousand tons of raw cashew nuts. The foreign exchange earned through export of cashew kernels, cashew nut shell liquid (CNSL) and allied products during the year 2003-04 was equivalent to Rs.1811.5 crores. The import of raw nuts was 4.52 lakh tons during the year to meet the demand for processing units and export (The Cashew, July-Sept.2004). The gap between the demand and supply of raw nuts can be met by increasing the domestic production by exploiting the production potential of this crop.

Cashew traditionally has been cultivated in marginal and unproductive wastelands. But, recently the crop also has been receiving intensive management practice, which has resulted in high density planting with lesser spacing. The major requirement of high density planting is tree size control. This can be brought about by evolving dwarf varieties or by management practices for manipulation of the canopy by various degree of targeted, type and timed pruning of branches or shoots.

Further, it is a hardy crop growing in a semi wild manner in the poorest soils in the coastal belt of southern states of India. It is essentially a crop of the tropics, however, it is acclimatized to a wide range of climatic and soil conditions. The low level of yield potential of this crop is due to poor management. In order to increase the yield potential

of each tree, the balanced growth of the crop by various mechanisms are to be studied. Utilization of the plant growth regulators or growth retardants or chemicals that can regulate the metabolism and thereby growth of the tree is controlled by which the canopy structure is regulated and increased yields can be achieved. The beneficial effects of various growth substances and nutrients in improving the canopy structure, floral morphology and nut yield of the tree needs emphasis besides pruning.

Moreover, the cashew tree is a low spreading evergreen tree with a number of primary and secondary branches. According to Argles (1969) two or three peak periods of growth are usually observed in a bearing cashew tree, even though under favourable conditions the stray shoot growth may occur almost every month. The pattern of growth of a bearing tree consists of a generative flower flush and a vegetative flush. The vegetative flush, consisting of lateral shoots, always develops soon after the main crop has matured. There are two types of branching in cashew, intensive and extensive (Dasarathi, 1958). According to him, the intensive shoot grows to a length of about 25-30 cm and terminates in a panicle. Simultaneously, three to eight laterals arise within 10-15 cm of the apex. Some of these lateral shoots may also terminate in panicles in the same flowering season repeating the same growth pattern, giving a well covered bushy appearance to the tree. In extensive type, the shoot grows to a length of 20-30 cm and rests. A bud sprouting 5-8 cm below the apex leads further growth. Even though both kinds of branching are observed in all trees one type dominates in a tree. Seventy five per cent of the shoots of the intensive types produce panicles as against 12 per cent in extensive types.

A critical review of the existing knowledge revealed that cashew trees enter a brief rest period (quiescent stage) after harvest of the crop (May-June) and it continues upto next productive flushing season (September-October). The flushes or flower bearing twigs are known as lateral shoots and these shoots usually form from the terminal portion of leader shoot (previous seasons lateral shoot). In most of the trees one such leader shoot will give a single new shoot (lateral) from its terminal bud. If the terminal bud is disturbed by means of pruning the dormant lateral buds will sprout resulting in more number of lateral shoots per unit area. The flowering in cashew is on terminal buds, and therefore, the plant should put forth new vegetative flushes through more laterals after harvest. It may be possible that if the tree could be physiologically so manipulated to put forth more number new vegetative growth flushes immediately, successively after harvesting this new growth may attain requisite physiological maturity to differentiate flower buds in October-November to produce more flowering laterals during the months of January-February of the following year under local agro-climatic conditions.

To achieve this, pruning of shoots immediately after harvest was attempted to encourage early vegetative growth and also to activate the quiescent buds on the shoots of both intensive and extensive branches in the tree canopy. Pruning is reported to have a positive effect on increased C/N ratio owing to increased photosynthetic efficiency, there by accumulation of starch by the improved light penetration in the trees. Also high phenolics content, ascorbic acid content and lower levels of gibberellin-like substances in the leaves of flowering shoot was higher at critical period of flower bud formation were reported in mango by Chacko (1968) and Saidha, (1980). The effect of pruning critically on the development of different shoots, in quantity and quality to obtain better crop was

not studied thoroughly in cashew cultivars in the East Coast region. Though, pruning helps in the production of more laterals in pruned shoots, it is not certain whether all these laterals produce more panicles in the succeeding year.

Similarly, crop productivity is dependent upon several developmental patterns and physiological processes operative in plant in response to management practices and environment. The physiological efficiency of a plant can be improved by prolonging photosynthesis, reducing photorespiration and affecting better partitioning of photoassimilates, improving mineral ions uptake and stimulating nitrogen metabolism. In several species, application of growth retardants was shown to stimulate photosynthesis through increased LAI (Leaf Area Index) or delaying leaf senescence, increasing the functional duration of the leaf or delaying degradation of chlorophyll and hence improving the source-sink relationship (Jaggard *et al.*, 1982).

The use of growth regulators to regulate and alter the physiological processes of cell division, cell elongation, cell multiplication by specifically blocking the same steps in pathways of endogenous hormonal bio-synthesis, without evoking substantial growth distortions and these are known to influence various growth and developmental processes like vegetative growth, flowering, fruit set, quality and post-harvest aspects. The recent development of a number of highly active growth retardants has further enhanced the potency of growth regulators use in horticulture. Their use is especially beneficial in fruit trees where the dwarfing rootstocks or compact scion cultivars are not available.

Paclobutrazol is successfully used to lessen the height of several fruit trees by inhibiting cell elongation and induction of dark green colour in the leaves (Davies *et al.*,

1986; Malik and Thind, 1994). Paclobutrazol reduced the vegetative growth of various fruit trees and orchard trees. Thus the requirement for pruning was decreased and the flowering pattern was altered favourably and resulted in profuse fruiting. Their use is especially beneficial in fruit trees like cashew where dwarfing rootstock or compact scion cultivars are not available. In the paclobutrazol treated leaves increased net photosynthesis on a leaf area basis may have been due to the presence of thicker leaves which have a larger mesophyll surface area resulting in improved opportunities for CO₂ exchange (Jaggard *et al.*, 1982). Similarly, Pushpalatha (2002) reported that the profound influence by way of retarding vegetative growth and causing early intensive flowering are another favourable effects of spray application of paclobutrazol at the rate of 1g per L together with KNO₃ 1 per cent to mature lateral shoots of cashew before flushing during late October.

The growth retardant daminozide has also been used for many years to reduce excessive shoot growth. Its growth retarding activity is however, restricted to relatively few plant species such as apple, groundnut and chrysanthemum. In light of structural similarities between daminozide and 2-oxy-glutaric acid and re-evaluating order results from the literature it has been proposed that daminozide, like acyl-cyclohexanediones would block gibberellic acid formation as an inhibitor of 2-oxy-glutamate dependant dioxygenases (Rademacher, 1993).

To achieve high productivity of cashew, the growth parameters have to be optimized and unproductive components of plants need to be minimized without affecting the overall growth of the tree and nut quality. Therefore, controlling the tree size in high density orchards is one of the methods of increasing production, studied in

mango (Khader,1991). Once the trees get occupied their allotted spaces, crowding may occur and canopies of adjacent trees begin to overlap. The most commonly known horticultural methods to control tree growth are pruning and by the use of growth regulators or retardants.

Similarly, in order to check excessive vegetative growth in the extensive and intensive branching type of shoots and to encourage more flowering laterals by using growth retardants like paclobutrazol and alar (succinic acid 2,2 dimethyl-hydrazide) which were found to be effective in several crops also attempted in cashew by exogenous application to increase the per tree productivity.

In the light of these circumstances, to get optimum tree canopy, more number of lateral shoots, more flowering laterals, early and uniform flowering in cashew cv. BPP-4 and BPP-6 which are distinct in their growth pattern of cashew, the present study is undertaken with the following objectives:

- 1) To study the effect of pruning in different months and on different types of shoots (both extensive and intensive) of early and late varieties of cashew.
- 2) To study the effect of plant growth retardants on morphometrics of early and late varieties of cashew.
- 3) To study the correlation coefficients among the various growth and yield attributing characters of cashew.

Review of Literature

CHAPTER-II

REVIEW OF LITERATURE

Cashew (*Anacardium occidentale* L.) belongs to the family *Anacardiaceae* which includes many economically important tropical and sub-tropical trees and shrubs. The cultivated cashew is a low spreading evergreen tree of the tropics, with a number of primary and secondary branches (Jhonson, 1973). The pattern of growth of a bearing tree consists of a generative flower flush and a vegetative flush. The vegetative flush consists of lateral shoots, always develops soon after the main crop has matured. Flowering is terminal and is usually preceded by the vegetative flush (Argles, 1969). Chakravarthy *et al.*, (1972) reported that vegetative shoots of cashew which appeared in April–May developed panicle in about 92 per cent cases during next flowering season while those produced in December-January months bore flowers in only about 10 per cent of the shoots in the same season. From the studies conducted at Kodur and Taliperamba, Rao and Hassan (1957) stated that there are two active phases in cashew, one beginning in October and lasting till January, and another between March and May out of these phases, shoots produced during October-January gave rise to panicles while the later emerged flushes were invariably unproductive.

Dasarathi (1958) recognized two types of branching in cashew in a study conducted in Andhra Pradesh. An intensive shoot was one which grew to a length of about 20-30 cm terminating into a panicle with 3-8 laterals produced simultaneously with in 10-15 cm of apex and some of them may terminate with panicles in same flowering season. An extensive shoot was one, which grew to a length of 20-30 cm but ended with no inflorescence in the season. He reported that about 85 to 90 per

cent of the intensive shoots produced inflorescences but among the extensive shoots only about 12 per cent produced inflorescences.

According to Nambiar (1977) under Kerala conditions the bearing shoots following the harvest of fruits produced two laterals in June-July. These shoots produced flower in December and also produced a few laterals. Some of these laterals produced flowers during the main season that was in the month of December.

2.1 Effect of pruning:

Canopy architecture and tree form development have been extensively studied by Halle and Oldeman (1979) and according to them cashew has a development pattern of an orthotropic rhythmically active, terminal meristem which produce an indeterminate trunk bearing tiers of branches, each branch complex orthotropic and sympodially branched as a result of terminal flowering.

Pruning is one of the important practices in the cultivation of horticultural crops especially woody perennials; pruning has become an integral part of cultivation. Pruning should maintain a good balance between growth and fruiting. Pruning generally reduces the total light interception because of reduced growth and canopy size. Summer pruning has been shown to improve light penetration within tree canopies (Marini and Barden, 1987). Even though there was marked improvement in yield as a result of canopy manipulation by pruning, the literature available on pruning, time of pruning, level of pruning, kind of pruning and quantum of branches to be pruned seems to be scanty in cashew. However, the work done so far in the various aspects is reviewed hereunder. The work done in other perennial horticultural crops has also been reviewed at appropriate places in the text for better understanding of the response of cashew for pruning.

The productivity of the cashew largely depends on the genetic make up of variety used, the orchard management practices and canopy management at micro-level than are adopted and this can be achieved by selective pruning. Tubbs (1955) in a review on the control of vegetative growth and reproduction of fruit tree pointed out that response to pruning in mature trees is related both to tree vigour and the balance between vegetative and reproductive processes.

It is reported that the pruning of the dead wood alone in older trees helps in increasing the nut yield by 30-40 per cent. The earlier studies have revealed that pruning of leader shoot helped in stabilizing the yield in older plantations with declined yield (Khan *et al.*, 1987).

2.1.1. Pruning on vegetative growth:

The leader shoot pruning increased the number of laterals produced per shoot significantly. Maximum number of laterals (4.83 per shoot) was recorded in July pruning followed by August (4.07) and June (3.79). The lateral shoot pruned in June also produced significantly more number of laterals per shoot (3.01) over the control (2.05) as reported by (Mohan and Room Singh, 1988) in cashew. This has also been observed by earlier workers in cashew (Mohan, 1983), in guava (Aravindakshan, 1963) and in fig (Sundararaj *et al.*, 1969).

The leader shoot pruning done in month of August, July and June were produced significantly the longest lateral shoots of 24.6 cm, 20.8 cm and 20.6 cm respectively where as in control 14.1 cm was recorded (Mohan and Room Singh, 1988). Similar reports have been made in guava by Bajpai *et al.*, (1973) and Alexander and Maggs (1971) in sweet orange.

The decapitation of shoots to ten centimeters back from the tip in Baneshan cv. mango recorded the highest number of shoots were with two laterals of 261 in number followed by three laterals of 230 in number were reported by Suresh Kumar *et al.*, (2003).

The pruning followed by spraying of 2 per cent KNO₃ increased the number of laterals or leaders compared with untreated controls in the cashew (Mohan and Rao, 1995). The removal of 25 per cent of n₆, 50 per cent of n₆, 25 per cent n₅ branches have triggered the production of optimum number of proleptic branches in cashew (Nalini, 2002).

The growth of cashew tree with respect to height and spread of canopy remained similar to control in yearly and alternate or shape pruned trees. The number of flowering laterals were reduced in yearly and alternate year pruned trees compared to shape pruned and control trees. The number of non-flowering laterals was more in yearly and alternate year pruned trees (Anon. 1999).

Maximum canopy spread was observed in plants which were not given pruning treatments. Yearly pruned trees irrespective of variety had significantly lower canopy spread. The number of flowering and non-flowering laterals remained unaffected due to leader shoot pruning. The length of lateral shoots however, was reduced due to leader shoot pruning. The number of laterals per leader shoots either flowering or non-flowering though differed significantly, their difference was negligible (Anon.2001).

Mohan and Room Singh (1988) reported that maximum number of leaves ranging from 8.8 to 11.6 per shoot was recorded almost in all treatments where as in unpruned control it was only 7.0. The leader shoot pruning during August recorded

the largest leaf area of 1312 cm² per shoot followed by July pruned shoots (1152 cm²). Similarly, the lateral shoots pruned tree during July also recorded the largest leaf area of 996 cm² when compared to unpruned trees (666.0 cm²) in cashew. Similarly, Grigorov (1975) also reported such larger leaf area due to pruning in apples.

Pruning the leaders in July stimulated the production of flowering laterals followed by June pruned leaders in cashew (Chattopadhyay and Ghosh, 1994).

The effect of various pruning severities revealed that the growth of emerging shoots were more in the first, second and third order trees whereas less emerging was found in the fourth and fifth order pruning treatments while the highest length (182cm) and girth (15.26cm) were observed by Lal *et al.*, (1999) in mango cv. Dashehari.

The shoots of sufficient length bear flower panicles and normal fruits in the following year. These shoots were less than half of the length of shoot produced on unpruned trees in mango (Iyer and Subrahmanyam, 1973). Pruning of cv. Fazli mango for its rejuvenation produced the highest number of new shoots (23.50) when the leader remained intact (Banik and Sen, 2002).

Pruning after harvest in mango was studied in mango cv. "Sensation" and observed maximum number of shoots in the pruned shoots than the unpruned branches (Oosthuyse, 1994).

There is a significant decrease in total shoots per canopy surface, but 62 days after pruning that difference was no longer significant and 174 days after pruning there was no significant effect either on floral and vegetative activities in mango (Rojas, 1996).

Moderate pruning (10 cm) of fruited shoots immediately after harvest followed by 2.0 per cent urea spray encouraged early new vegetative growth than in unpruned and severely pruned (30 cm) trees bypassing usual dormancy period (Chandrasekhar, 1999).

Pruning the branches by cutting precisely the last shoot on the node soon after harvest increased the shoot formation by as much as 47-50 per cent and resulted in 3-4 shoots per branch (AIAT, 2001). Urrutia *et al.* (1997) observed in Tommy Atkins mango, that more and larger new shoots were produced on pruned trees than control.

The maximum shoot length of 165.35 cm and diameter of 1.24 cm was recorded whereas a minimum shoot length of 98.25 cm and diameter of 1.05 was observed by Syamal and Rajput, (1989) Gupta and Singh, (1977) and Sharma *et al.*, (1980) in ber.

Annual shoot growth increased with the reduction in the number of fruiting shoots per node per tree. The longest annual shoot (35.0 cm) was recorded in trees which were subjected to 26.27 fruiting shoots per tree in ber but the trunk girth and tree canopy volume were however, remained unaffected by any of the treatments (Sharma *et al.*, 1997).

Pruning in July-August was the best month for increased more number of shoots in 'on' year of Dashehari mango trees which flowered in the same year and produced enough vegetative growth to flower and fruit in the following 'off' season (Mohan Swaroop *et al.*, 2001).

Maximum increase in the shoot length as well as shoot thickness was recorded in the most heavily pruned trees (60 per cent pruning) which was significantly highest

than lightly and medium pruned trees. The longest (43.54) and very thick (0.51 cm) shoots pruned in the month of September in peach (Rathi *et al.*, 2003).

2.1.2 Effect of pruning on reproduction:

Mohan (1983) observed an increased rate of productive laterals in cashew by pruning in June. Pruning of shoots in July and August produced significantly higher number of total flowers and bisexual flowers. Leader shoot pruning in July was the best treatment producing 384 flowers per panicle of which 111.3 were hermaphrodite flowers while the lateral shoot pruning in July produced 109.3 hermaphrodite flowers per panicle (Mohan and Room Singh, 1988). And similar findings were reported by Aravindakshan(1963), Sundararajan and Muthuswamy (1964) and Bajpai *et al.*, (1973) in guava.

Twenty eight year old cashew trees were subjected to light, moderate and severe pruning in July 1988 and the results revealed that the trees with 3 branches pruned recorded the highest number of panicles m² (39.0), highest number of flowers per panicle (588.7) and fruit set to the extent of 14.42 per cent in cashew (Mohan, 1983).

Pruning leader shoots in July stimulated the production of flowering laterals and the number of bisexual flowers per panicle was more in cashew (Chattopadhyay and Ghosh, 1994).

In mango, the pruning of twigs, which were expected to flower, did not interfere with the flowering potential, however on the contrary it caused production of multiple panicles on the left out stumps (Ravishankar,1976). The mild pruning of Alphonso fruited shoots in October resulted in flowering to an extent of 35 per cent when sprayed with potassium nitrate (Patil,1981). By severe pruning of fruited shoots

in early December resulted in maximum (85.7%) induction of flowering in the following expected “off ” year followed by 64.3 per cent recorded by the same intensity of pruning done in mid-November in Alphonso mango (Srihari and Rao, 1998).

Suresh Kumar *et al.*, (2003) reported on the decapitation of shoots to ten cm. back from the tip in mango cv. Baneshan recorded the highest percentage of flowering was with three and four lateral shoots of 91 per cent and 93 per cent respectively.

In mango, the vegetative bud break was promoted in 3 months period following pruning. The pruning inhibited flowering and this inhibition increased as the intensity of pruning increased (Rojas *et al.*, 1997). Pruning in high density “Haden” mango trees to a length of 30 cm from the tip, the flowering and fruit set was maximum (Gil *et al.*, 1998).

Chandrasekhar (1999) reported that moderate pruning (10 cm) of fruited shoots immediately after harvest followed by 2 per cent urea spray increased the percentage of flowering to 98 per cent and higher percentage of perfect flowers when compared to unpruned and severely pruned trees in mango.

The fruit set and fruit retention increased in light pruning treatments than in severely pruned shoots of ber. Maximum fruit set of 43.60 per cent and fruit retention of 33.50 per cent was recorded in 60 cm pruned shoot (Syamal and Rajput, 1989, Awasthi and Misra, 1969 and Lal and Prasad, 1980).

In ber (*Zizyphus rotundifolia* L.) maximum number of flowers 489.82 per branch let and the maximum percentage of bisexual flowers (26.83) by medium pruning was recorded in ber and this might be due to the fact that high carbon content

and low nitrogen content coupled with hormonal balance in the shoots (Nanthakumar *et al.*, 1987).

Pruning of guava during winter season at different intensities recorded maximum number of flowers (14.10), fruit set (10.06%) and fruit retention (7.90 %) per shoot (Mishra and Pathak, 1998).

The new shoots born on an 'off' year tree did not produce panicles, whereas those produced during 'on' year after pruning in July-August, September, November and December produced panicles. The number of panicles born on a shoot in July pruning was maximum (3.09) followed by those pruned in August (2.83). The number of hermaphrodite flowers was higher in panicle produced after November (29.04) and December (29.86) pruning during "on" year in mango (Mohanswaroop *et al.*, 2001).

The heavily pruned trees flowered in 210 days later to that of less severe pruned trees, full bloom was delayed by 8 days and also decrease in flowering shoot rate in mango. (Chen-Hou Bin *et al.*, 1996).

Pruning after harvest was evaluated in 'Sensation' mango and it was observed that there was slightly delayed flowering but more uniform flowering (Oosthuysen, 1994).

Pruning at 6.7 cm and 12-13 cm below the base of the panicle induced flower initiation in the axillary buds in each portion and more number of panicle were formed with pruning in March than April in cv. 'Irwin' mango reported by Sasaki *et al.*, (2000).

2.1.3. Effect of pruning on yield:

A marked increase in the nut yield tree⁻¹ was almost recorded in every selection due to the pruning in cashew. The average yields increased from 1.440 kg tree⁻¹ before pruning to 6.080 kg tree⁻¹ after pruning in cashew tree during the 4th year of its age (Khan *et al.*, 1987).

Leader shoot pruning during August was the best treatment in producing the highest yield tree⁻¹ (9.300 kg), which was 116 per cent more than the yield of unpruned trees. July leader shoot pruning and lateral shoot pruning during August also recorded the higher yields of 9.200 kg and 7.900 kg tree⁻¹ respectively when compared to unpruned trees (4.300 kg) (Mohan and Room Singh, 1988).

Pruning in the closely spaced plantations (5x5m) significantly increased the nut yield per tree in cashew and recorded 319.2 kg per ha over unpruned trees (228.3 kg ha⁻¹) (Anon.1998).

The highest cumulative yield of cashew was recorded in the pruned trees than to that of unpruned trees irrespective of their times of pruning. Similarly the number of nuts matured per panicles (4.0) and apple weight were significantly low in yearly pruned trees compared to other treatments (Anon.1999). Pruning of leader shoots in July resulted in the production of maximum number of fruits per panicle and nut yield per tree (Chattopadhyay and Ghosh, 1994).

Pruning of leader shoots consecutively for 5 years in 30 trees of 13 years old plantation recorded a mean nut yield of 3.530 kg tree⁻¹ over unpruned trees of 1.510 kg tree⁻¹ in cashew (Gangadhara Nayak,1996). Pruning of 25 per cent of n₅ branches at an interval of 3 years period coupled with high density management practices, the yield of cashew was almost doubled (Nalini,2002).

Shanmugavelu and Selvarajan (1985) reported that the mango thinning treatments when performed in August to September gave higher yield than the yield of previous year without pruning. In pruning studies to rejuvenate old mango trees, yield of 298.4 kg in the 'on' year and 158.0 kg in 'off' year were obtained by removal of secondary branches keeping the leader intact (Mallick *et al.*, 1985).

Yields of the trees pruned in October were higher than those of control during the second season. Trees pruned and thinned in October and November had more uniform fruits of larger size than the controls in both the seasons in cv. 'sensation' of mango (Fivaz and Stassan, 1996).

The effect of various pruning severities in cv. Dashehari revealed that fruit yield was higher in fourth order pruned trees than the other treatments. No fruit yield was obtained in first and second order pruned trees during first and second year Lal *et al.*, 1999). They further stated that cumulative fruit yield of first five years in fourth order pruned trees gave the highest yield of 284.64 kg tree⁻¹ as compared to control (113.52 kg tree⁻¹).

Light pruning limits vegetative growth and activated the quiescent fruit bearing buds by redistributing the endogenous hormonal substances and favoured flowering, fruiting and improved the fruit yield in mango (Usha, 2000).

The pruning also affected fruiting and fruit quality of Dashehari mango. The number of mature fruits born on each panicle was 91.22 per cent higher in trees pruned in July, followed by those pruned in August (50.68 percent) than those unpruned. It was concluded that during 'on' year, trees should be pruned in July and August to increase fruit yield by 22.2 to 58.0 per cent (Mohanswaroop *et al.*, 2001).

Pruning of tertiary branches and centre opening without applying paclobutrazol gave the highest fruit number of 228.66 and 150.00 tree⁻¹ respectively and the yield of 44.65 kg tree⁻¹ was reported by Shinde *et al.* (2002).

The medium level of pruning by leaving 75 cm of the secondary shoot from the base and removing the remaining wood reduced significantly higher fruit yield (21.51 kg tree⁻¹) than the unpruned trees (18.70 kg tree⁻¹) in ber (Singh *et al.*, 1978 and Nanthakumar *et al.*, 1987).

On other hand, the unpruned and lightly pruned tree produced more fruits 85.32 and 83.56 kg tree⁻¹ respectively (Syamal and Rajput, 1989). Contrarily, severe pruning decreased the yield tree⁻¹ in ber (Gupta and Singh, 1977 and Sandhu *et al.*, 1983).

Pruning in the month of May indeed produced significantly more shoots and more number of fruits reached per shoot (7.90) and higher yields per plant (25.78 kg) in guava (Misra and Pathak, 1998). Pruning in guava cv. Lucknow-49 increased the fruit retention per shoot in the cropping of winter season. The shoots pruned in the month of May at the level of 50 per cent produced maximum fruits per tree (Lal, 1983).

A reduction in average fruit yield was noticed with the reduction in fruiting nodes per tree. The highest fruit yield of 21.8 tons ha⁻¹ was recorded in pruning treatment at 1000 nodes level and the lowest fruit yield was 13.8 tons ha⁻¹ at 400 nodes level in peach (Sharma *et al.*, 1997). Kanwar and Nijjar (1988) also reported that fruit yield decreased with an increase in the thinning of fruitful shoots in Flordausun cv. of peach.

The yield per tree also decreased with increasing severity of pruning. A maximum fruit yield of 28.55 kg per tree in unpruned trees and minimum 18.75 kg per tree under severely pruned trees (60 per cent pruning) caused a yield reduction of 34.3 per cent in peach (Rathi *et al.*, 2003)

2.2 Effect of paclobutrazol:

Among the plant growth regulators, the synthetic organic chemicals, paclobutrazol, is one such compound, which belongs to the triazole group of compounds. The growth retardant properties of paclobutrazol, like any other growth retardants are largely attributed to interference with gibberellins synthesis (Dalziel and Lawrence, 1984). Although, the use of growth regulators in regulation of flowering is in vogue in mango for quite sometime, its utility in cashew was studied to a lesser extent. Further, the growth regulation is gaining importance in cashew cultivation in overcoming the problems associated with the fruit set development and final retention. More emphasis is to be given to basic aspects of hormones and their interaction and the seasonal variations in endogenous hormonal levels. The role of hormones in canopy containment, dwarfing, improper filling of nuts and improvement in size of nut are yet to be studied. Role and mode of action are some of the aspects to be studied by using some of the recent growth regulators and emphasized by Nayak and Rao (1993) in cashew.

2.2.1 Effect of paclobutrazol on vegetative growth:

The significant plant growth response to paclobutrazol in shortening of internodes and reduction in height in treated plants was because of its suppression of the mitotic activity in these plants (Thind and Malik, 1994 and Kaufman and Sang, 1988). It is more active in retarding growth when applied to soil or directly to stem

compared to foliar application as it exclusively translocated in the xylem (Dalziel and Lawrence, 1984).

The soil application of paclobutrazol 8 g a.i.tree⁻¹ reduced the plant height by 72 per cent, canopy spread by 65 per cent, length of flowering lateral by 64 per cent and length of non-flowering lateral by 75 per cent as compared to control (Anon. 1999).

The soil application of paclobutrazol at the rate of 8 g a.i.tree⁻¹ in 3 years old tree of cv. Kanaka has reduced the plant height increment by 82.7 per cent, canopy spread increment by 66.7 per cent number of non-flowering laterals per square meter by 9.8. The length of flowering laterals by 71.3 per cent and length of non-flowering laterals of 78.0 per cent have been reduced (Anon. 1999)

The increased number of flushes per square meter and number of flowering laterals per square meter has been reported. In the treated plants rosetting of leaves and panicles emerging from the apical buds of previous season's shoots were also observed (Anon. 1999).

Similarly, in the second year of application of paclobutrazol @ 6 and 8 g a.i. tree⁻¹ also reduced the plant height increment by 50.0 and 51.7 per cent, canopy spread increment by 58.9 and 57.5 per cent, length of flowering laterals by 38.9 and 55.3 per cent and length of non-flowering laterals by 69.0 and 74.4 per cent when compared to control. It also increased the number of flushes per square meter by 38.6 and 64.2 per cent and number of flowering laterals per square meter by 70.9 and 127.4 per cent when compared to control (Anon. 1999).

Working on the effect of paclobutrazol on the 60 day old soft-wood grafts cashew cv. BLA-139-1 with soil drenching at 25, 50, 75 ppm reduced the number of leaves, scion length, girth at collar, leaf area and the length of tap root but increased the lateral root growth (Misra *et al.*, 1991).

Pushpalatha,(2002) reported that the application of 1000 ppm foliar application of paclobutrazol and 1 per cent KNO₃ to mature lateral shoots of cashew before flushing (during the late October) reduced the length of flush (5.49cm), number of leaves (6.71) per shoot, days flushing (8.59), flushing span (23.71 days) but increased the number of flushes m⁻² (30.65).

Kwon and Lee (1986) reported that soil application of paclobutrazol was effective in reducing the over vigorous growth of apple seedling.

Kulkarni (1988) studied the effect of soil and foliar application of paclobutrazol on young container grown mango grafts. Soil application @ 1.25 g a.i. per plant controlled the growth while 2.5 g a.i. per plant produced delayed toxicity symptoms of epinasty and leaf scorching.

Paclobutrazol applied through foliar spray on two year old grafted mango plants @ 2000 ppm per plant in the month of September every year caused significant reduction in plant height, trunk girth and shoot girth (Khader, 1991).

Soil drenching of paclobutrazol (2.5, 5.0 or 10.0 g tree⁻¹) suppressed the flushing, shoot length, leaf number and leaf area and reported to be more effective in mango (Kurian and Iyer,1993a).

Paclobutrazol applied at the rate of 20, 60 and 240 mg a.i. tree⁻¹ to 2 year old grafts and non-grafted mango and peach cultivars caused inhibition of growth

(Salomon and Reuveni, 1994). Severe inhibition of growth occurred at higher levels especially in the grafted plants. Desai and Chundawat (1994) stated that the soil application of paclobutrazol to Alphonso mango trees reduced the vegetative growth.

Significant reduction in vegetative growth in young apple, peach and sweet cherries due to soil application was found to be effective only for young trees compared to old trees. According to Miller and Swietlik, (1986) paclobutrazol treatment to the soil under the trees generally inhibited the vegetative growth in apple and peach trees of different ages.

Kulkarni (1988) reported that the application of paclobutrazol on 1-8 year old veneer grafted mango trees reduced the inter nodal length, shoot length and incremental height. Soil application of paclobutrazol resulted in reduction of shoot growth, plant height and internal nodal length (Tongumpai *et al.*, 1993) in mango.

Sergent and Leal (1989) opined that the soil drenching of paclobutrazol ranging from 1 to 6 g ha⁻¹ could control over vigorous growth in apple trees when applied twice at one year interval. Application of paclobutrazol at high concentration to the soil was reported to inhibit shoot growth, increased leaf thickness and leaf area increased leaf chlorophyll content in apple (Hao *et al.*, 1991).

Werner, (1995) reported that soil drench at 750, 1500 and 2250 mg L⁻¹ of paclobutrazol was found effective in reducing tree trunk girth, number of new shoots, shoot growth and leaf area in mango.

Sarkar *et al.*, (1998) reported that the lowest increase in height (0.073 m), girth (0.058 m), canopy spread (0.498 m in EW and 0.458 m in SW direction), shoot length

(11.55 cm) and canopy volume (5.75 m³) when compared to control by the application of 6 g a.i. paclobutrazol tree⁻¹ in mango.

Hoda *et al.*, (2001) reported that application of paclobutrazol reduced the length of terminal shoot to a minimum length of 9.32 cm when applied to soil @ 10 g a.i. tree⁻¹. Faizan Ahmed *et al.*, (2000) reported that the Cultar® application 90 days before bud break reduced the shoot growth significantly in litchi.

Zora Singh *et al.*, (2000) reported that the application of paclobutrazol (Cultar®) was the best to reduce the tree vigour, promote flowering, fruit set and yield in Dasheheri mango.

Application of paclobutrazol as soil by drenching around the tree trunk had the leaves with highest chlorophyll content among the treated trees in mango (Gonzalez and Blaikie, 2003).

Miranda (2001) reported that there was a reduction in vegetative growth until visible floral differentiation. Significant differences were found between cultivars with respect to number of leaves produced with in each growth flush in mango.

Murti *et al.*, (2001) reported that application of paclobutrazol at 5 and 10 g a.i tree⁻¹ on 17 year old mango cv. Alphonso reduced the tree height, mean shoot length and number of dormant shoots.

2.2.2. Effect of paclobutrazol on reproduction:

Application of 1000 ppm paclobutrazol together with 1 per cent KNO₃ to mature lateral shoots of cashew before flushing (during late October) reduced the days to flowering (29.59), duration of flowering (25.35) but increased the number of

panicles m^{-2} (26.99) and number of hermaphrodite flowers per panicle (137.33) in Madakkathara-2 cv. of cashew when compared to control (Pushpalatha, 2002).

Wieland and Wample (1985) opined that paclobutrazol helps in accumulation of carbohydrates and inhibits the gibberellin biosynthesis in the tissues creating a favourable condition for flowering.

According to Kulkarni (1988), soil application of paclobutrazol at 10 g a.i. tree^{-1} promoted flowering in Banganapalli mango trees while foliar spray have not been proved effective.

Paclobutrazol increased the percentage of flowering in mango cv Dashehari with 1000, 2000 and 3000 mg L^{-1} as foliar spray (Khader, 1991) and in cv Kingsten Pride with 8 ml L^{-1} as foliar or soil drench (Winston, 1992).

Ram and Tripathi, (1993) observed that paclobutrazol treatments increased flowering and fruiting in the new shoots when applied during September to November by reducing the vegetative growth (30-35%) in mango.

Desai and Chundawat (1994) reported that paclobutrazol treatment significantly increased the number of panicle per tree with significant increase in size of panicle and number of total flowers per panicle.

Srihari and Rao (1997) reported that the maximum flowering of 57.5 per cent flowered directly on previous season fruited shoots of the trees treated with paclobutrazol at the rate of 10 g a.i. tree^{-1} applied to the soil at 2 feet away from the trunk in Alphonso cv. of mango.

Sarkar *et al.*, (1998) have studied the effect of paclobutrazol on soil drench (1.5, 3.0 and 6.0 g a.i. per tree) and foliar application of cycocel and chlormequat and reported that paclobutrazol 6.0 a.i.tree⁻¹ greatly reduced the number of male flowers and increased the sex ratio in cv. Kesar of mango.

Kurian and Iyer (1993_a) reported that early and profuse flowering was a striking response for paclobutrazol treatments in nine year old mango trees when observed for two successive years. Treatments resulted in condensed panicles, enhanced proportion of hermaphrodite flowers and reduced pollen fertility. Tongumpai *et al.*, (1993) reported that drenching the mango tree basins with paclobutrazol @ 6 g a.i. tree⁻¹ induced early flowering.

Medina-Urrutia and Campbell (1994) treated six year old mango trees with paclobutrazol and found an early and profuse flowering in response to soil application of paclobutrazol.

Application of paclobutrazol at 2.5, 5.0, 7.5 and 10.0 g a.i. tree⁻¹ during July 1992 after pruning was found to advance the flowering by 11.4, 19.2, 26.8 and 28.8 days respectively in mango (Burondkar *et al.*, 1997).

Shinde *et al.*, (2000) reported that the application of paclobutrazol applied @ 3 ml and 5 ml m⁻² and 90 days before bud break (15th August) and 120 days before bud break (15th July) significantly increased the flowering (68.48 to 80.60 per cent) in mango.

Zora Singh *et al.*, (2000) reported that the application of paclobutrazol to mango cv Dashehari as foliar spray and soil drenching has decreased the panicle length but increased the percentage of hermaphrodite flower per panicle and fruit set.

Hoda *et al.* (2001) also observed an increased fruit set (43.25) in cv Langra by soil application of 10 g a.i. tree⁻¹ of paclobutrazol.

Burondkar *et al.*, (2000) reported that application of paclobutrazol at 0, 2.5, 5.0, 7.5 and 10.0 g a.i tree⁻¹ advanced the flowering by 12.6, 20.3 27 and 28.3 days respectively and increased number of flowers per panicle by 64.9, 76.6, 84.64 and 85.71 respectively in Alphonso cv. of mango.

Vijayalakshmi and Srinivasan, (2000) reported that the application of 10 ml paclobutrazol resulted in longest panicle (31.57cm), maximum number of hermaphrodite flowers (189.67) and number of male flowers (425) during the off year in cv Alphonso of mango.

Shinde *et al.*, (2002) reported that the highest flowering percentage of 71.66 was obtained in the old Alphonso mango by center opening and application of paclobutrazol to the soil.

2.2.3 Effect of paclobutrazol on yield:

Soil application of 8 g a.i. tree⁻¹ of paclobutrazol for the cashew increased the number of nuts per panicle (114 per cent) and nut yield per tree (73.0 per cent) (Anon. 1999).

Spray application of cultar ® 1000 ppm together with KNO₃ 1 per cent to mature lateral shoots of cashew before flushing during late October significantly increased the nut yield tree⁻¹ (4.3 kg) when compared to control (1.7 kg) by Pushpalatha (2002).

Kulkarni (1988) reported that there was a significant increase in yield per tree when paclobutrazol was applied to mango trees. Similar results of higher and early yields were also reported in mango when trees were treated with paclobutrazol (Feungchan *et al.*, 1989).

Burondkar and Gunjate (1991) observed that soil application of 5 to 10 g or a foliar application of 1000 ppm of paclobutrazol were found to be significantly more effective for consistent and higher yield.

Fruit yield in mango was enhanced at 2.5 or 5.0 g a.i. per tree but at 10.0 g a.i. tree⁻¹ it reduced the yield (Kurian and Iyer, 1993b). Singh and Dhillon (1992) reported that application of paclobutrazol either as foliar spray or as a soil drench prior to fruit bud differentiation enhanced yield compared to controls in the cv. Kingston Pride of mango.

Burondkar and Gunjate (1993) stated that yield increased to 101.87 fruits tree⁻¹ when compared to control in mango. Medina-Urrutia and Campbell (1994) reported that high annual yield (195 kg tree⁻¹) was obtained with soil application of 6 l of paclobutrazol ha⁻¹ in mango cv Tommy Atkins when compared to control (112 kg tree⁻¹).

The 'off' year yield as percentage of the previous 'on' year yield was significantly higher (88.35%) in the trees received paclobutrazol 10 g a.i. tree⁻¹ applied at 2 feet away from trunk (Srihari and Rao, 1997). Rao *et al.*, (1997) reported that the highest 55 percent of the 'off' year yield of preceding 'on' year in the trees treated with paclobutrazol at the rate of 2000 ppm foliar spray in Alphonso cv. of mango.

Sarkar *et al.*, (1998) reported that there was highest fruit yield tree⁻¹ (12.79 kg) on the application of 3 g a.i. tree⁻¹ of paclobutrazol in mango. It was 294.8 per cent increase over the control.

Shinde *et al.*, (2000) reported that the application of paclobutrazol at 0.75 g and 1.25 g a.i. m² area significantly increased fruit yield from 30.03 kg tree⁻¹ in control to 92.82 to 117.87 kg per tree respectively.

Hoda *et al.*, (2001) reported that the trees treated with cultar ® as soil application @ of 5 g a.i. tree⁻¹ produced maximum number (232.23) of fruits as well as weight (54.26 kg tree⁻¹).

Medina-Urrutia (1995) reported that soil application of paclobutrazol significantly increased the yield of 12.6 ton ha⁻¹ over control trees in the cv Tommy Atkins mango. Zora Singh *et al.*, (2000) reported that soil application of cultar ® (20-40 g tree⁻¹) was the best treatment to promote yield in Dashehari mango.

Mendonca *et al.*, (2002) reported that application of paclobutrazol at 1000 and 1500 ppm increased the number of fruits per plant by 280 and 250 percent respectively. Avilan *et al.* (2001) among different treatments application of paclobutrazol @ 2.5 a.i. tree⁻¹ produced the highest yield 22.69 ton ha⁻¹ in mango.

Shinde *et al.*, (2002) reported that the application of paclobutrazol gave the highest fruit number (228.66) and mean yield of 44.65 kg tree⁻¹ in the cv. Alphonso in mango. Faizan Ahmed *et al.*, (2000) reported that the application of paclobutrazol at 5 ml m² of canopy spread gave higher yield of 52.06 kg when compared to control (37.49 kg) in Rose scented litchi.

2.3. Effect of alar (SADH or daminozide):

The effectiveness of synthetic growth retardant Alar® (succinic acid 2,2 di methyl hydrazide) in orchard management of temperate fruit crops especially in apple had adequately been reviewed in literature. Among the tropical fruit crops a major part of the research work for regulation of flowering using the growth retardant is seems to be undertaken in mango trees.

2.3.1. Effect of alar on vegetative growth:

Foliar sprays of alar applied early in the spring on young apple trees reduced extension of growth (Veinbrants, 1972).

Erasmus and Zyl (1974) observed that alar at 1000 ppm to 3000 ppm applied 25 or 48 days after full bloom greatly reduced the rate of shoot elongation while 1000 or 2000 ppm applied after full bloom significantly reduced shoot growth and increased flower bud differentiation (Dimitrovski *et al.*, 1976).

Das and Pandey (1976) reported that the application of both daminozide and maleic hydrazide applied to the shoots during September increased shoot diameter and delayed the appearance of subsequent flushes in mango. And daminozide at 7000 ppm increased flowering shoot to 66 per cent as against 27 per cent in control.

Effect of spraying growth retardant, alar at 1000 and 2000 ppm at two times viz., May and full bloom reduced the growth in the following year in apple (Atawia and Hassan, 1995).

Singh and Sharma, (1973) reported that the effect of growth retardant alar (daminozide) at 2000, 4000 or 6000 ppm reduced the shoot growth as inter nodal

length but did not affect shoot diameter or inter node number on two year old grafted pear plants.

Foliar spray of alar (daminozide) at 1500 or 3000ppm tree⁻¹ suppressed the flushing, shoot length, leaf number and leaf area in mango (Kurian and Iyer, 1993a).

Total chlorophyll content per leaf area unit was increased by the foliar application of daminozide at 2000 ppm to the trees of apple cultivars was reported by Melrose and Granny Smith and no carry over effects on the leaf characteristics (Milatovic D, 2001).

The daminozide at 1000, 2000 or 4000 ppm at 2, 6 or 12 weeks after full bloom in Red Delicious apples the total leaf chlorophyll content was increased with increased concentration. (Pant *et al.*, 1985).

The peanuts were sprayed with an aqueous solution of 2000 ppm B9 (daminozide) the cells of the assimilation tissue enlarged and the thickness of the leaves, the number of chloroplasts, grana and lamella were increased. And also leaf chlorophyll content also increased (Chen and Pan, 1986)

Total leaf chlorophyll decreased rapidly after treatment then gradually leveled off, but was reduced while daminozide at 2000 ppm + GA3 at 50 ppm combination of foliar spray on sweet persimmon (*Diospyrous kaki* L.) (Lee and Kim, 1991).

Grauslund (1983) reported that there was a reduction in vegetative growth in the second year by the application of cycocel and SADH (daminozide) in the cv Le Conte pear.

Cobianchi ~~D~~ (1986) reported that application of daminozide at 0.66 g per tree for two times (June 1982 and April 1983) reduced the tree size to an extent of 30 per cent in the young cherry trees.

Weston (1982) reported that the application of daminozide @ 4 g dm⁻¹ at 2.6 cm spaced radish plants (high density planting) leaf area was increased (83.2 cm²) bud stem length was reduced (0.45 cm) when compared to the normal spaced planting and increased the root fresh weight (8681 g m⁻²) of radish.

Alar (daminozide) at 2000, 4000 and 6000 ppm was found to reduce shoot growth and inter nodal length but did not affect the shoot diameter or inter node number.

Isoda (1989) reported that the application of 0.2 per cent SADH (daminozide) to the Kyoho grapes, shoot growth was checked and the effect of daminozide was confined to the year of treatment with no carry over response.

2.3.2. Effect of alar on reproduction:

Application of alar at 2000 ppm, 25 days after full bloom significantly increased flower bud differentiation and yield (Dimitrovski *et al.*, 1976).

In studies with the cultivars of mango spraying of alar at 5000 ppm at monthly intervals from May to December recorded higher percentage of flowering (Suryanarayana, 1977). Spraying apple trees with 2000 ppm alar (daminozide) two years after full bloom increased flowering in the following year (Ramirez and Hoad, 1984).

Rao and Ravishankar, (1992) reported that two sprays of alar at 500 ppm at fortnightly interval up to middle October produced highest mean number of panicles per shoot in apple. Effect of spraying growth retardant alar at 1000 or 2000 ppm at two times viz., mid-May and full bloom was studied by Atawia and Hassan (1995) in apple and found that spraying at mid-May showed the effect of reducing the growth and enhancing flower production in the following year.

Sprays of alar at 1500 or 3000 ppm slightly increased the flowering in the first year and reduced the flowering in the second year in mango cv. Alphonso. Treatments variously resulted in the condensed panicles and enhanced proportion of hermaphrodite flowers and a reduction of pollen fertility (Kurian and Iyer, 1993a).

Application of a mixture of ethephon and SADH (daminozide) at 200 ppm 2 days after flowering associated with excessive flower bud formation which usually resulted in abundant cropping in the following season in the apple cv. Lobo and Spartan (Basak *et al.*, 1988).

SADH (daminozide) application at 1000 ppm at full bloom stage enhanced the percentage of fruit set and found to be most effective when compared to all other treatments in Granny Smith (Ramina *et al.*, 1986).

Full application of SADH (daminozide) to the apple trees promoted blooming of apples and this increment in blooming intensity was also proportional to the concentration of SADH used and highest of 95.82 per cent was recorded at 7500 ppm of SADH and maximum fruit set of 87.69 per cent and low fruit drop of 36.38 per cent was recorded when the trees treated with 5000 ppm of SADH (Singh and Chadha, 1989).

Application of SADH at 500 and 1000 ppm were also found statistically at par with the best treatment (chlormequat chloride 1000 ppm) in respect of final fruit set of 37.7 per cent in pear cv. Le Conte (Singh *et al.*, 2003).

2.3.3 Effect of alar on yield:

Alar at 2000 ppm applied after full bloom significantly increased the yield in apple trees (Dimitrovski *et al.*, 1976). The apple trees treated with 0.3 per cent alar (daminozide) four weeks after flowering increased the yield and decreased the fruit weight (Kirillova and Toma, 1985).

Treatment with alar at 2000 or 3000 ppm did not produce any marked effect on number flower bud and fruiting intensity in pear (Piper and Sadowaski, 1987).

Application of SADH @ of 500 ppm and 1000 ppm significantly increased the yield (47.8 and 51.2 kg tree⁻¹ respectively) compared to control (15.5 tree⁻¹) in pear cv Le Conte (Singh *et al.*, 2003).

Application of ethephon + SADH mixture increased both the total yield and fruit size but over thinning was also observed in apples when sprayed 400 ppm of ethephon and 500 ppm of SADH mixture (Basak and Niezborala, 1991).

Application of daminozide at 1700 mg l⁻¹ consistently increased the proportional and absolute total yields (0.9 kg tree⁻¹) and also increased the per cent red coloured fruits (48 per cent) in cherries cv. Merton Glory and Van Cherries (Irena Modlibowska and Wickenden, 1982).

Extension of growth was least at the highest daminozide rate and fruit yields were highest in trees treated with highest of 2000 or 4000 ppm at 6 or 12 weeks after full bloom in Red Delicious apples (Pant *et al.*, 1985).

Maximum average yield per tree (96.0 kg tree⁻¹) was recorded in the treatment of SADH 5000 ppm in apples and highest yield efficiency of 3.2 (Singh and Chadha, 1989).

Application of daminozide + ethephon spray increased the cumulative per tree yield of Delicious cv. of apple (81.3) (Richard and George, 1995).

2.4 Correlations:

The percentage of flowering shoots per unit area of tree canopy and total surface canopy area reported having strong positive and a weak positive correlation by hermaphrodite flowers with yield between in cashew (Parameswaran *et al.*, 1984b).

Anitha *et al.*, (1991) reported that nut yield was positively, highly and significantly correlated with number of nuts per panicle (+0.961) and mean number of perfect flowers per panicle (+0.564) in cashew.

Manoj *et al.*, (1994) reported that nut yield per tree had a significant positive correlation with mean canopy spread (+0.57), number of nuts per panicle (+0.36), height of the tree (+0.26) and individual nut weight (+0.24).

Materials & Methods

CHAPTER III

MATERIAL AND METHODS

The present investigation was carried out at the Cashew Research Station, Bapatla, Guntur District of Acharya N.G. Ranga Agricultural University, during the years 2001-02 and 2002-2003 to study the effect of pruning and plant growth retardants on growth and development of cashew (*Anacardium occidentale* L.)

3.1 Geographical Location:

The Cashew Research Station, Bapatla, Guntur district, Andhra Pradesh is located at an elevation of 5.49m above mean sea level and is situated on latitude of 15° 54' and longitude of 80° 28' East and about 7km away from the Bay of Bengal.

3.2 Weather:

The monthly mean maximum temperature ranged from 22.6°C to 39.2°C during the year 2001-02 and 29.0°C to 38.7°C during the year 2002-03. The mean minimum temperature ranged from 18.0°C to 28.2°C and 17.0°C to 27.8°C during 2001-02 and 2002-03 respectively. A total rainfall of 1097.8mm and 704.0mm (30% deficit of normal rainfall of 1000mm) was received during the year 2001-02 and 2002-03 respectively. The meteorological data for the experimental period was recorded and presented in the Appendix-I to III.

3.3 Soils:

The soil on which the experimental cashew trees were planted was a coastal sandy soil with low water holding capacity.

Plate 1: Place of experimentation



Cashew Research Station, Bapatla



View of the Experimental Plot

3.4 Varieties:

Two varieties viz., BPP-4 (vigorous) and BPP-6 (off-season type/late season) released from the Cashew Research Station, Bapatla during the year 1982 were selected and studied in all the three experiments carried out in the present investigation.

The brief description of the two varieties are furnished below:

Character	BPP-4 (9/8 Epurupalem selection)	BPP-6 (Selection of T.No.56)
Canopy type	Open	Open
Branching type	Extensive	Extensive
Flowering	February-April	February-May (even upto June)
Nut weight	5.0 g	6.0g

3.5. Age of the trees:

The five year old trees, on which the present investigation was taken up were soft-wood grafts and were planted at a spacing of 4x4m distance during January, 1997 in the scion block of Cashew Research Station, Bapatla.

3.6 Plot Size:

Cashew trees of uniform growth, size and vigour were selected from both the varieties of BPP-4 and BPP-6. A single tree in each variety was considered as experimental plot and the treatments were imposed on the trees separately as suggested by Rath *et al.*, (2003).

3.7 Experiment I: Effect of time and level of pruning on growth and development of cashew:

It consists of three factors viz., varieties (two), time of pruning (three) and level of pruning (four).

3.7.1 Design:

The experiment with 24 treatments derived from the above factors was conducted in a mixed factorial randomized block design. The treatments were replicated twice adopting two trees separately for each treatment. Thus the experiment was conducted in 48 trees. The details of the experimental treatments are as follows.

Factor 1	Two varieties	V1 (BPP-4) V2 (BPP-6)
Factor 2	Four levels of pruning	L0- No pruning (control) L1- Leader shoot pruning L2- Lateral shoot pruning L3- Leader + Lateral shoot pruning
Factor 3	Three pruning times	T1- Mid July T2- Mid August T3- Mid September

3.7.2 Time of pruning:

The experimental trees selected were pruned during the months of mid-July (T1) (from 10th to 15th July), mid August (T2) (from 10th to 15th August) and mid-September (T2) (10th to 15th September) during both the years of study i.e., 2001-02 and 2002-03 as per the programme.

3.7.3 Level of pruning:

The selected trees were pruned over the canopy surface area of a tree. The pruning was done uniformly on the shoots measuring length of 5 cm from apex of every shoot.

3.8 Experiment II: Effect of paclobutrazol on growth and development of cashew varieties by soil application:

It consists of two factors viz., varieties (two) and paclobutrazol concentrations (five).

3.8.1 Design:

The experiment with 10 treatments derived from the above factors was conducted in a mixed factorial randomized block design. The treatments were replicated thrice adopting three trees separately for each treatment. Thus the experiment was conducted in 30 trees. The details of the experimental treatments are as follows.

Factor 1	Two varieties	V1 (BPP-4)
		V2 (BPP-6)
Factor 2	Five levels of paclobutrazol concentrations	C0- Without application (control)
		C1- 2 g a.i. per tree
		C2- 4 g a.i. per tree
		C3- 6 g a.i. per tree
		C4- 8 g a.i. per tree

3.8.2 Paclobutrazol (pp333):

The paclobutrazol (Cultar®) the commercial grade product procured from Zeneca Agrochemicals Ltd., Kollurupuram, Chennai of 25 EC formulation was used for soil application as a source material.

3.8.3 Method and time of application:

The paclobutrazol dissolved in the 5 L of water was applied around the tree i.e., 1.5m away from the tree trunk by making a trench and covered with the soil in the month of August during the both the years of study as suggested by Anon. (2000).

3.9 Experiment III: Effect of Alar on growth and development of cashew varieties by foliar application:

It consists of two factors viz., varieties (two) and alar concentrations (seven).

3.9.1 Design:

The experiment with 14 treatments derived from the above factors was conducted in a mixed factorial randomized block design. The treatments were replicated twice adopting one tree separately for each treatment. Thus the experiment was conducted in 28 trees. The details of the experimental treatments are as follows.

Factor 1	Two varieties	V1 (BPP-4)
		V2 (BPP-6)
Factor 2	Seven levels of alar concentrations	C0- water spray (control)
		C1- 500 ppm single spray
		C2- 500 ppm double spray
		C3- 500 ppm triple spray
		C4- 1000 ppm single spray
		C5- 1000 ppm double spray
		C6- 1000 ppm triple spray

3.9.2 Alar:

The alar (succinic acid 2,2 di-methyl hydrazide) 99% of the laboratory grade product procured from Loba Chemie Private Ltd., Mumbai was used for the foliar application as source material.

3.9.3 Method and time of application:

Spray solution of different concentrations of growth retardant (as per treatment) were prepared in parts per million on the basis of dissolving one milligram of growth retardant in 1000ml of water to get 1 part per million (ppm). The spray solution of

growth retardant was freshly prepared during each round of spray by dissolving required quantity of growth retardant in small quantity of absolute methyl alcohol and then made up to required volume by adding water. Teapol (0.2 ml/L) as used as a surfactant.

The quantity of spray solution required per spray to cover the entire canopy of the tree was worked out by initially spraying with water. Then, the quantity of spray solution was prepared.

The interval of spraying is 15 days from the mid-August during the year 2001-02 and 2002-03. Accordingly two and three sprayings were given in each treatment of Alar by foliar application in different doses as per programme of research work.

3.10 Observations recorded:

Four uniformly growing shoots were selected from the middle portion of the four directions of the tree at 50 per cent flowering stage and tagged for the purpose of recording observations on vegetative growth, flowering and fruit characters.

3.10.1 Vegetative growth characters:

The observations for the some of the important vegetative growth characters such as incremental growth for plant height, stem girth, mean canopy spread, number of shoots per square meter, shoot length, number of leaves per square meter and leaf area per shoot were recorded when the plants had completed the current seasons growth (during the month of January of the succeeding year).

3.10.1.1 Incremental growth in plant height (cm):

The difference of the growth for the initial year to the year after the treatment imposition was calculated for the plant height. Height of the tree from the ground level to the top most growing point was recorded in each year with the help of straight graduated bamboo stick marked with white paint as adopted by Anon. (1999).

3.10.1.2. Incremental growth in stem girth (cm):

The perimeter of the main trunk at 50 cm height from the ground level was measured as a girth of stem using a tape. The difference of the stem girth for the initial year to that of the year of treatments imposition was calculated as adopted by Anon (1999).

3.10.1.3 Incremental growth in mean canopy spread (cm):

The canopy diameter was calculated as the mean of the diameters in two directions i.e., East-West and North-South using a straight graduated bamboo stick marked with white paint, which was expressed in centimeters. The difference in the mean canopy spread of the growth for the initial to that of year of treatment imposition was calculated as adopted by Anon. (1999).

3.10.1.4 Number of shoots m⁻²:

The numbers of shoots (both terminal and laterals) developed per unit surface area on trees given different treatments were recorded at the end of each vegetative growth phase (January month). The counting of shoot was taken up randomly on four directions using a square of wooden frame and the averages were calculated for each replication as suggested by Kumar *et al.*, (1995)

3.10.1.5 Shoot length (cm):

The length of the current seasons fully grown shoot was recorded by measuring the length from point of the origin of new growth to the base of the panicle by using meter scale as suggested by Anon. (1999).

3.10.1.6 Number of leaves m⁻²:

The number of fully expanded leaves on every shoot in a square meter area was recorded from four directions of the tree canopy and the averages were calculated for each replication as suggested by Anon. (1999).

3.10.1.7 Leaf area per shoot (cm²):

The total leaves of the shoot were collected from the four directions of the tree canopy and the individual leaves measured for leaf area by using Delta T Model leaf area meter and expressed in “square centimeters”.

3.10.1.8. Chlorophyll-a and Chlorophyll-b content in leaves (mg / gram of weight):

The chlorophyll content in the index leaf (3rd or 4th leaf from the tip of shoot) was estimated colorimetrically by di-methyl sulphoxide (DMSO) method of Hiscox and Stan (1979). Leaf samples were collected in each replication from all the treatments of the cashew experimental trees. A leaf sample of 150 mg was taken and immersed in 10 ml of pure di-methyl sulphoxide (DMSO) contained in stoppered specimen tube for 3 hrs. and kept in a dry oven maintained at 60°C to 65°C. The optical densities of the supernatant liquid were taken at 645 and 663 nm. in Spectronic-20 colorimeter and chlorophyll content was calculated according to the following formula as suggested by Arnon (1949).

$$\text{Chl.a} = (12.7 \times D_{663}) - (2.69 \times D_{645}) \times V/1000 \times W$$

$$\text{Chl.b} = (22.9 \times D_{645}) - (4.68 \times D_{663}) \times V/1000 \times W$$

V= Volume of di-methyl sulphoxide (DMSO)

W= Fresh weight of sample taken

3.10.2 Flowering characters:

The character such as flowering shoots per square meter, non-flowering shoots per square meter, number of panicles per square meter, time of flowering (duration in days), number of hermaphrodite flowers in each panicle were recorded and the sex-ratio was calculated during the month of February-March i.e. at 50 per cent flowering stage.

3.10.2.1 Number flowering shoots m⁻²:

The counting of flowering shoots was taken up randomly in all four directions of the surface canopy using a one square meter wooden frame and the averages were calculated as adopted by Anon.(1999).

3.10.2.2 Number non-flowering shoots m⁻²:

The counting of non-flowering shoots was taken up randomly in the four directions of the tree surface canopy using one square meter wooden frame and the averages were calculated. The ratio of the flowering to non-flowering shoots per square meter was worked out as adopted by Anon. (1999).

3.10.2.3 Number of panicles m⁻²:

The total number of panicles per square meter was recorded by counting the panicles in all four directions of the surface tree canopy by using one square meter wooden frame and the averages worked out as adopted by Anon. (1999).

3.10.2.4 Time of flowering (duration in days):

The duration of flowering in a tree was recorded based on the total number of days taken from first flower bud opened on the tree to the last flower bud opened on the tree from a tagged panicle of each direction and the averages were worked out as adopted by Anon. (1999).

3.10.2.5 Number of hermaphrodite flowers panicle⁻¹:

The number of male and hermaphrodite flowers per panicle from the day of first flower opening to the last flower bud opened was recorded from the four directions of the tree and the averages were calculated as adopted by Anon. (1999).

3.10.2.6 Sex ratio:

Sex ratio was calculated by dividing the total number of male flowers produced by the total number of hermaphrodite flowers produced in the panicle and expressed as male to hermaphrodite ratio as suggested by Sapkal *et al.* (1994).

$$\text{Sex ratio} = \frac{\text{Total number of staminate flowers}}{\text{Total number of hermaphrodite flowers}}$$

3.10.3 Fruit (nut) characters:

Fruit of cashew is a drupaceous nut. It forms from the hermaphrodite flower. The different nut characters at various developmental stages were recorded.

3.10.3.1 Percentage of fruits set panicle⁻¹:

The percentage number of fruits set per panicle was calculated based on the number of fruits set in relation to the total number of hermaphrodite flowers produced in

each panicle of the four directions and the averages were calculated and expressed in “percentage” as adopted by Kumar *et al.*, (1995).

3.10.3.2 Number of nuts panicle⁻¹:

The total number of fruits per panicle was recorded by taking into the number of nuts that matured in each panicle. The total of fruits along with nuts retained on each panicle of the four directions were collected and averages were worked out as suggested by Kumar *et al.*, (1995).

3.10.3.3 Number of nuts reached maturity m⁻²:

The total number of fruits retained till maturity of all the panicles in a square meter collected in all the directions of the canopy and the averages were worked out as suggested by Kumar *et al.*, (1995).

3.10.3.4 Nut weight (g):

The mean weight of nut was recorded by taking the nut weight at different periods of harvesting season. The fallen nuts collected from the ground were sun dried for 48 hours and then nut weight was recorded as suggested by Kumar *et al.*, (1995).

3.10.3.5 Nut yield tree⁻¹:

The nut yield per tree was recorded by taking the weight of all the nuts harvested from the tree in different pickings and the averages worked out as suggested by Kumar *et al.*, (1995).

3.11 Statistical analysis:

The data were subjected to statistical analysis and the statistical significance was tested by 'F' value at 5 per cent level probability (Fischer and Yates, 1963) and the critical differences were worked out for the effects, which were significant. The analysis of variance for each character was done as per the standard statistical procedure for Factorial RBD given by Panse and Sukhatme (1978). Simple correlations among eight characters viz., mean nut yield per tree, plant height increment, canopy spread increment, number of shoots per square meter, number of panicles per square meter, number of hermaphrodite flowers per panicle, number of nuts per panicle, number of nuts reached maturity per square meter and nut weight were worked out as outlined by Fisher and Yates (1963).

Results

CHAPTER IV

RESULTS

Cashew (*Anacardium occidentale L.*) is a hardy crop grown in a semi-arid manner in the poor sandy soils of the coastal belt in South India. Although Cashew is more valued for its nuts in the international market the necessary management practices and attention was not given properly. Consequently, yield potential of cashew is very poor. On one hand the plant put up huge vegetative growth and producing profuse flowering in the season, but the percentage of fruit set and the marketable yield is quite low. As such it is believed that the plant is mostly utilizing the photosynthates towards unproductive vegetative growth at the cost of flowering and fruit setting. Therefore, in order to increase the yield potential of each cashew tree a balanced growth of the crop by various mechanisms have to be developed. In this regard, utilization of plant growth regulators and adoption of tree pruning methods may regulate the growth of crop. With this in view 3 different experiments viz., 1) effect of time and level of pruning on growth and development of cashew 2) effect of paclobutrazol on the growth and development of cashew 3) effect of alar on growth and development of cashew varieties by foliar spraying were carried out during the years 2001-02 and 2002-03 at Cashew Research Station, Bapatla. The observations were made on plant growth and yield attributing characters of cashew and the data were statistically analysed and presented below.

4.1 EFFECT OF TIME AND LEVEL OF PRUNING:

4.1.1 Incremental growth in plant height (cm):

The data on incremental growth in plant height as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were collected and statistically analysed and presented in the Table 4.1a and 4.1b.

4.1.1.1 During 2001-02:

The data of the table showed significant difference between the levels of pruning and their interactions of variety x pruning, pruning x time and variety, pruning and time interactions. The non-significant differences were recorded for varieties, time and variety x time interaction for the character incremental growth in plant height.

Between the varieties the non-significant differences were recorded. However, the variety BPP-6 (V2) recorded the lowest incremental growth in plant height of 73.13 cm. The variety BPP-4 (V1) recorded an incremental growth in plant height of 74.58 cm.

Among the pruning times, non-significant differences were recorded. However, the treatment mid-August pruning (T2) recorded the lowest incremental growth in plant height of 72.81 cm. The treatment mid-July pruning (T1) recorded the maximum incremental growth in plant height of 74.69 cm.

Among the levels of pruning, the treatment Leader+Lateral shoot pruning (L3) recorded the lowest incremental growth in plant height of 69.17 cm and it was significantly lower than the control (L0 76.25 cm). The treatment Lateral shoot pruning (L2) recorded the maximum incremental growth in plant height of 76.25 cm which was on par with the control (L0).

Table 4.1a: Incremental growth in plant height, stem girth, mean canopy spread and number of shoots m⁻² in cashew as influenced by pruning variety, time of pruning and level of pruning.

	Incremental growth in plant height (cm)			Incremental growth in stem girth (cm)		Incremental growth in mean canopy spread (cm)		Number of shoots m ⁻²	
	2001-02	2002-03		2001-02	2002-03	2001-02	2002-03	2001-02	2002-03
Varieties:									
BPP-4 (V1)	74.58	55.50		6.15	7.50	53.72	49.48	37.54	22.36
BPP-6 (V2)	73.13	43.13		6.28	5.83	52.32	49.19	35.21	21.38
Time of pruning:									
Mid-July (T1)	74.69	46.56		6.01	7.31	54.01	51.97	37.75	21.42
Mid-August (T2)	72.81	54.06		6.34	6.00	49.12	46.41	34.44	21.67
Mid-September (T3)	74.06	47.19		6.28	6.89	52.18	49.62	36.94	22.53
Level of pruning:									
Control (no pruning) (L0)	76.25	48.33		6.33	6.50	57.83	52.92	30.00	20.21
Leader shoot pruning (L1)	73.75	35.00		5.42	5.25	45.45	42.29	37.30	22.38
Lateral shoot pruning (L2)	76.25	60.00		6.25	6.42	63.01	56.21	36.00	20.42
Leader + Lateral shoot pruning (L3)	69.17	53.75		6.84	8.50	46.79	45.92	33.08	22.00
2001-2002:									
Varieties	S Em	CD		S Em	CD	S Em	CD	S Em	CD
Time of pruning	1.24	NS		0.14	NS	0.38	0.79	0.49	1.03
Levels of pruning	1.52	NS		0.17	NS	0.47	0.98	0.61	1.27
	1.74	3.63		0.20	0.41	0.54	1.13	0.71	1.46
2002-2003:									
Varieties	3.10	6.50		0.18	0.37	1.87	NS	0.22	0.45
Time of pruning	3.84	NS		0.22	0.46	2.30	NS	0.27	0.55
Levels of pruning	4.40	9.20		0.25	0.53	2.65	5.49	0.31	0.63



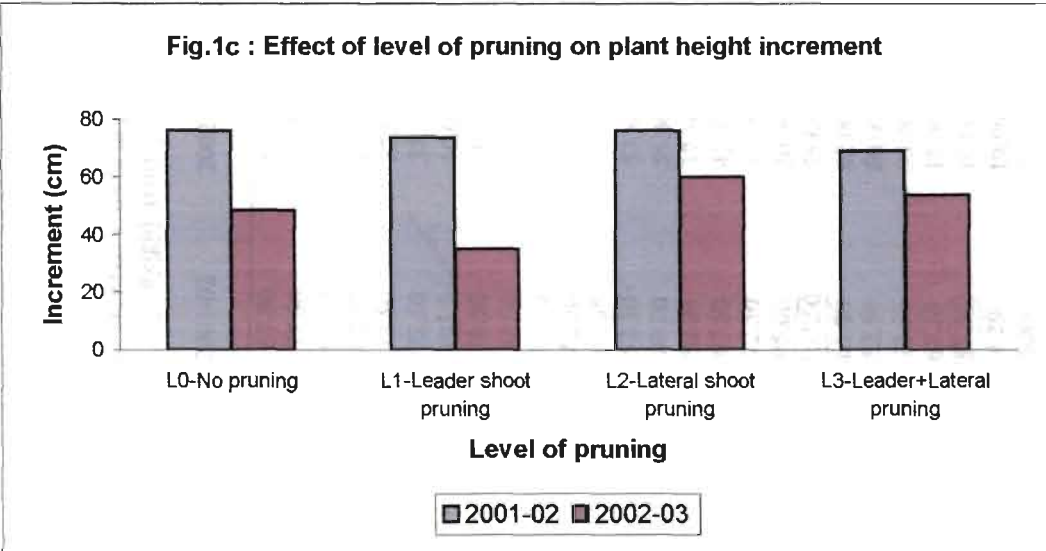
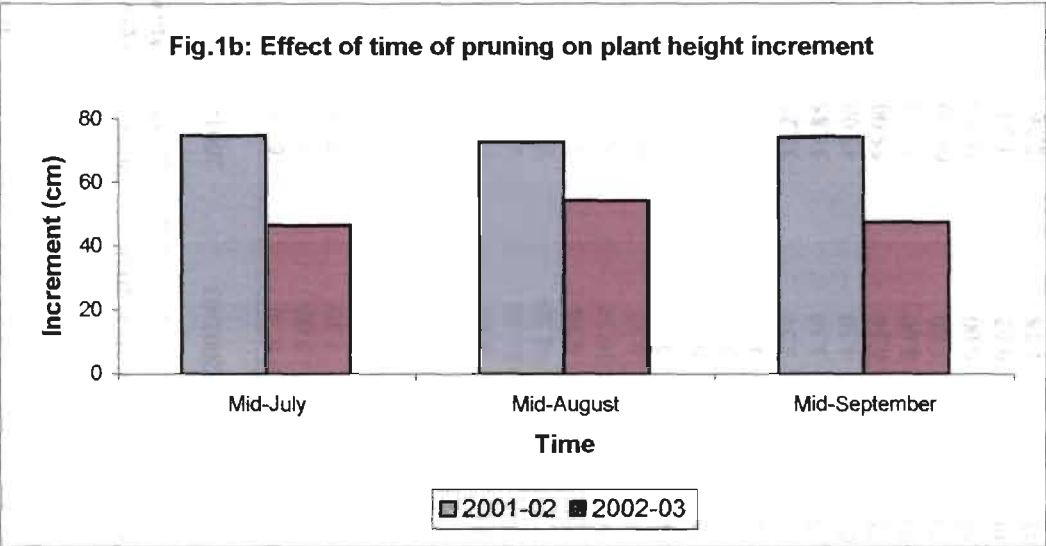
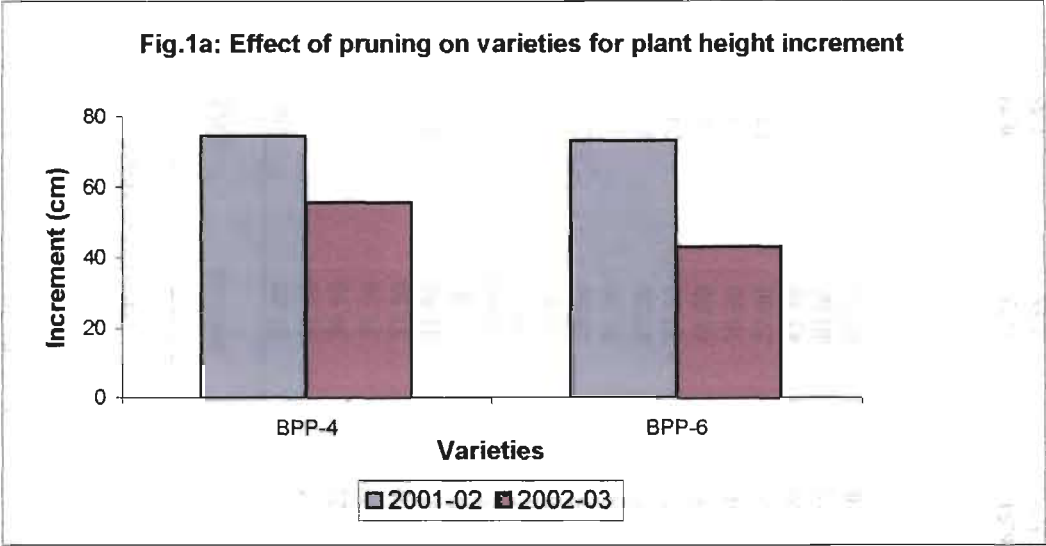


Table 4.1b: Incremental growth in plant height, stem girth, mean canopy spread and number of shoots m⁻² in cashew as influenced by interactions of variety, time of pruning and level of pruning.

INTERACTION:	Incremental growth in plant height (cm)		Incremental growth in stem girth (cm)		Incremental growth in mean canopy spread (cm)		Number of shoots m ⁻²	
	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03
V1L0T1	67.50	60.00	6.00	6.50	63.75	53.75	37.00	20.38
V1L1T1	72.50	40.00	8.00 ✓	8.00	57.75	51.25	51.50	28.63
V1L2T1	92.50	40.00	5.50	4.50	77.50	71.25	39.50	21.75
V1L3T1	62.50	25.00	6.25	6.50	36.25	30.00	37.50	22.00
V1L0T2	72.50	37.50	5.50	5.50	57.50	60.00	37.50	18.25
V1L1T2	72.50	37.50	4.50 ✓	5.50	35.00	30.00	41.50	26.38
V1L2T2	105.0 ✓	10.00 ✓	4.25	5.00	78.75	77.50	47.00	22.63
V1L3T2	70.00	70.00	5.25	6.50	56.25	53.75	33.00	18.00
V1L0T3	62.50	82.50	7.50 ✓	10.50	47.25	56.25	39.00	21.38
V1L1T3	67.50	67.50	6.75	14.50	23.75	20.00	25.00	22.25
V1L2T3	82.50	115.00	7.75 ✓	6.50	54.50	22.50	29.00	22.63
V1L3T3	67.05	80.00	6.50	10.50	56.50	67.50	33.00	24.12
V2L0T1	52.50 ✓	57.50	5.50	6.50	60.75	58.75	37.50	19.88
V2L1T1	80.00	55.00	6.50	7.00	32.25	32.50	27.50	24.50
V2L2T1	92.05	37.50	6.50	6.00	55.00	50.00	41.00	18.13
V2L3T1	67.50	42.50	5.25 ✓	6.00	57.50	52.50	35.00	22.13
V2L0T2	72.50	37.50	4.50	4.50	61.25	61.25	27.00	17.88
V2L1T2	95.00	30.00	6.50	3.50	31.25	20.00	45.50	27.63
V2L2T2	102.50 ✓	75.00	7.75 ✓	5.50	51.85	66.25	40.00	20.25
V2L3T2	65.00	62.00	6.00	4.50	43.00	27.50	32.50	21.50
V2L0T3	52.50	60.00	6.75	6.50	55.00	56.00	25.00	21.75
V2L1T3	72.50	35.00	6.25	8.00	35.50	57.00	43.00	21.88
V2L2T3	67.50	15.00	7.25	5.00	60.50	62.50	37.50	22.00
V2L3T3	57.50 ✓	10.00	6.50	6.00	50.00	46.00	31.00	19.13
SEm	4.29	10.90	0.49	0.62	1.33	6.51	1.73	0.75
CD (0.05)	8.89	22.50	1.01	1.28	2.76	13.46	3.58	1.55

Among the interactions significant differences were recorded. The lowest incremental growth of plant height was recorded by V1L2T2 (10.0 cm) and V2L3T3 (10.0 cm). The maximum incremental growth in plant height was recorded by V1L2T3 (115.0 cm). The other treatments of interactions effects recorded in between 15.0 cm to 82.5 cm of incremental growth in plant height.

4.1.2 Incremental growth in stem girth (cm):

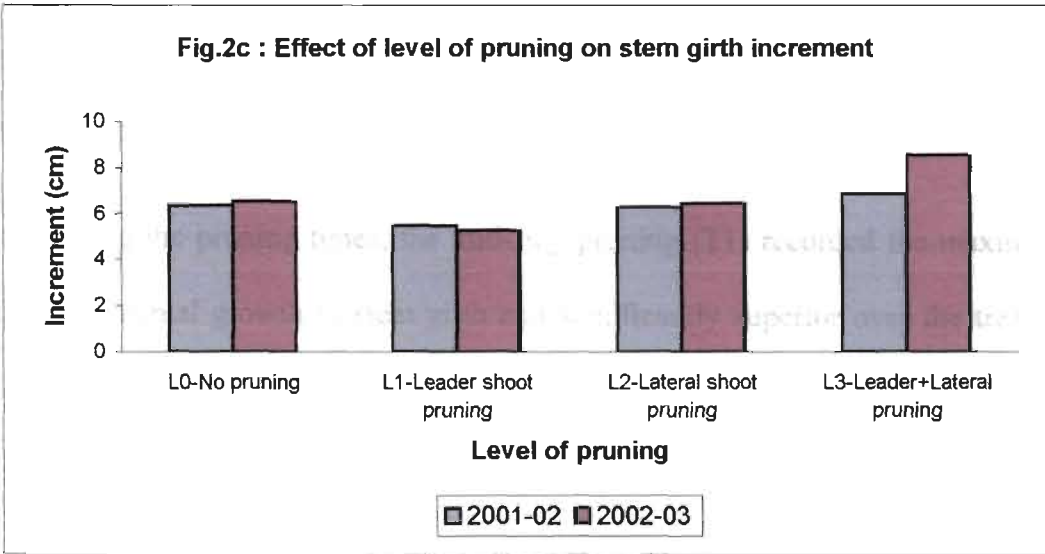
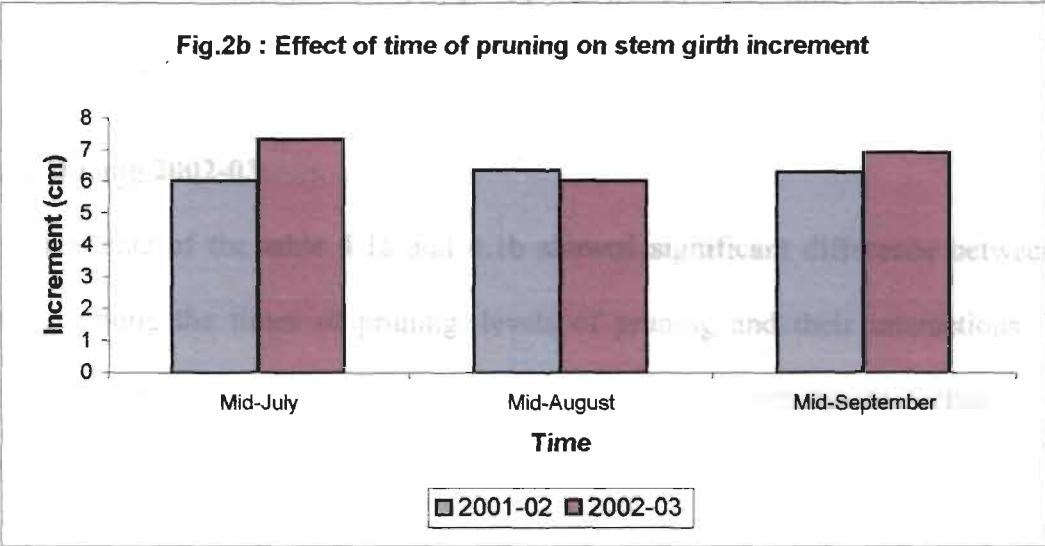
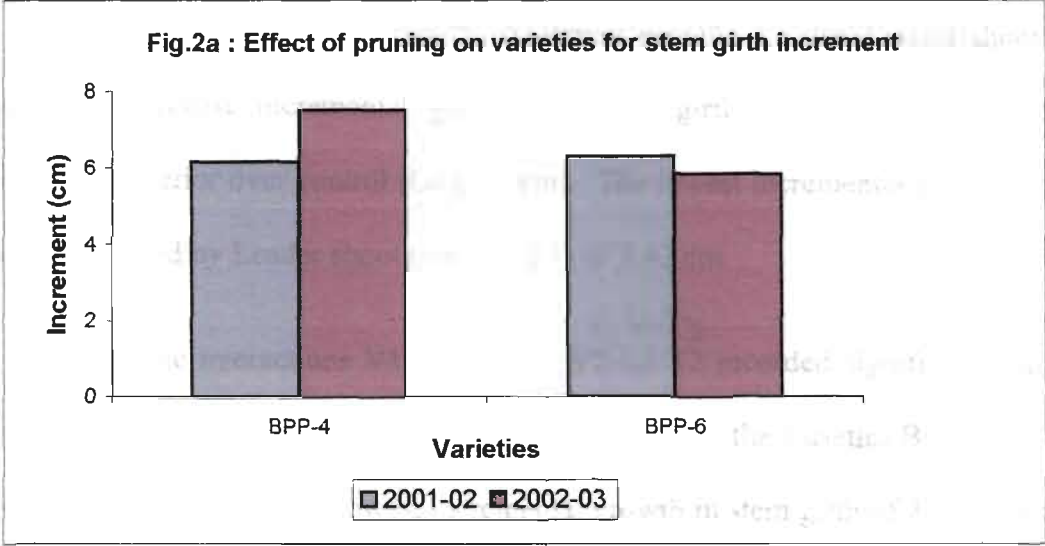
The data on incremental growth in stem girth as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were recorded, statistically analysed and presented in the Table 4.1a and 4.1b.

4.1.2.1 During 2001-02:

The data of the table showed significant differences between the levels of pruning and all their interactions. The non-significant differences were recorded for varieties and time of pruning for the character incremental growth in stem girth.

Between the varieties, non-significant differences were recorded. However, the variety BPP-6 (V2) recorded the maximum incremental growth in stem girth of 6.28 cm while the other variety V1 (BPP-4) recorded an incremental growth in stem girth of 6.15 cm.

Among the pruning times, non-significant differences were recorded. However, the highest increment in stem girth of 6.34 cm was recorded by mid-August pruning (T2). The minimum incremental growth in stem girth was recorded with the treatment mid-July pruning (T1) of 6.01 cm.



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Among the levels of pruning the treatment pruning Leader+Lateral shoot (L3) recorded the highest incremental growth in stem girth of 6.84 cm, which was significantly superior over control (L0 6.33 cm). The lowest incremental growth in stem girth was recorded by Leader shoot pruning (L1) of 5.42 cm.

Among the interactions V1 L1 T1 and V2 L2 T2 recorded significantly highest incremental stem girth of 8.0 cm and 7.8 cm respectively of the varieties BPP-4 (V1) and BPP-6 (V2) respectively. The lowest incremental growth in stem girth of 4.5 and 5.3 was recorded by the treatments V1 L1 T2 and V2 L3 T1. The other interaction effects recorded in between 4.3 cm to 7.5 cm of incremental growth in stem girth.

4.1.2.2 During 2002-03:

The data of the table 4.1a and 4.1b showed significant difference between the varieties, among the times of pruning, levels of pruning and their interactions. Non-significant differences were recorded for variety x time of pruning interactions for the character incremental growth in stem girth.

Between the varieties the variety BPP-6 (V2) recorded the maximum incremental growth in stem girth of 7.5 cm while the other variety BPP-4 (V1) recorded an incremental growth in stem girth of 5.83 cm.

Among the pruning times, the mid-July pruning (T1) recorded the maximum of 7.31cm incremental growth in stem girth and significantly superior over the treatments mid-August pruning (T2) and which is on par with mid-September pruning (T3 6.89 cm).

Among the levels of pruning Leader+ Lateral shoot (L3) pruning recorded the maximum of 8.50 cm incremental growth in stem girth significantly superior over control L0 (6.50 cm). The lowest incremental growth in stem girth of recorded by L1 (Leader shoot pruning 5.25 cm).

Among the interactions, highest incremental growth in stem girth was recorded by V1 L1T3 (14.5 cm) and V2L1T3 of 8.0 cm and it was the treatments V1L1T3 and V2L1T3 were significantly superior over their corresponding interactions. The V2L1T2 recorded minimum incremental growth of stem girth of 3.5 cm. The other interactions affects recorded in between 4.5 cm to 10.5 cm of incremental growth in stem girth.

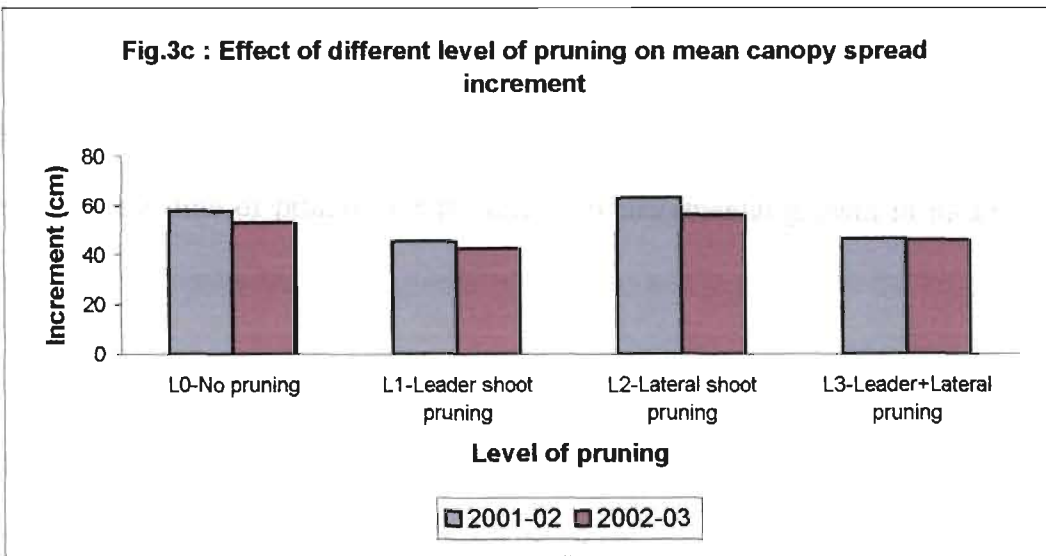
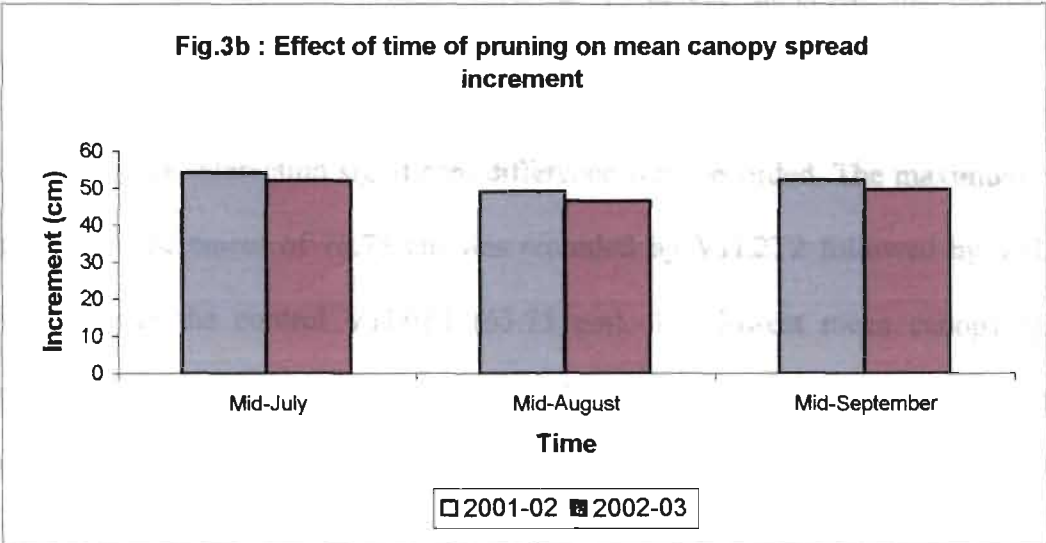
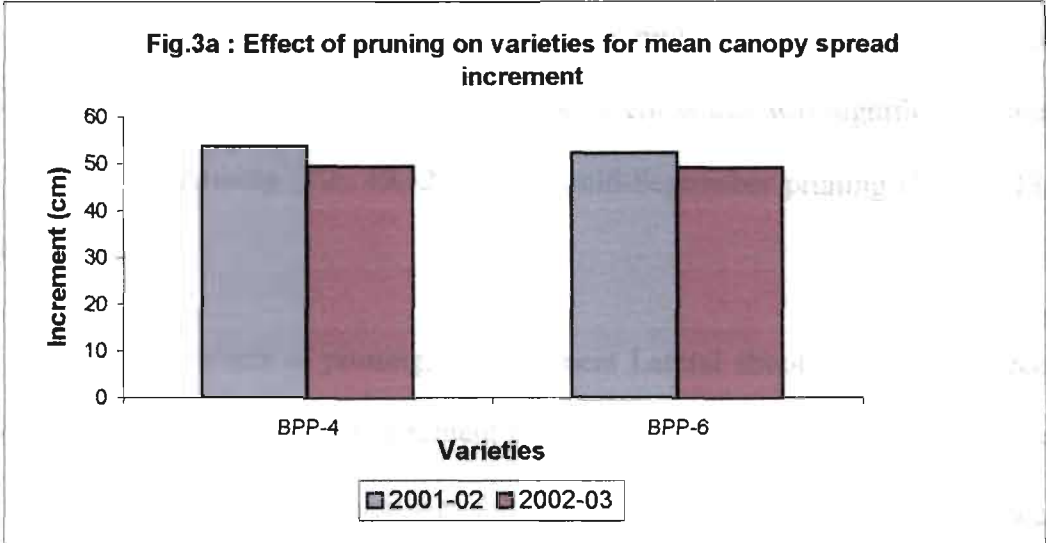
4.1.3 Incremental growth in mean canopy spread (cm):

The data on incremental growth in mean canopy spread of North-South and East–West direction of a tree as influenced by varieties, level of pruning, time of pruning and their interaction during the years 2001-02 and 2002-03 were collected and statistically analysed and presented in the Table 4.1a and 4.1b.

4.1.3.1 During 2001-02:

The data of the table showed significant difference between the varieties, level of pruning, time of pruning and for their interactions for the character incremental growth in mean canopy spread.

Between the varieties, the variety BPP-4 (V1) recorded the highest incremental growth in mean canopy spread of 53.72 cm while the other variety BPP-6 (V2) recorded 52.32cm of mean canopy spread increment.



Among the pruning times, the treatments mid-July pruning (T1) recorded a maximum mean canopy spread increment of 54.01 cm which was significantly superior over mid-August pruning (T2 49.12 cm) and mid-September pruning (T3 52.18 cm) treatments.

Among the levels of pruning, the treatment Lateral shoot pruning (L₂) recorded the highest mean canopy spread increment of 63.01 cm which was significantly superior over control (L₀ 57.83 cm) which was followed by Leader +Lateral shoot pruning (L₃ 46.79 cm) and the lowest 45.45 cm of mean canopy spread increment was recorded by the treatment Leader shoot pruning (L₁).

Among the interaction significant difference were recorded. The maximum mean canopy spread increment of 78.75 cm was recorded by V1L2T2 followed by V1L2T1 (77.50 cm) over the control V1L0T1 (63.75 cm). The lowest mean canopy spread increment of 23.75 cm was recorded by V1L1T3. The other treatments of interactions recorded a range from 32.25 cm to 63.75 cm of mean canopy spread increment.

4.1.3.2 During 2002-03:

The data of the Table 4.1a and 4.1b showed significant difference among the levels of pruning and their interactions. The non-significant differences were recorded for the varieties and time of pruning for the character incremental growth in mean canopy spread.

Between the varieties non-significant differences were recorded. However, the variety BPP-4 (V1) recorded the mean canopy spread incremental growth of 49.48 cm while the other variety BPP-6 (V2) recorded 49.19 cm of mean canopy spread increment.

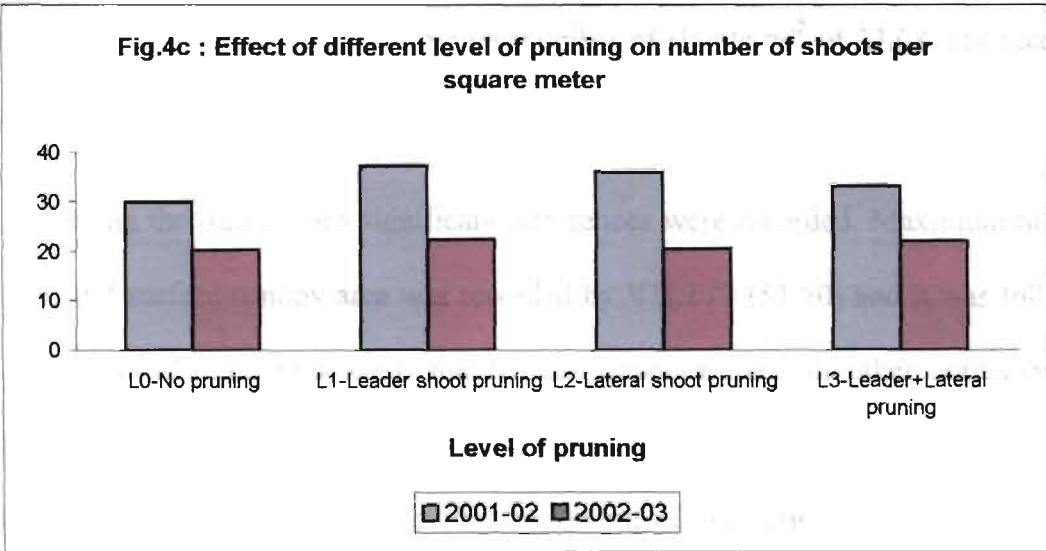
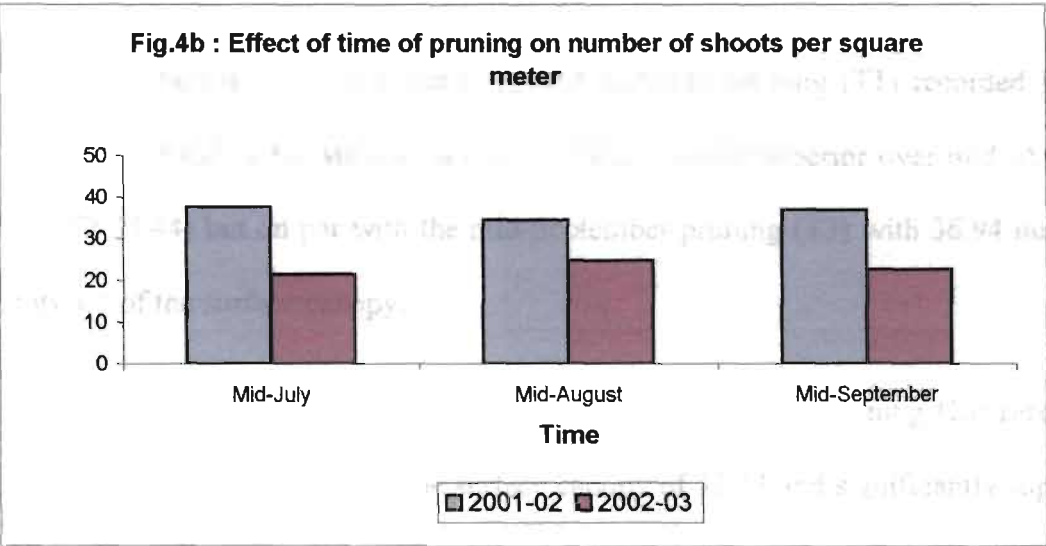
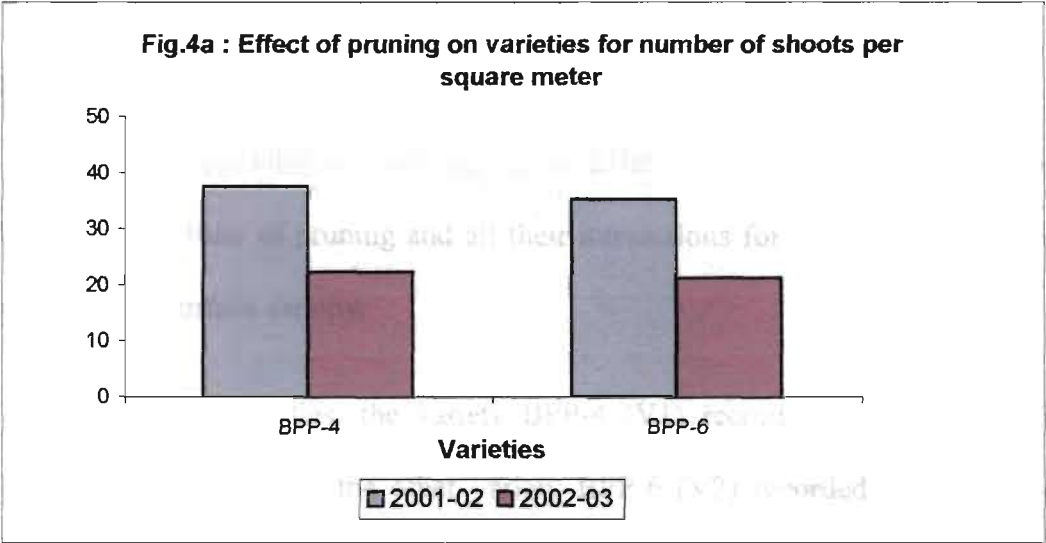
Among the pruning times, the non-significant differences were recorded. However, the treatment mid-July pruning (T1) recorded a maximum mean canopy spread increment of 51.97, which was followed by mid-September pruning (T3) of 49.62 cm. The lowest 46.41 cm of mean canopy spread were recorded by mid-August pruning (T2) of 46.41 cm.

Among the levels of pruning, the treatment Lateral shoot pruning (L₂) recorded significant highest mean canopy spread increment of 56.21cm which was followed by control (L₀) of 52.92 cm. The lowest mean canopy spread increment of 42.29 cm was recorded by the treatment Leader shoot pruning (L₁).

Among the interaction significant differences were recorded. The treatment V1L2T2 recorded maximum of 77.50 cm mean canopy spread increment it was followed by V1L2T1 (71.25 cm), which was significantly superior over the control (53.75 cm). The lowest mean canopy spread increment of 20.0 cm was recorded by treatment V1L1T3. The other treatments of interaction effects recorded a range from 27.50 cm to 67.50 cm of mean canopy spread increment.

4.1.4 Number of shoots m⁻² of the surface canopy:

The data on incremental growth in number of shoots m⁻² as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were collected and statistically analysed and presented in the Table 4.1a and 4.1b.



4.1.4.1 During 2001-02:

The data of the table showed significant difference between varieties, among the levels of pruning, time of pruning and all their interactions for the character number of shoots m^{-2} of the surface canopy.

Between the varieties, the variety BPP-4 (V1) recorded the maximum 37.54 number of shoots m^{-2} while the other variety BPP-6 (V2) recorded 35.21 number of shoots m^{-2} of the surface canopy.

Among the pruning times, the treatment mid-July pruning (T1) recorded 37.75 number of shoots m^{-2} of the surface canopy and significantly superior over mid -August pruning (T2 34.44) but on par with the mid-September pruning (T3) with 36.94 number of shoots m^{-2} of the surface canopy.

Among the levels of pruning, the treatment Leader shoot pruning (L_1) recorded maximum number of shoots m^{-2} of the surface canopy of 37.33 and significantly superior over control (L_0 30.0). It was followed by and Lateral shoot pruning (L_2 36.08) which was on par with each other. The minimum number of shoots m^{-2} of 33.08 was recorded by Leader+ Lateral shoot pruning (L_3).

Among the interactions significant differences were recorded. Maximum number of shoots m^{-2} surface canopy area was recorded by V1L1T1 (51.50) and it was followed by V2L2T2 (45.5) and they were significantly superior over all other corresponding interactions. The treatments V1L1T3 and V2L0T3 recorded minimum number of shoots m^{-2} of surface canopy of 25.00. The other treatments of interaction showed a range from 27.00 to 47.00 number of shoots m^{-2} of surface canopy.

Plate 2: Effect of pruning on production of shoots in the variety BPP-4



Control



Leader shoot pruning in July



Leader shoot pruning in August



Leader shoot pruning in September



Leader + Lateral shoot pruning in July



Leader + Lateral shoot pruning in August



Leader + Lateral shoot pruning in September

Plate 3: Effect of pruning on production of shoots in the variety BPP-6



Control



Leader shoot pruning in July



Leader shoot pruning in August



Leader shoot pruning in September



Leader + Lateral shoot pruning in July



Leader + Lateral shoot pruning in August



Leader + Lateral shoot pruning in September

4.1.5 Shoot length (cm):

The data on shoot length as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were collected and statistically analyzed and presented in the Table 4.2a and 4.2b.

4.1.5.1 During 2001-2002:

The data of the table showed significant difference between varieties, among the level of pruning, and their interactions. The non-significant differences were recorded by time of pruning for the character shoot length.

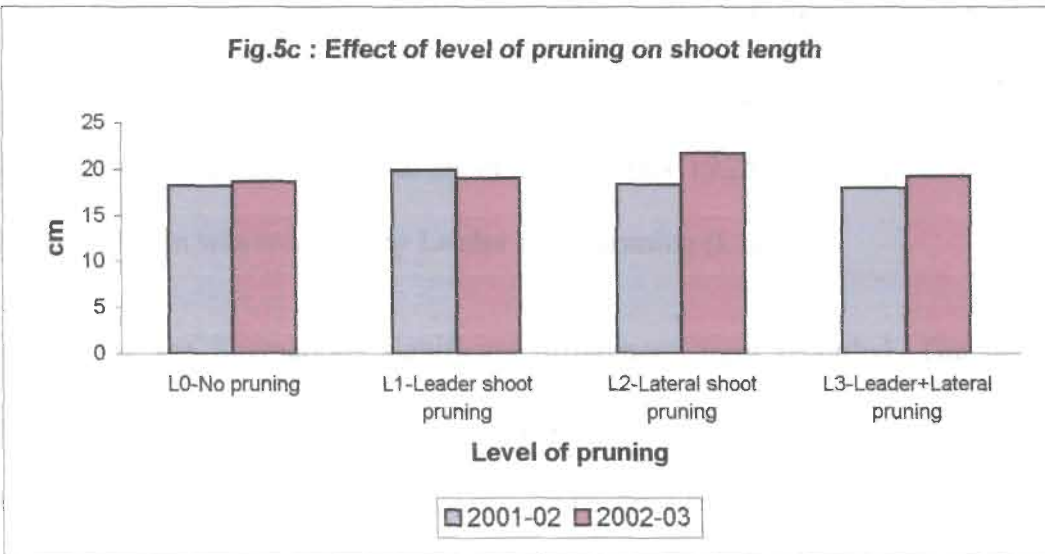
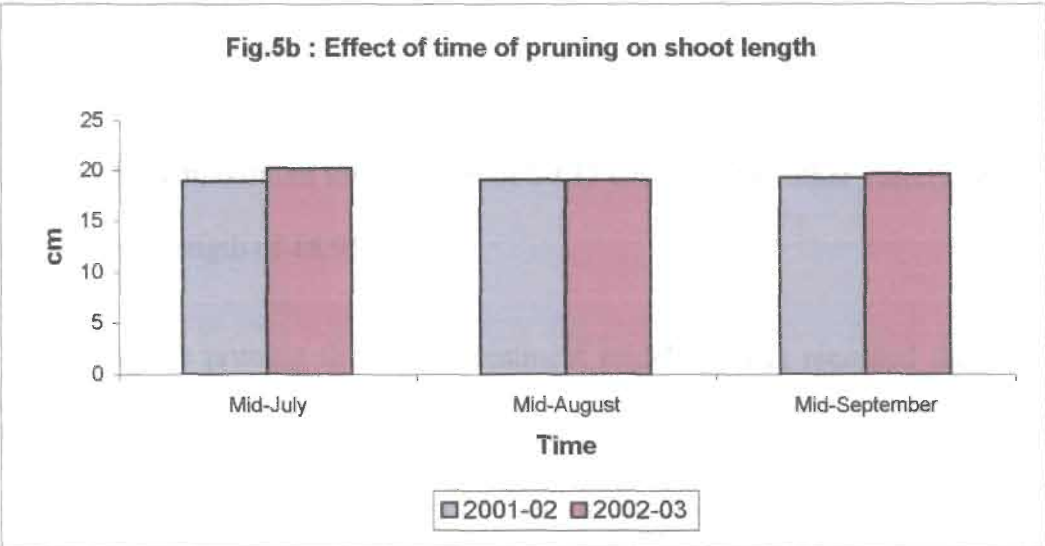
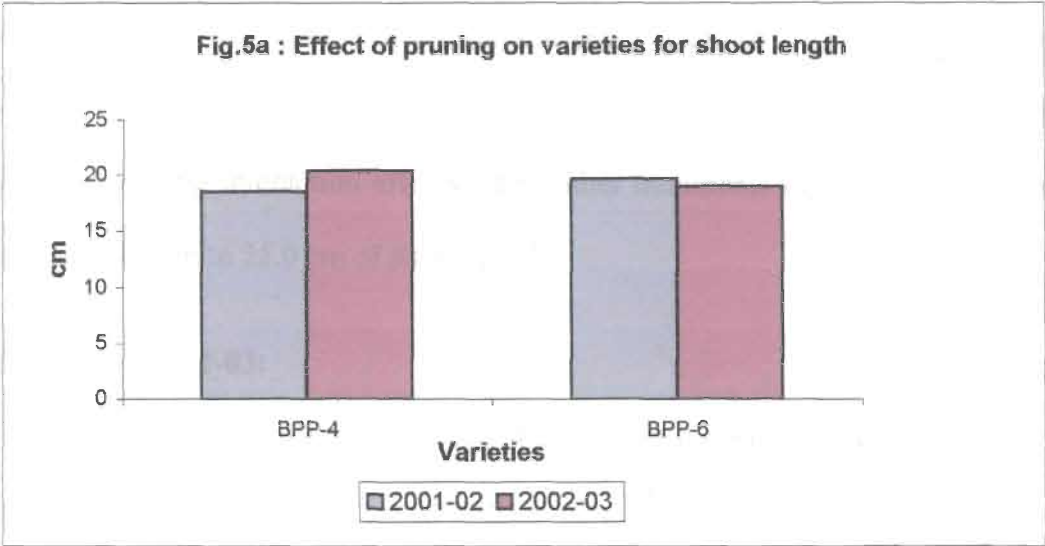
Between the varieties, the variety BPP-6 (V2) recorded significantly the maximum shoot length of 19.63 cm while the other variety BPP-4 (V1) recorded a shoot length of 18.54 cm.

Among the pruning times, non-significant differences were recorded. However, the treatment mid-September pruning (T3) recorded the highest shoot length of 19.25 cm followed by mid –August pruning 19.06 cm (T2) and mid-September 18.94 cm (T3) of shoot length.

Among the levels of pruning the treatment Leader shoot pruning (L1) recorded maximum shoot length of 19.83 cm significantly superior over control (L0 18.16 cm) and it was followed by Lateral shoot pruning (L2) of 18.33 cm. The minimum shoot length of 18.00 cm was recorded by Leader+ Lateral shoot pruning (L3).

Among the interactions significant differences were recorded. The V2 L2 T1 recorded maximum shoot length of 26.0 cm was followed by V1 L2 T1 of 25.5 cm. The

Table 4. 2a: Shoot length, number of leaves m ² and total leaf area of shoot in cashew as influenced by pruning variety, time of pruning and level of pruning.						
	Shoot length (cm)		Number of leaves m ²		Leaf area per shoot (cm ²)	
	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03
Varieties:						
BPP-4 (V1)	18.54	20.33	331.29	349.77	476.35	608.18
BPP-6 (V2)	19.63	18.95	288.12	268.32	553.26	594.74
Time of pruning:						
Mid-July (T1)	18.94	20.20	339.00	285.32	486.12	599.42
Mid-August (T2)	19.06	19.09	289.88	312.78	508.43	595.06
Mid-September (T3)	19.25	19.64	300.25	329.03	549.58	609.89
Level of pruning:						
Control (No pruning) (L0)	18.16	18.67	317.92	323.91	523.73	659.50
Leader shoot pruning (L1)	19.83	18.98	330.42	346.41	518.35	650.20
Lateral shoot pruning (L2)	18.33	21.69	301.75	289.92	486.45	547.66
Leader + Lateral shoot pruning (L3)	18.00	19.25	288.75	275.90	530.70	548.43
2001-2002						
	S Em	CD	S Em	CD	S Em	CD
Varieties	0.30	0.62	3.59	7.43	3.18	6.58
Time of pruning	0.42	NS	4.39	9.09	3.89	8.06
Levels of pruning	0.42	0.88	5.01	10.51	4.50	9.32
2002-2003						
	S Em	CD	S Em	CD	S Em	CD
Varieties	0.19	0.39	5.11	10.57	3.72	7.69
Time of pruning	0.23	0.47	6.26	12.95	4.55	9.42
Levels of pruning	0.26	0.55	7.23	14.95	5.26	10.88



V1 L0 T3 and V2 L0 T3 recorded minimum shoot lengths of 13.5 cm and 13.00 cm respectively. The treatments V2 L2 T1 and V1 L2 T1 were significantly superior over all other corresponding interaction effects. The other treatments of interactions showed a range from 14.5 cm to 25.0 cm of shoot length.

4.1.5.2 During 2002-03:

The data of the Table 4.2a and 4.2b showed significant difference between varieties, among the levels of pruning, time of pruning and their interactions for the character shoot length.

Between the varieties, significant differences were recorded. The variety BPP-4 (V1) recorded the maximum shoot length of 20.33 cm while the other variety BPP-6 (V2) recorded a shoot length of 18.95 cm.

Among the pruning times, the treatment mid-July (T1) recorded the maximum shoot length of 20.20 cm, which was significantly superior over mid –August (T2 19.09 cm) followed by mid-September (T3 19.64 cm) of shoot length.

Among the levels of pruning, the treatment Lateral shoot pruning (L2) recorded maximum shoot length of 21.69 cm significantly superior over control (L0 18.67 cm) and it was followed by Leader +Lateral shoot pruning (L3 19.25 cm). The minimum shoot length of 18.98 cm was recorded by Leader shoot pruning (L1).

Among the interactions significant differences were recorded. The maximum shoot length of 29.00 cm was recorded by the treatment V2 L2 T2 followed by V1 L2 T2 recorded 28.88 cm of shoot length. The minimum shoot length of 11.13 cm was recorded

Table 4.2b: Shoot length, number of leaves m⁻² and leaf area per shoot in cashew as influenced by interactions of variety, time of pruning and level of pruning.

	Shoot length (cm)			Number of leaves m ⁻²			Leaf area per shoot (cm ²)	
	2001-02	2002-03	2001-02	2001-02	2002-03	2001-02	2002-03	2002-03
INTERACTION:								
V1L0T1	14.50	15.50	252.00	186.25	417.60	540.25		
V1L1T1	18.50	19.75	439.00	508.09	612.86	800.34		
V1L2T1	25.50	23.00	299.50	425.18	436.65	530.13		
V1L3T1	21.00	21.25	437.50	415.35	435.29	589.62		
V1L0T2	13.50	18.75	235.00	276.13	388.92	523.82		
V1L1T2	24.50	17.00	365.00	501.78	617.49	856.85		
V1L2T2	19.00	28.88	375.00	355.09	399.81	53242		
V1L3T2	20.50	24.00	268.00	339.69	459.39	594.91		
V1L0T3	13.50	17.00	315.00	284.35	523.83	480.74		
V1L1T3	18.50	20.75	365.00	336.25	563.67	735.76		
V1L2T3	17.00	18.13	265.00	226.32	439.05	564.76		
V1L3T3	16.50	20.00	267.50	342.78	421.70	548.60		
V2L0T1	15.50	16.00	285.00	244.94	314.22	530.56		
V2L1T1	21.00	20.25	325.00	343.19	691.52	662.55		
V2L2T1	26.00	17.50	315.00	235.84	669.52	693.31		
V2L3T1	18.00	18.38	250.00	215.63	544.53	743.20		
V2L0T2	17.00	19.38	270.00	272.44	420.57	597.81		
V2L1T2	25.00	19.13	425.00	397.16	703.30	590.03		
V2L2T2	22.50	29.00	322.50	315.94	696.26	667.91		
V2L3T2	21.50	11.13	215.00	228.53	408.11	443.20		
V2L0T3	13.00	20.13	215.00	215.94	431.34	566.79		
V2L1T3	22.50	11.88	325.00	213.09	517.60	455.64		
V2L2T3	18.50	21.38	310.00	307.88	646.99	573.13		
V2L3T3	15.00	23.38	200.00	229.31	595.24	412.68		
SEm	1.04	0.65	12.44	17.70	11.03	12.88		
CD (0.05)	2.15	1.34	25.73	34.62	22.82	26.65		

by the treatment V2 L3 T2. The treatments V2 L2 T2 and V1 L2 T2 were significantly superior over all other corresponding interaction effects. The other treatments of interaction showed a range from 11.88cm to 24.00 cm of shoot length.

4.1.6 Number of leaves m⁻²:

The data on number of leaves m⁻² of the surface canopy as influenced by varieties, level of pruning, time of pruning and their interactions during the year 2001-02 and 2002-03 were collected and statistically analysed and presented in the Table 4.2a and 4.2b.

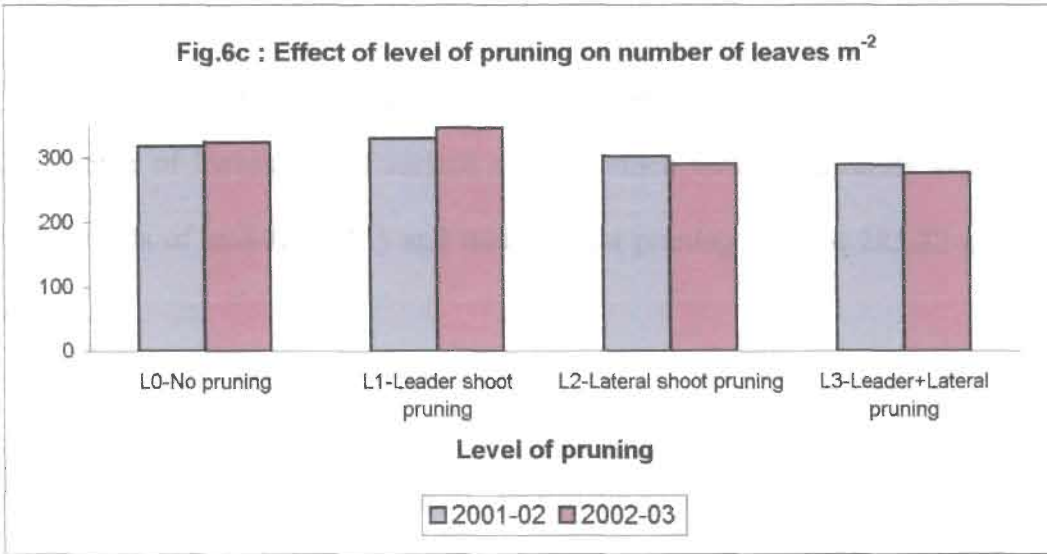
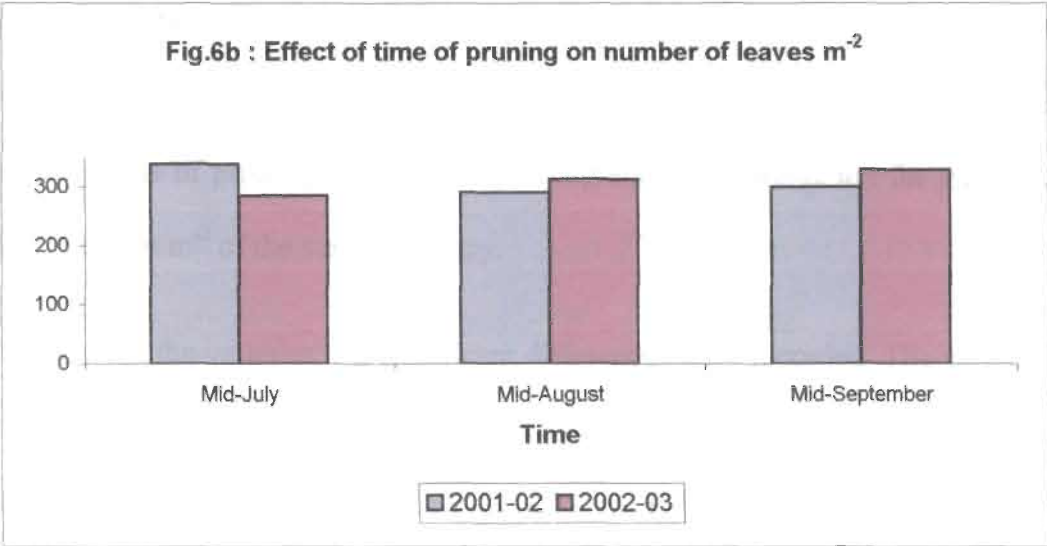
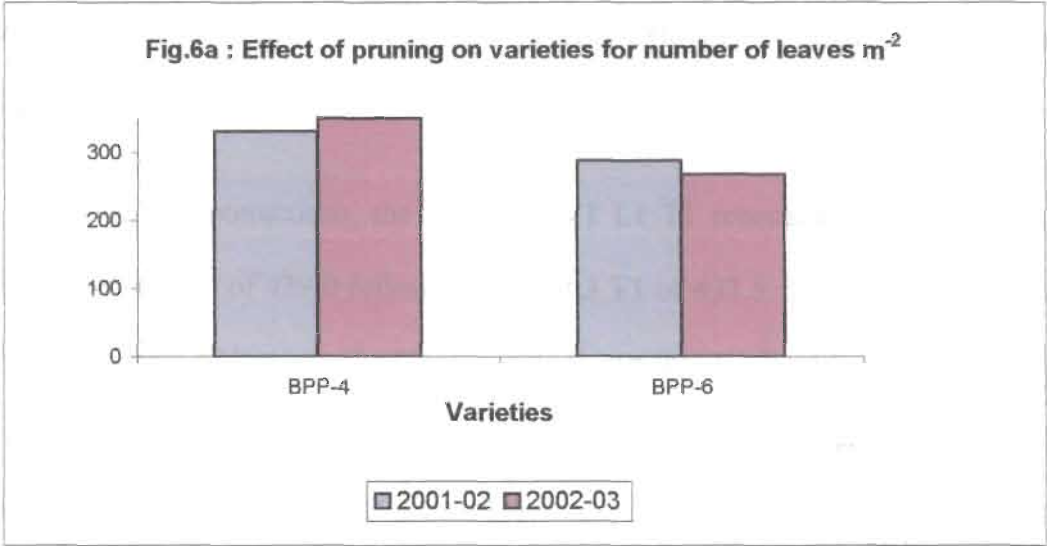
4.1.6.1 During 2001-02:

The data of the table showed significant difference between varieties, among the levels of pruning, and time of pruning and their interaction for the character number of leaves m⁻² of the surface canopy.

Between the varieties significant differences were recorded. The variety BPP-4 (V1) recorded the maximum number of leaves m⁻² of the surface canopy of 331.29 while the other variety BPP-6 (V2) recorded 288.12 number of leaves m⁻² of the surface canopy.

Among the time of pruning the treatment mid –July (T1) recorded 339.0 no of leaves m⁻² of surface canopy and significantly superior over other treatments of pruning mid-August (T2) and mid–September (T3) of 289.88 and 300.25 respectively.

Among the levels of pruning the treatment L1 (Leader shoot pruning) recorded significantly the highest number of leaves m⁻² of surface canopy of 330.42 which was significantly superior over control (L0 317.92). The lowest number of leaves per m⁻² was



recorded by Leader +Lateral shoot pruning (L3 288.75) followed by Lateral shoot pruning (L2 301.75).

Among the interactions, the treatment V1 L1 T1 recorded significantly highest number of leaves m^{-2} of 439.0 followed by V1 L3 T1 of 437.5. The treatment V2 L3 T3 recorded lowest no of leaves m^{-2} of 200.0. The treatments V1 L1 T1 and V1 L3 T1 were significantly superior over their other corresponding interactions. The other treatments of interaction showed a range from 215.0 to 425.0

4.1.6.2 During 2002-03:

The data of the Table 4.2a and 4b showed significant difference between varieties, among the levels of pruning, and time of pruning and their interaction for the character number of leaves m^{-2} of the surface canopy.

Between the varieties, the significant differences were recorded. The variety BPP-4 (V1) recorded the highest number of leaves m^{-2} of the surface canopy of 349.75 while the other variety BPP-6 (V2) recorded 268.32 number of leaves m^{-2} of the surface canopy.

Among the time of pruning, the treatment mid –September (T3) recorded highest 329.03 number of leaves m^{-2} of surface canopy which was significantly superior over other treatments of mid-July (T1) and mid–August pruning (T2) of 285.32 and 312.78 respectively.

Among the levels of pruning, the treatment Leader shoot pruning (L1) recorded significantly highest number of leaves m^{-2} of surface canopy of 346.41 which was on par

with control (L₀ 323.91). The treatment Leader shoot pruning (L1) significantly superior over other levels of pruning. The lowest number of leaves per m⁻² was recorded by Leader +Lateral shoot pruning (L3) of 275.90.

Among the interactions, the treatment V1 L1 T1 recorded significantly the highest number of leaves of 508.09 followed by V1 L1 T2 (501.78). The V1 L0 T1 recorded the lowest number of leaves m⁻² of 186.25. The treatments V1 L1 T1 and V1 L1 T2 were significantly superior over their other corresponding interactions. The other treatments of interactions showed a range from 215.94 to 425.18.

4.1.7 Leaf area per shoot (cm²):

The data on leaf area per shoot as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were collected and statistically analysed and presented in the Table 4.2a and 4.2b.

4.1.7.1 During 2001-02:

The data of the Table 4.2a and 4.2b showed significant difference between varieties, among the levels of pruning, and time of pruning and their interaction for the character leaf area of the shoot.

Between the varieties BPP-6 (V2) recorded the maximum leaf area per shoot of 553.26 cm² while the other variety BPP-4 (V1) recorded 476.35 cm² of leaf area per shoot.

Fig.7a : Effect of pruning on varieties for leaf area per shoot

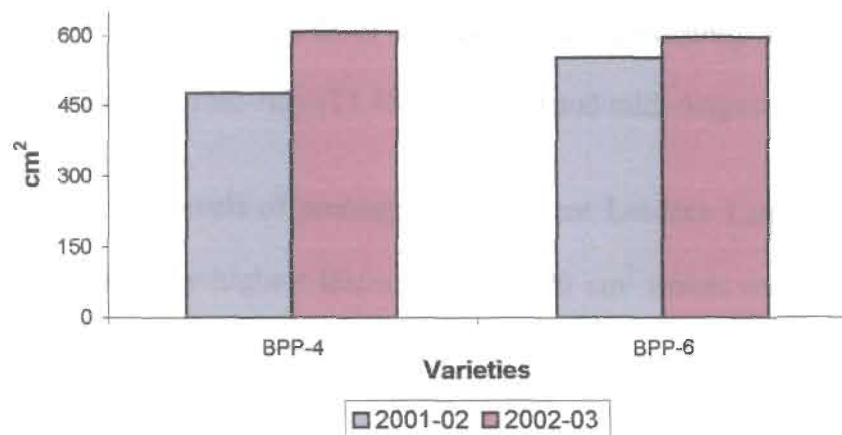


Fig.7b :Effect of time of pruning on leaf area per shoot

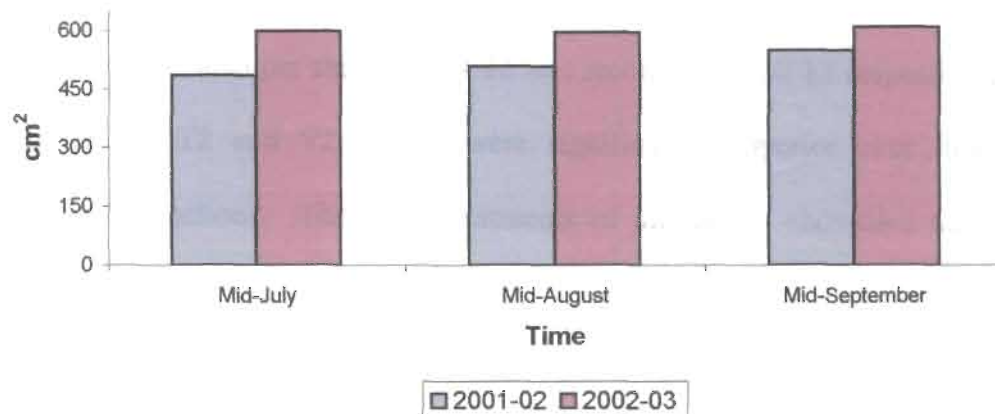
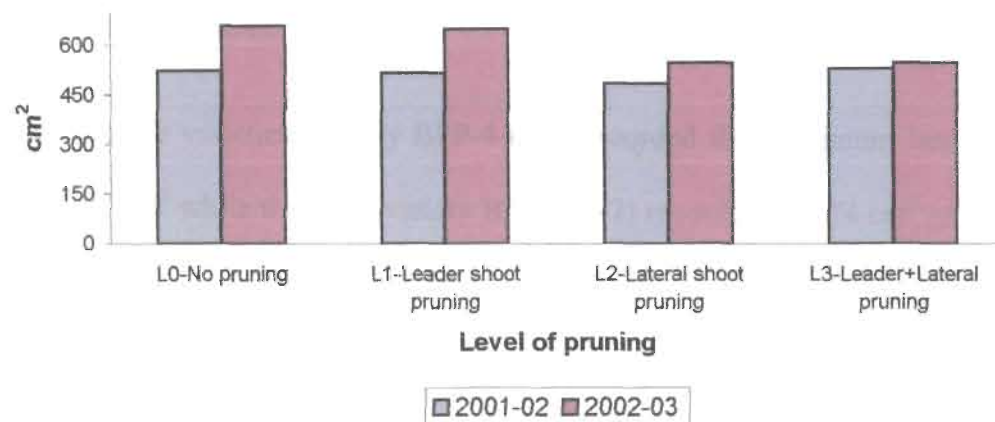


Fig.7c : Effect of level of pruning on leaf area per shoot



Among the time of pruning, the treatment mid-September (T3) recorded maximum 549.88 cm² leaf area of the shoot and significantly superior over other two times of pruning i.e., mid-July (T1 486.120 cm²) and mid-August (T2 508.43 cm²).

Among the levels of pruning, the treatment Leader+ Lateral shoot pruning (L3) recorded significantly highest leaf area of 530.70 cm² which was significantly superior over control (L0 523.73 cm²). The lowest leaf area per shoot of 486.45 cm² was recorded by Lateral shoot pruning (L2).

Among the interactions, the treatment V2 L1 T2 recorded significantly highest leaf area per shoot of 703.30 followed by V1 L1 T2 the maximum leaf area of 617.49 cm². The lowest leaf area per shoot of 314.22 was recorded V2 L0 T1 respectively. The treatments V1 L1 T2 and V2 L1 T2 were significantly superior over their other corresponding interactions. The other treatments of interaction showed a range from 417.60 to 696.26 cm² of leaf area of the shoot.

4.1.7.2 During 2002-03:

The data of the Table 4.2a and 4.2b showed significant difference between varieties, among the levels of pruning, and time of pruning and their interaction for the character leaf area per shoot.

Between the varieties, variety BPP-4 (V1) recorded the maximum leaf area per shoot of 608.18 cm² while the other variety BPP-6 (V2) recorded 594.74 cm² of leaf area of the shoot.

Among the time of pruning, the treatment mid–September (T3) recorded maximum 549.88 cm² leaf area of the shoot and significantly superior over other two times of pruning i.e., mid-July (T1 486.120 cm²) and mid–August (T2 508.43 cm²).

Among the levels of pruning, the treatment Leader+ Lateral shoot pruning (L3) recorded significantly highest leaf area of 530.70 cm² which was significantly superior over control (L0 523.73 cm²). The lowest leaf area per shoot of 486.45 cm² was recorded by Lateral shoot pruning (L2).

Among the interactions, the treatment V2 L1 T2 recorded significantly highest leaf area per shoot of 703.30 followed by V1 L1 T2 the maximum leaf area of 617.49 cm². The lowest leaf area per shoot of 314.22 was recorded V2 L0 T1 respectively. The treatments V1 L1 T2 and V2 L1 T2 were significantly superior over their other corresponding interactions. The other treatments of interaction showed a range from 417.60 to 696.26 cm² of leaf area of the shoot.

4.1.7.2 During 2002-03:

The data of the Table 4.2a and 4.2b showed significant difference between varieties, among the levels of pruning, and time of pruning and their interaction for the character leaf area per shoot.

Between the varieties, variety BPP-4 (V1) recorded the maximum leaf area per shoot of 608.18 cm² while the other variety BPP-6 (V2) recorded 594.74 cm² of leaf area of the shoot.

Among the time of pruning, the treatment mid-September (T3) recorded maximum 609.8 cm² leaf area of the shoot which was significantly superior over other two times of pruning i.e., T1 (mid-July 599.4 cm²) and T2 (mid-August of 595.0 cm²).

Among the levels of pruning control (L0) recorded the highest leaf area per shoot of 659.5 cm², which was significantly superior over all other levels of pruning. It was followed by Leader shoot pruning (L1 650.2 cm²) and Leader + Lateral shoot pruning (L3 548.43) which were on par with each other. The lowest leaf area per shoot of 547.66 was recorded by Lateral shoot pruning (L2).

Among the interactions, the treatment V1 L1 T2 recorded the significantly the highest leaf area per shoot of 856.88 cm² followed by V1 L1 T1 of 800.34 cm². The V2 L3 T3 recorded lowest leaf area per shoot of 412.68 cm². The treatments V1 L1 T2 and V1 L1 T1 were significantly superior over all other corresponding interactions. The other treatments of interactions showed a range from 443.20 cm² to 743.20 cm² of leaf area per shoot.

4.1.8 Number of flowering shoots m⁻²:

The data on number of flowering shoots m⁻² as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were collected and statistically analysed and presented in the Table 4.3a and 4.3b.

4.1.8.1 During 2001-02:

The data of the table showed significant difference between varieties, among the levels of pruning, and time of pruning and their interaction for the character number of flowering shoots m⁻² of surface canopy.

Table 4.3a: Number of flowering shoots m ⁻² , number of non-flowering shoots m ⁻² , number of panicles m ⁻² and time of flowering in cashew as influenced by pruning variety, time of pruning and level of pruning.							
	Number of flowering shoots m ⁻²		Number of non-flowering shoots m ⁻²		Number of panicles m ⁻²		Time of flowering (days)
	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03	2001-02 2002-03
Varieties:							
BPP-4 (V1)	24.40	11.42	9.62	9.30	20.57	13.54	91.29 91.42
BPP-6 (V2)	20.79	11.72	9.29	5.92	17.98	19.19	94.04 95.67
Time of pruning:							
Mid-July (T1)	22.21	11.98	9.25	8.83	18.13	16.58	92.81 93.25
Mid-August (T2)	23.75	10.48	8.68	7.89	20.33	15.51	92.81 93.75
Mid-September (T3)	21.83	12.26	10.44	6.21	19.29	17.00	93.50 93.63
Level of pruning:							
Control (No pruning) (L0)	20.33	12.94	10.42	7.02	17.56	17.10	90.17 90.67
Leader shoot pruning (L1)	27.59	14.29	8.92	7.29	18.81	17.43	92.58 92.33
Lateral shoot pruning (L2)	21.87	8.56	10.25	7.94	18.91	16.28	93.25 94.33
Leader + Lateral shoot pruning (L3)	25.58	8.06	8.25	8.33	17.71	14.62	96.16 96.83
2001-2002							
	S Em	CD	S Em	CD	S Em	CD	S Em CD
Varieties	0.29	0.59	0.34	NS	0.29	0.59	0.25 0.51
Time of pruning	0.35	0.73	0.42	0.86	0.35	0.73	0.30 NS
Levels of pruning	0.41	0.84	0.48	0.99	0.41	0.84	0.35 0.73
2002-2003							
	S Em	CD	S Em	CD	S Em	CD	S Em CD
Varieties	0.24	NS	0.11	0.25	0.25	0.54	0.22 0.45
Time of pruning	0.30	0.63	0.14	0.30	0.32	0.66	0.27 NS
Levels of pruning	0.35	0.72	0.17	0.35	0.37	0.76	0.31 0.64

Between the varieties, variety BPP-4 (V1) recorded the highest number of flowering shoots m^{-2} 24.40 while the other variety BPP-6 (V2) recorded a number of flowering shoots m^{-2} of 20.79 of surface canopy.

Among the time of pruning, the treatment mid–August (T2) recorded highest number of flowering shoots m^{-2} of 23.75, which was significantly superior over mid–September (T3 21.83) followed by mid-July pruning (T1 22.21) of surface canopy.

Among the levels of pruning significant differences were recorded. The treatment Leader shoot pruning (L1) recorded significantly highest number of flowering shoots m^{-2} of 27.59, which was significantly superior over control (L0 20.33). The lowest number of flowering shoots m^{-2} of 21.87 was recorded by Lateral shoot pruning (L2) of surface canopy.

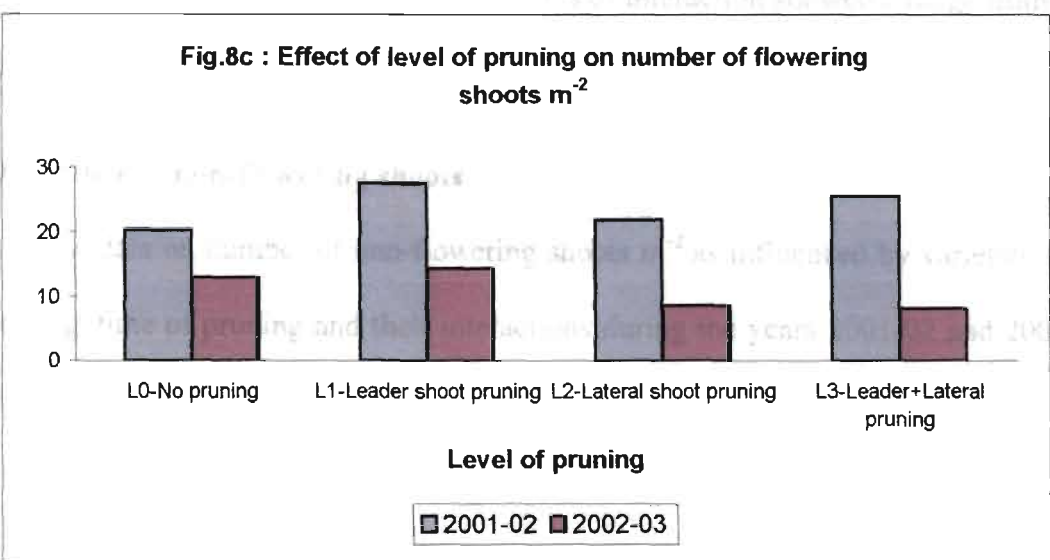
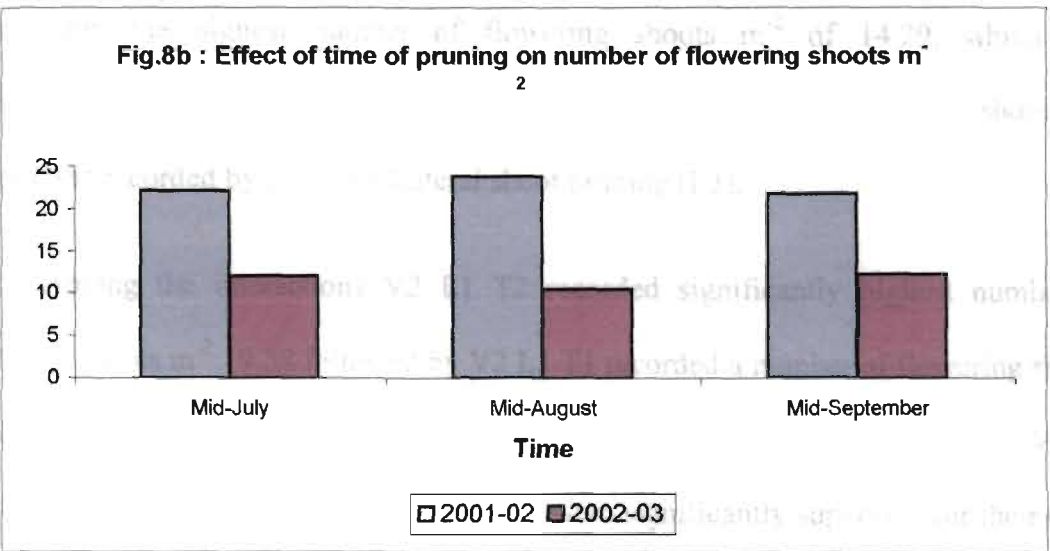
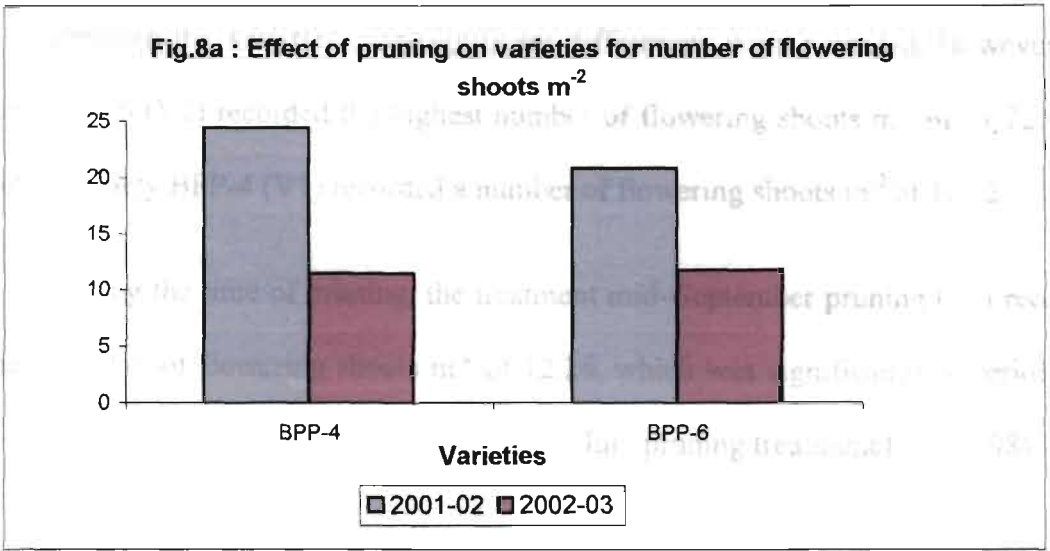
Among the interactions, the treatment V2 L1 T2 recorded significantly highest number of flowering shoots m^{-2} of 31.50 followed by V1 L1 T2 of 30.65. The lowest number of flowering shoots m^{-2} of 11.00 was recorded by V2 L0 T1. The treatments V2 L1 T2 and V1 L1 T2 were significantly superior over all other corresponding interactions. The other treatments of interactions showed a range from 11.50 to 29.00 of number of flowering shoots m^{-2} .

4.1.8.2 During 2002-03

The data of the Table 4.3a and 4.3b showed significant difference among the levels of pruning, time of pruning and their interaction and non-significant differences between varieties for the character number of flowering shoots m^{-2} .

Table 4.3b: Number of flowering shoots m⁻², number of non-flowering shoots m⁻², number of panicles m⁻² and time of flowering in cashew as influenced by interactions of variety, time of pruning and level of pruning.

INTERACTION:	Number of flowering shoots m ⁻²			Number of non-flowering shoots m ⁻²			Number of panicles m ⁻²		Time of flowering (duration in days)	
	2001-02	2002-03	2001-02	2001-02	2001-02	2001-02	2001-02	2002-03	2001-02	2002-03
V1L0T1	18.50	9.50	13.00	10.38	12.13	12.88	90.5	89.5		
V1L1T1	28.50	17.75	5.50	5.38	29.63	18.88	88.0	88.0		
V1L2T1	24.50	12.00	8.50	6.37	20.63	9.75	87.5	88.0		
V1L3T1	24.90	10.88	6.50	7.62	19.25	12.88	90.0	88.5		
V1L0T2	20.50	10.00	16.50	8.13	16.00	6.63	90.5	90.5		
V1L1T2	30.65	17.25	4.00	5.50	28.63	22.88	92.5	90.0		
V1L2T2	26.25	5.00	6.50	13.63	23.62	14.87	89.5	91.5		
V1L3T2	26.50	5.00	4.50	10.88	19.75	16.31	91.5	92.5		
V1L0T3	19.50	12.38	24.50	5.00	16.12	10.12	90.5	91.5		
V1L1T3	27.00	14.25	4.00	12.00	26.00	16.50	93.5	94.5		
V1L2T3	27.50	5.50	7.50	15.25	21.00	8.37	95.0	96.0		
V1L3T3	18.50	9.62	14.50	11.50	13.50	12.37	96.5	96.5		
V2L0T1	11.00	8.62	26.50	6.62	8.50	16.25	92.5	94.0		
V2L1T1	22.50	18.87	5.00	4.62	28.50	23.87	90.5	91.5		
V2L2T1	17.00	10.87	4.00	8.75	18.00	21.00	92.0	93.0		
V2L3T1	15.00	11.37	6.50	8.13	15.50	22.50	93.5	94.0		
V2L0T2	13.00	8.87	14.50	10.50	10.00	16.88	94.5	95.5		
V2L1T2	31.50	19.38	5.50	3.88	23.50	22.87	94.5	95.5		
V2L2T2	25.00	14.63	5.00	10.75	17.00	17.62	95.5	96.5		
V2L3T2	22.50	4.63	7.50	3.63	19.00	20.13	96.0	97.5		
V2L0T3	11.50	9.75	13.50	3.75	18.00	18.63	96.5	96.5		
V2L1T3	30.00	13.63	6.00	1.50	23.00	19.13	97.5	97.5		
V2L2T3	29.00	13.25	8.50	4.75	18.75	13.00	96.5	98.5		
V2L3T3	21.50	6.87	9.00	5.00	16.00	18.37	98.0	98.0		
SEm	0.99	0.86	1.17	0.41	0.99	0.89	0.86	0.76		
CD (0.05)	2.07	1.78	2.43	0.85	2.06	1.86	NS	NS		



Between the varieties, non-significant differences were recorded. However, the variety BPP-6 (V2) recorded the highest number of flowering shoots m^{-2} of 11.72 while the other variety BPP-4 (V1) recorded a number of flowering shoots m^{-2} of 11.42.

Among the time of pruning, the treatment mid-September pruning (T3) recorded highest number of flowering shoots m^{-2} of 12.26, which was significantly superior over mid-August (T2 10.48) and on par with the mid-July pruning treatment (T1 11.98).

Among the levels of pruning, the treatment Leader shoot pruning (L1) recorded significantly the highest number of flowering shoots m^{-2} of 14.29, which was significantly superior over control (L0 12.94). The lowest number of flowering shoots m^{-2} of 8.06 was recorded by Leader + Lateral shoot pruning (L3).

Among the interactions V2 L1 T2 recorded significantly highest number of flowering shoots m^{-2} 19.38 followed by V2 L1 T1 recorded a number of flowering shoots m^{-2} of 18.87. The lowest number of flowering shoots m^{-2} of 4.63 was recorded by V2 L3 T2. The treatments V2 L1 T2 and V2 L1 T1 were significantly superior over their other corresponding interactions. The other treatments of interaction showed a range from 5.00 to 17.25 of number of flowering shoots m^{-2} .

4.1.9 Number of non-flowering shoots m^{-2} :

The data on number of non-flowering shoots m^{-2} as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were recorded, statistically analysed and presented in the Table 4.3a and 4.3b.

4.1.9.1 During 2001-02:

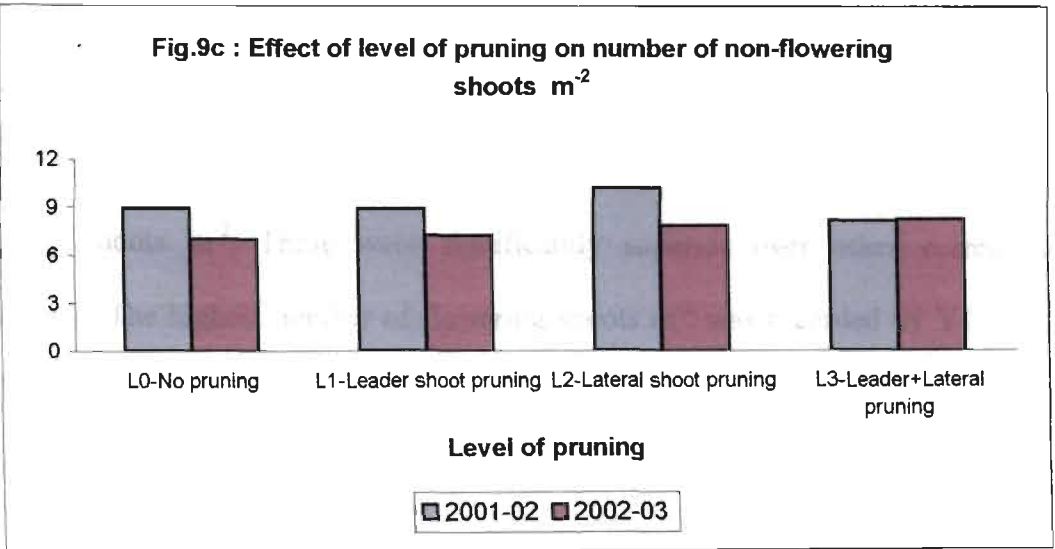
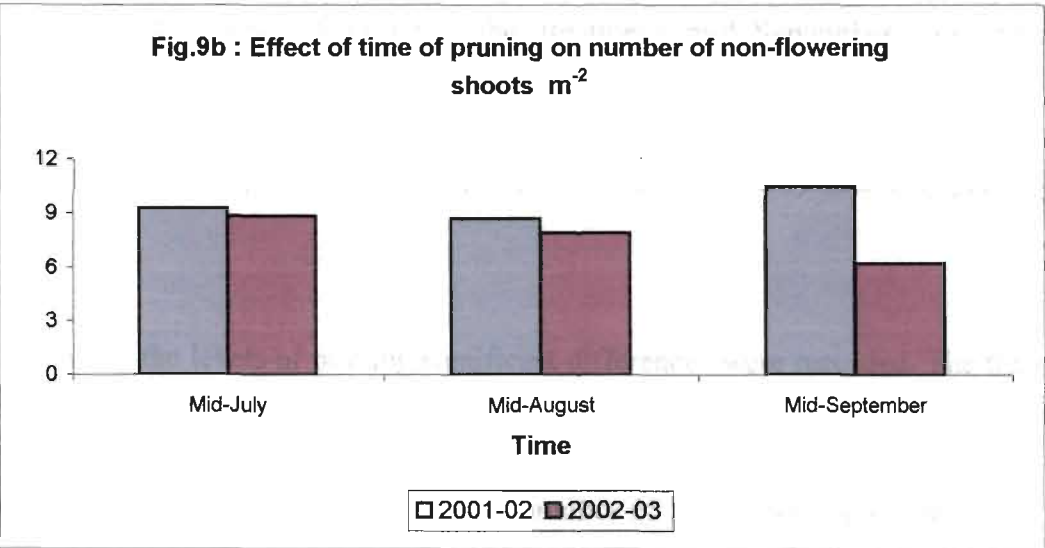
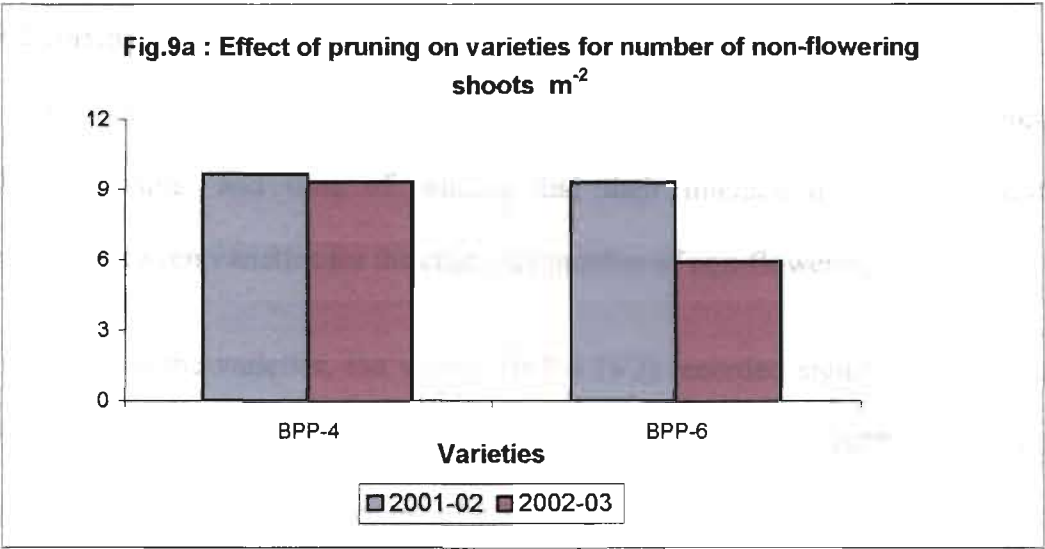
The data of the table showed significant difference among the levels of pruning, and time of pruning and their interaction and non-significant differences between varieties for the character number of non-flowering shoots m^{-2} .

Between the varieties non-significant differences were recorded. However, the variety BPP-6 (V2) recorded the lowest number of non-flowering shoots m^{-2} 9.29 while the other variety BPP-4 (V1) recorded a number of non-flowering shoots m^{-2} of 9.62.

Among the time of pruning, the treatment mid–August (T2) recorded significantly lowest number of non-flowering shoots m^{-2} of 8.68, which was significantly superior other two times of pruning mid-July (T1 9.25) followed by mid–September (T3 10.44).

Among the levels of pruning significant differences were recorded. The treatment Leader shoot pruning (L1) recorded significantly lowest 8.92 number of non-flowering shoots m^{-2} followed by Leader + Lateral shoot pruning (L3). The highest number of non-flowering shoots m^{-2} of 10.25 was recorded by Lateral shoot pruning (L2). The treatment Leader shoot pruning (L1) was found to be significantly superior over all other treatments for number of non-flowering shoots m^{-2} .

Among the interactions, the treatment V1 L1 T3 and V2 L2 T1 recorded significantly lowest number of non-flowering shoots m^{-2} 4.0, which were significantly superior over control V1L0T1 (13.00). The highest number of flowering shoots m^{-2} of 26.50 was recorded by V2 L0 T1. The other treatments of interactions showed a range from 5.0 to 24.5 of number of non-flowering shoots m^{-2} .



4.1.9.2 During 2002-03

The data of the Table 4.3a and 4.3b showed significant difference among the levels of pruning, and time of pruning and their interaction and non-significant differences between varieties for the character number of non-flowering shoots m^{-2} .

Between the varieties, the variety BPP-6 (V2) recorded significantly the lowest number of non-flowering shoots m^{-2} of 5.92, while the other variety BPP-4 (V1) recorded a number of non-flowering shoots m^{-2} of 9.30.

Among the time of pruning, the treatment mid-September (T3) recorded significantly lowest number of non-flowering shoots m^{-2} of 6.21 which was significantly superior other times of pruning mid-August (T2 7.89) followed by mid-July pruning (T1 8.83).

Among the levels of pruning significant differences were recorded. The treatment control (L0) recorded significantly lowest 7.02 number of non-flowering shoots m^{-2} when compared to other treatments. The highest number of non-flowering shoots m^{-2} of 8.33 was recorded by Leader + Lateral shoot pruning (L3 8.33).

Among the interactions, the treatment V2 L1 T3 recorded significantly lowest number of non-flowering shoots m^{-2} 1.50 followed by V2L3T2 of 3.63 of number of flowering shoots m^{-2} . These were significantly superior over other corresponding interactions. The highest number of flowering shoots m^{-2} was recorded by V1 L2 T3 of 15.25. The other treatments of interactions showed a range from 3.75 to 13.63 of number of non-flowering shoots m^{-2} .

4.1.10 Number panicles m^{-2} :

The data on number of panicles m^{-2} as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were recorded, statistically analysed and presented in the Table 4.3a and 4.3b.

4.1.10.1 During 2001-02:

The data of the table showed significant difference between varieties, among the levels of pruning, and time of pruning and their interaction for the character number of panicles m^{-2} .

Between the varieties significant differences were recorded, the variety BPP-4 (V1) recorded the maximum number of panicles m^{-2} of 20.57 while the other variety BPP-6 (V2) recorded a number of panicles m^{-2} of 17.98.

Among the time of pruning, the treatment mid–August pruning (T2) recorded significantly maximum number of panicles m^{-2} of 20.33, which was significantly superior other two times of pruning mid-July (T1 18.13) followed by mid–September (T3 19.29).

Among the levels of pruning significant differences were recorded. The treatment Lateral shoot pruning (L2) recorded significantly maximum number of panicles m^{-2} of 18.91, which was significantly superior to control (L₀ 17.56) but on par with Leader shoot pruning (L1 18.81). The lowest number of panicles m^{-2} was recorded by Leader + Lateral shoot pruning (L3 17.71).

Among the interactions, the treatment V1 L1 T1 recorded significantly the highest number of panicles m^{-2} of 29.63 followed by V1 L1 T2 (28.63). The lowest 8.50 number

Fig.10a : Effect of pruning on varieties for number of panicles m^{-2}

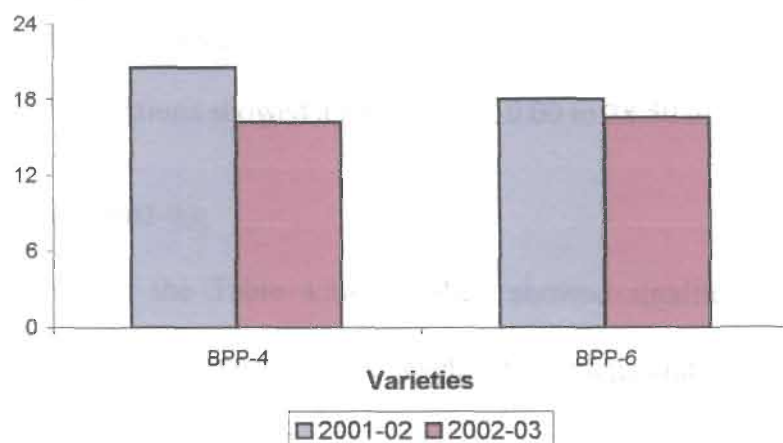


Fig.10b : Effect of time of pruning on number of panicles m^{-2}

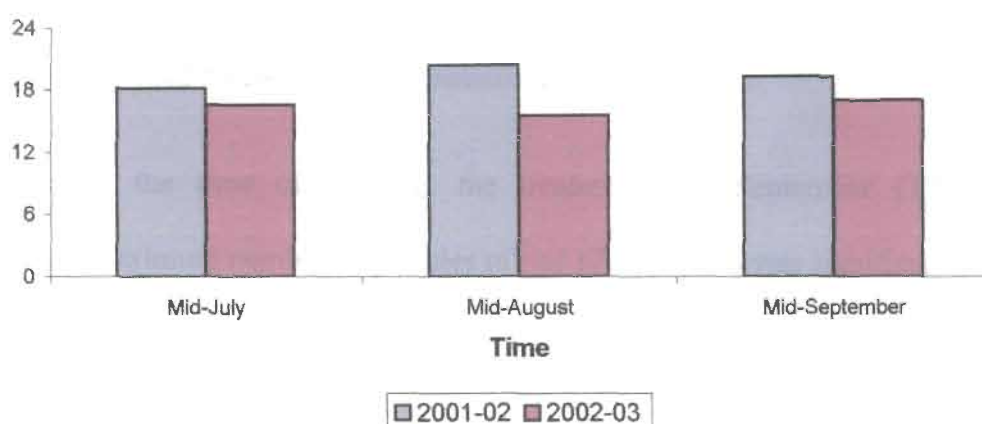
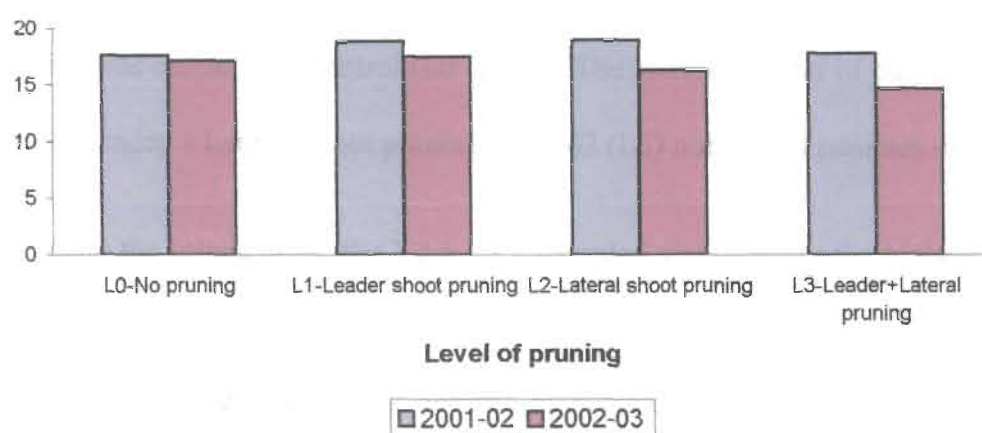


Fig.10c : Effect of level of pruning on number of panicles m^{-2}



of panicles m^{-2} was recorded by V2 L0 T1. The treatments V1L1T1 and V1L1T2 were significantly superior over all other treatments of number of panicles m^{-2} . The other treatments of interactions showed a range from 10.00 to 28.50 of number of panicles m^{-2} .

4.1.10.2 During 2002-03:

The data of the Table 4.3a and 4.3b showed significant difference between varieties, among time of pruning, the levels of pruning, and their interactions for the character number of panicles m^{-2} .

Between the varieties significant differences were recorded. The variety BPP-6 (V2) recorded the maximum number of panicles m^{-2} of 19.19 while the other variety BPP-4 (V1) recorded 13.54 number of panicles m^{-2} .

Among the time of pruning, the treatment mid-September (T3) recorded significantly maximum number of panicles m^{-2} of 17.00, which was significantly superior other two times of pruning mid-July (T1 16.58) followed by mid-August pruning (T2 15.51).

Among the levels of pruning significant differences were recorded. The treatment Leader shoot pruning (L1) recorded significantly maximum number of panicles m^{-2} of 17.43, which was on par with control (L0 17.10). The lowest number of panicles m^{-2} was recorded by Leader + Lateral shoot pruning of 14.62 (L3) number of panicles m^{-2} .

Among the interactions, the V2 L1 T1 recorded significantly the highest number of panicles m^{-2} of 23.87 followed by V1 L1 T2 recorded 22.88 number of panicles m^{-2} . The V2 L0 T2 recorded the lowest number of panicles m^{-2} of 6.63. The treatments

V2L1T1 and V1L1T2 were significantly superior over all other treatments. The other treatments of interactions showed a range from 9.75 to 22.87 of number of non-flowering shoots m^{-2} .

4.1.11 Time of flowering (duration in days):

The data on time of flowering (duration in days) as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were recorded and statistically analysed and presented in the Table 4.3a and 4.3b.

4.1.11.1 During 2001-02:

The data of the table showed significant difference between varieties, among the levels of pruning and non-significant differences were recorded for the time of pruning and their interactions for the character time of flowering.

Between the varieties, the variety BPP-4 (V1) recorded significantly the minimum duration of flowering of 91.29 days while the other variety BPP-6 (V2) recorded the duration of flowering of 94.04 days.

Among the time of pruning, the non-significant differences were recorded. However, the treatment mid-July (T1 92.81 days) recorded significantly minimum duration of flowering which was on par with mid-August (T2 92.81 days) followed by mid-September pruning (T3 93.50 days).

Among the levels of pruning, the treatment control (L0) recorded significantly minimum duration of flowering of 90.17 days, which was significantly superior to other

Fig.11a :Effect of pruning on varieties for time of flowering

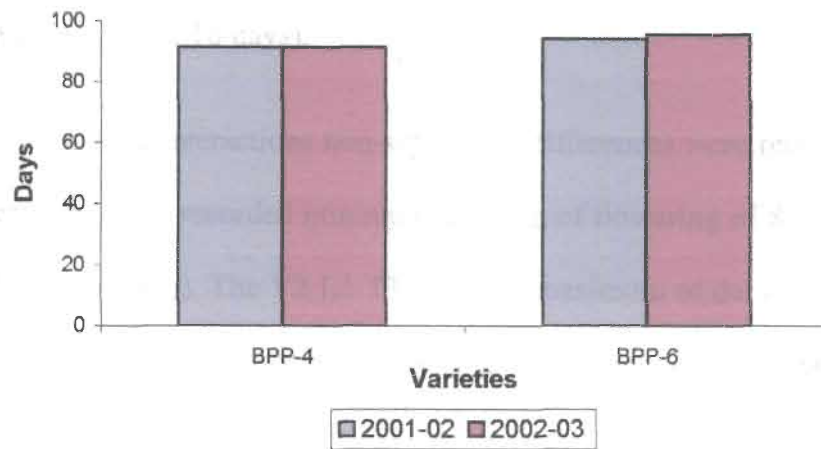


Fig.11b: Effect of time of pruning on time of flowering

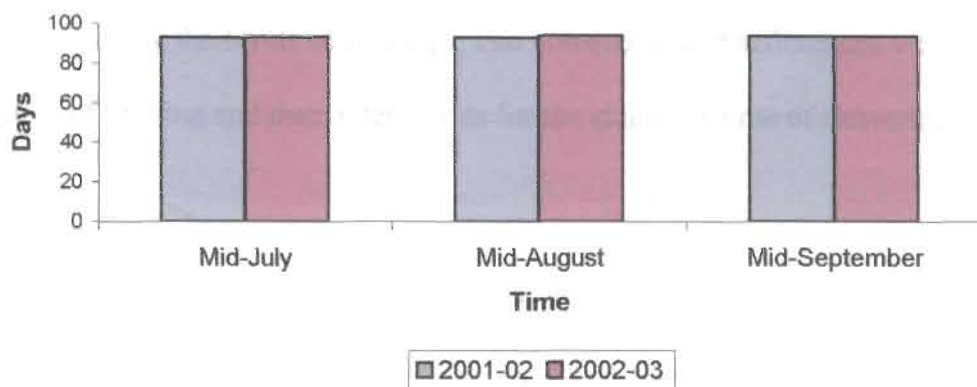
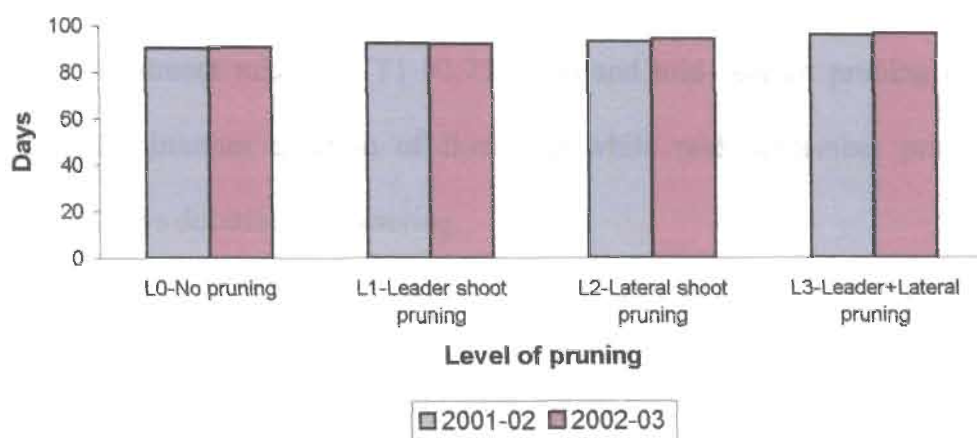


Fig.11c : Effect of level of pruning on time of flowering



levels of pruning. The maximum duration of flowering was recorded by Leader + Lateral shoot pruning (L3 96.16 days).

Among the interactions non-significant differences were recorded. However, the treatment V1 L2 T1 recorded minimum duration of flowering of 87.50 days followed by V1L1T1 (88.00 days). The V2 L3 T3 recorded maximum of duration of flowering 98.00 days. The other treatments of interactions showed a range from 90.00 to 97.50 days of duration of flowering.

4.1.11.2 During 2002-03:

The data of the Table 4.3a and 4.3b showed significant difference between varieties and among the levels of pruning. The non-significant differences were recorded among time of pruning and their interactions for the character time of flowering (duration in days).

Between the varieties, the variety BPP-4 (V1) recorded significantly the minimum duration of flowering of 91.42 days while the other variety BPP-6 (V2) recorded the duration of flowering of 95.67 days.

Among the time of pruning the non-significant differences were recorded. However, the treatment mid-July (T1 93.75 days) and mid-August pruning (T2 93.75 days) recorded minimum duration of flowering while mid-September pruning (T3) recorded 93.63 days duration of flowering.

Among the levels of pruning, the treatment control (L0) recorded significantly minimum duration of flowering of 90.67 days, which was significantly superior to other

levels of pruning it was followed by Leader shoot pruning (L1 92.33 days). The maximum duration of flowering was recorded by Leader + Lateral shoot pruning (L3 96.83 days).

Among the interactions the non-significant differences were recorded. However, the treatment V1 L1 T1 and V1 L1 T2 recorded minimum duration of flowering of 88.00 days followed by V1L2T of 88.00 days. The V2 L2 T2 recorded maximum of duration of flowering of 98.50 days. The other treatments of interactions showed a range from 88.50 to 98.50 days of duration of flowering.

4.1.12 Number of hermaphrodite flowers per panicle:

The data on number of hermaphrodite flowers per panicles as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were recorded, statistically analysed and presented in the Table 4.4a and 4.4b.

4.1.12.1 During 2001-02:

The data of the table showed significant difference between varieties, among the levels of pruning, and time of pruning and their interaction for the character number of hermaphrodite flowers per panicle.

Between the varieties significant differences were recorded. The variety BPP-4 (V1) recorded the maximum number of hermaphrodite flowers per panicle of 133.60 while the other variety BPP-6 (V2) recorded a number of hermaphrodite flowers per panicle of 126.70.

Table 4.4a: Number of hermaphrodite flowers panicle⁻¹, sex ratio, percentage of fruit set and number of fruits panicle⁻¹ in cashew as influenced by pruning variety, time of pruning and level of pruning.

	Number of hermaphrodite flowers panicle ⁻¹		Sex ratio (male to hermaphrodite flowers)		Percentage of fruit set		Number of fruits panicle ⁻¹	
	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03
Varieties:								
BPP-4 (V1)	133.60	117.23	4.87	4.45	4.33	2.44	5.31	3.48
BPP-6 (V2)	126.70	90.26	7.67	6.22	5.01	4.01	5.32	3.94
Time of Pruning:								
Mid-July (T1)	128.49	122.93	5.89	5.52	3.92	3.36	5.22	3.67
Mid-August (T2)	135.34	85.47	6.56	5.60	5.14	3.01	5.43	3.83
Mid-September (T3)	126.73	102.84	6.35	4.89	4.93	3.31	5.30	3.63
Level of Pruning:								
Control (No pruning) (L0)	118.30	78.30	5.72	6.05	5.63	3.98	4.67	3.42
Leader shoot pruning (L1)	145.60	179.50	7.39	5.87	4.63	3.47	5.03	3.65
Lateral shoot pruning (L2)	116.20	107.90	6.33	5.43	4.39	2.28	5.02	3.81
Leader + Lateral shoot pruning (L3)	140.70	149.20	5.64	3.99	4.02	3.17	5.53	3.96
2001-2002								
	S Em	CD	S Em	CD	S Em	CD	S Em	CD
Varieties	0.74	1.54	0.08	0.17	0.09	0.20	0.09	NS
Time of pruning	0.91	1.88	0.09	0.20	0.12	0.25	0.11	NS
Levels of pruning	1.05	2.17	0.12	0.24	0.14	0.28	0.13	0.26
2002-2003								
	S Em	CD	S Em	CD	S Em	CD	S Em	CD
Varieties	0.24	0.51	0.11	0.23	0.03	0.06	0.58	0.12
Time of pruning	0.30	0.62	0.14	0.28	0.03	0.07	0.07	0.14
Levels of pruning	0.34	0.72	0.16	0.33	0.04	0.08	0.08	0.17

Fig.12a: Effect of pruning on varieties for number of hermaphrodite flowers panicle⁻¹

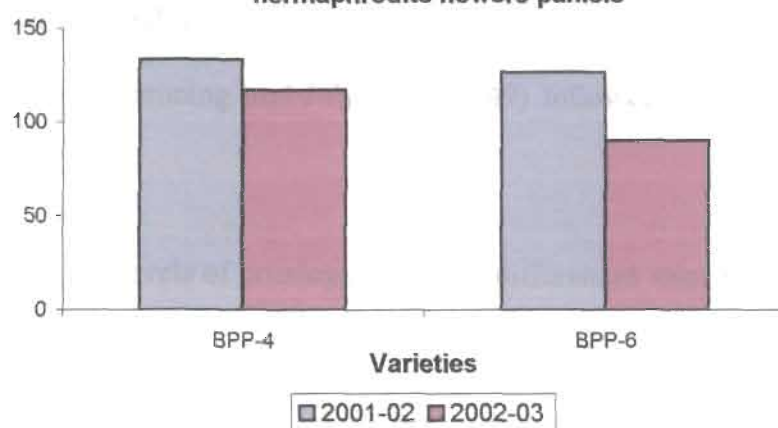


Fig.12b: Effect of time of pruning on number of hermaphrodite flowers panicle⁻¹

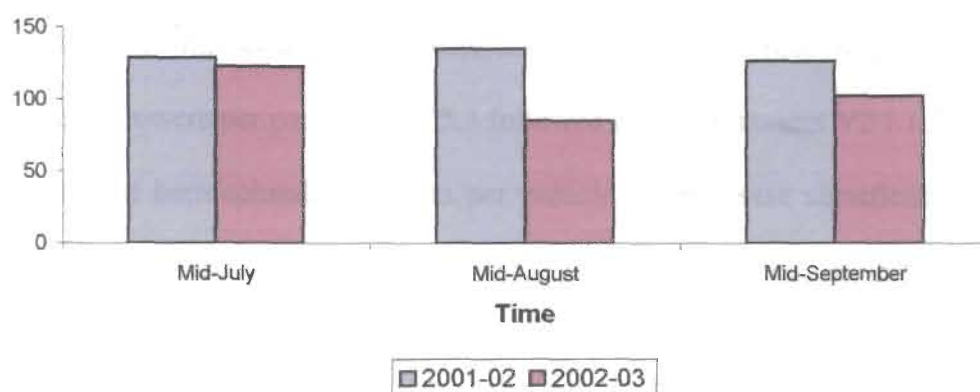
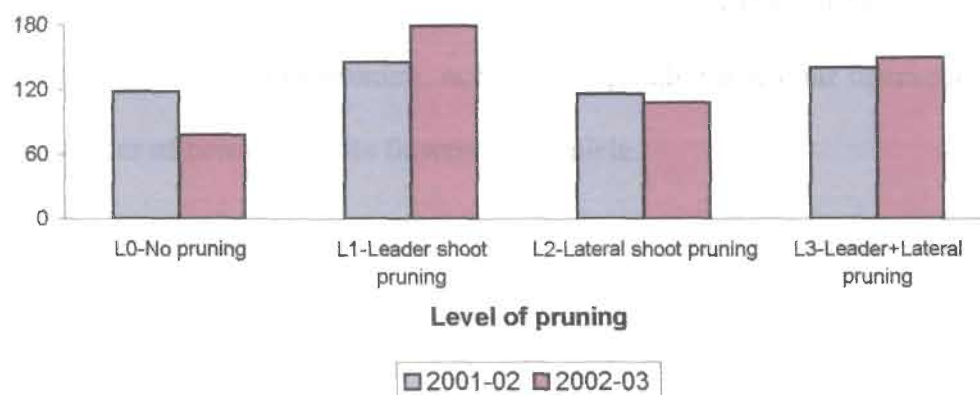


Fig.12c: Effect of level of pruning number of hermaphrodite flowers panicle⁻¹



Among the time of pruning, the treatment mid–August (T2) recorded significantly maximum hermaphrodite flowers per panicle of 135.34, which was significantly superior other two times of pruning mid-July (T1 128.49) followed by mid–September pruning (T3 126.73).

Among the levels of pruning significant differences were recorded. The treatment Leader shoot pruning (L1) recorded significantly maximum number of hermaphrodite flowers per panicle of 145.60, which was significantly superior over other levels of pruning it was followed by Leader + Lateral shoot pruning (L3 140.7). The lowest hermaphrodite flowers per panicle were recorded by Lateral shoot pruning (L2 116.2).

Among the interactions, the treatment V1 L1 T2 recorded highest number of hermaphrodite flowers per panicle of 203.3 followed by the treatment V2 L1 T1 recorded 181.5 number of hermaphrodite flowers per panicle. These were significantly superior over their corresponding interactions. The V2L3T2 recorded lowest number of hermaphrodite flowers per panicle of 66.5. The other treatments of interactions showed a range from 89.5 to 169.5 of number of hermaphrodite flowers per panicle.

4.1.12.2 During 2002-03:

The data of the Table 4.4a and 4.4b showed significant differences between varieties, among the levels of pruning, and time of pruning and their interaction for the character number of hermaphrodite flowers per panicle.

Between the varieties significant differences were recorded. The variety BPP-4 (V1) recorded the maximum number of hermaphrodite flowers per panicle of 117.23

Table 4.4b: Number of hermaphrodite flowers panicle⁻¹, sex ratio and percentage of fruit set, number of fruits per panicle in cashew as influenced by interactions of variety, time of pruning and level of pruning.

		Number of hermaphrodite flowers panicle ⁻¹		Sex ratio (male to hermaphrodite flowers)		Percentage of fruit set		Number of fruits panicle ⁻¹	
INTERACTION:		2001-02	2002-03	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03
V1L0T1		96.9	99.2	8.04	3.37	3.61	2.53	3.75	3.25
V1L1T1		124.5	89.9	4.14	5.95	5.13	2.56	6.38	3.13
V1L2T1		97.5	111.5	3.35	2.59	6.16	2.47	5.90	2.88
V1L3T1		112.8	122.8	5.10	4.98	3.62	2.24	3.90	2.88
V1L0T2		97.9	42.8	8.27	5.24	3.96	2.30	3.90	3.38
V1L1T2		203.3	95.8	7.20	7.69	7.50	3.17	7.25	3.25
V1L2T2		168.0	156.5	3.12	4.73	2.07	2.23	5.65	3.38
V1L3T2		112.5	151.4	7.72	5.29	4.88	2.54	5.55	4.25
V1L0T3		97.5	37.6	5.77	4.51	4.73	2.36	4.40	3.25
V1L1T3		163.0	174.6	5.06	3.46	4.06	3.31	6.03	5.63
V1L2T3		169.5	127.6	3.15	3.42	3.68	1.74	6.25	2.75
V1L3T3		161.0	119.9	3.53	2.23	2.49	1.84	4.15	3.75
V2L0T1		98.0	41.6	8.96	10.68	5.22	3.36	5.40	2.88
V2L1T1		181.5	56.5	6.75	7.07	9.21	8.71	7.50	5.25
V2L2T1		111.3	71.0	9.10	6.65	4.46	4.31	5.15	3.13
V2L3T1		98.0	76.0	10.74	6.00	5.08	5.22	5.25	4.13
V2L0T2		107.5	52.5	9.00	5.75	3.96	2.27	4.25	3.38
V2L1T2		154.3	87.0	4.08	5.56	3.64	5.60	5.65	4.88
V2L2T2		163.0	144.5	4.03	4.41	3.61	2.09	5.90	3.13
V2L3T2		66.5	38.0	7.44	7.05	5.45	1.40	3.60	5.18
V2L0T3		89.5	113.8	9.79	6.61	5.59	3.06	5.00	3.50
V2L1T3		128.3	168.1	7.95	6.52	4.09	5.90	5.25	4.13
V2L2T3		122.7	119.0	6.05	5.04	4.89	2.55	6.00	3.13
V2L3T3		99.6	115.0	8.08	3.28	4.89	3.66	4.90	4.38
SEm		2.58	0.85	0.28	0.39	0.34	0.09	0.31	0.20
CD (0.05)		5.33	1.76	0.58	0.81	0.69	0.20	0.63	0.42

while the other variety V2 (BPP-6) recorded number of hermaphrodite flowers per panicle of 90.26.

Among the time of pruning, the treatment mid-July (T1) recorded significantly maximum number of hermaphrodite flowers per panicle of 122.93 which was significantly superior other two times of pruning mid-September (T3 102.84) followed by mid-August (T2 85.47)

Among the levels of pruning significant differences were recorded. The treatment Leader shoot pruning (L1) recorded significantly maximum number of hermaphrodite flowers per panicle of 179.50, which was significantly superior over other levels of pruning and it was followed by Leader + Lateral shoot pruning (L3 149.2). The lowest hermaphrodite flowers per panicle were recorded by Lateral shoot pruning (L2 107.90).

Among the interactions, the treatment V1L1T3 recorded highest number of hermaphrodite flowers per panicle of 174.6 followed by the treatment V2L1T3 recorded number of hermaphrodite flowers per panicle of 168.1. These were significantly superior over their corresponding interactions. The V1L0T3 recorded lowest number of hermaphrodite flowers per panicle of 37.6. The other treatments of interactions showed a range from 38.0 to 156.5 of number of hermaphrodite flowers per panicle.

4.1.13 Sex ratio (male to hermaphrodite flowers):

The data on sex ratio as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were recorded, statistically analysed and presented in the Table 4.4a and 4.4b.

4.1.13.1 During 2001-02:

The data of the table showed significant differences between the varieties, among the levels of pruning and time of pruning and their interaction for the character sex ratio.

Between the varieties significant differences were recorded. The variety BPP-4 (V1) recorded significant lowest sex ratio of 4.87 while the other variety BPP-6 (V2) recorded a sex ratio of 7.67.

Among the time of pruning, the treatment mid-July (T1) recorded significantly lowest sex ratio of 5.89, which was significantly superior over other two times of pruning mid-September (T3 6.35) followed mid-August pruning (T2 6.56).

Among the levels of pruning significant differences were recorded. The treatment Leader +Lateral shoot pruning (L3) recorded significantly lowest sex ratio of 5.64, which was significantly superior over other levels of pruning over control (L0 5.72). The highest sex ratio of 7.39 was recorded by Leader shoot pruning (L1).

Among the interactions the significant differences were recorded. The treatment V1 L2 T2 recorded lowest sex ratio of 3.12 followed by the treatment V2 L2 T2 of 4.03. These treatments of interaction were significantly superior over all other corresponding interactions. The treatment V2L3T1 recorded highest sex ratio of 10.74. The other treatments of interactions showed a range from 3.15 to 9.10 of sex ratio.

**Fig.13a : Effect of pruning on varieties for sex ratio
(male to hermaphrodite flowers)**

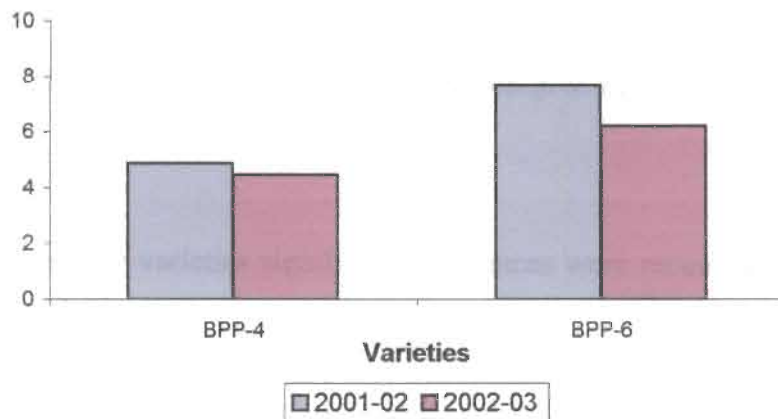


**Fig.13b : Effect of time of pruning on sex ratio
(male to hermaphrodite flowers)**

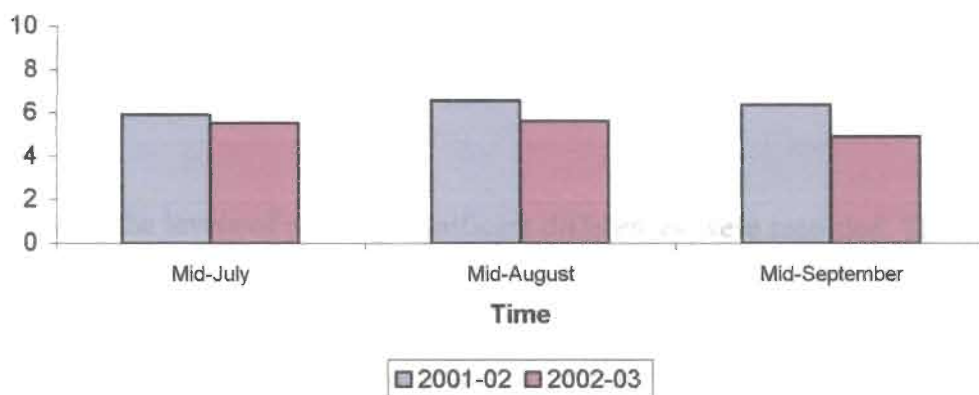
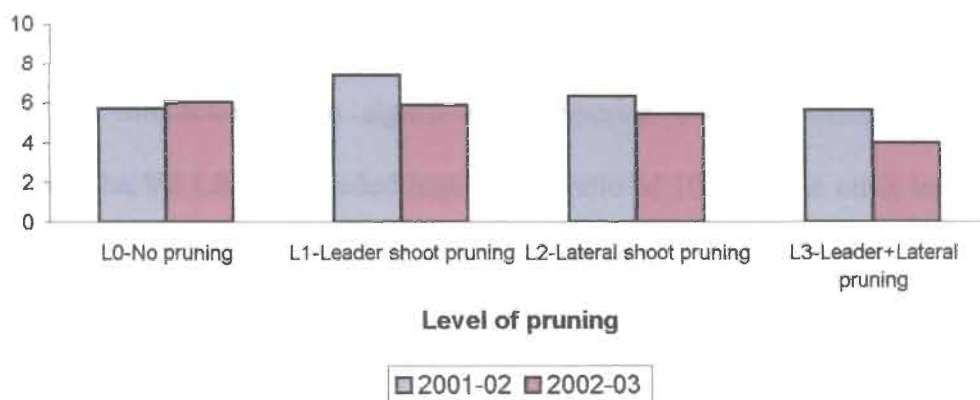


**Fig.13c: Effect of level of pruning on sex ratio
(male to hermaphrodite flowers)**



4.1.13.2 During 2002-03:

The data of the Table 4.4a and 4.4b showed significant differences between varieties, among the levels of pruning, time of pruning and their interaction for the character sex ratio.

Between the varieties significant differences were recorded. The variety BPP-4 (V1) recorded significant lowest sex ratio of 4.45 while the other variety BPP-6 (V2) recorded sex ratio of 6.22.

Among the time of pruning, the treatment mid-September (T3) recorded significantly lowest sex ratio of 4.89, which was significantly superior other two times of pruning mid-July (T1 5.52) followed mid-August (T2 5.60) which were on par with each other.

Among the levels of pruning significant differences were recorded. The treatment Leader +Lateral shoot pruning (L3) recorded significantly lowest sex ratio of 3.99, which was significantly superior over other levels of pruning and it was followed by Lateral shoot pruning (L2 5.43). The highest sex ratio of 6.05 was recorded by control (L0).

Among the interactions the significant differences were recorded. The treatment V1 L3 T3 recorded lowest sex ratio of 2.23 followed by V1 L2 T1 of 2.59. These treatments of interaction were significantly superior over all other corresponding interactions. The V2 L0 T1 recorded highest sex ratio of 10.68. The other treatments of interactions showed a range from 3.28 to 7.69 of sex ratio.

4.1.14 Percentage of fruits set:

The data on percentage of fruit set as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were collected and statistically analysed and presented in the Table 4.4a and 4.4b.

4.1.14.1 During 2001-02:

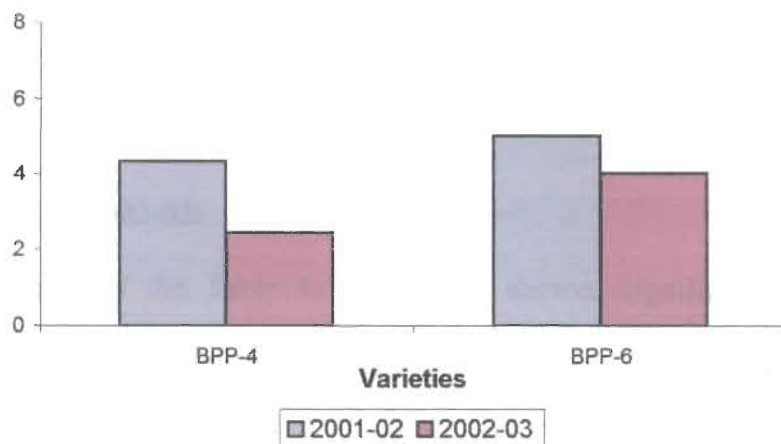
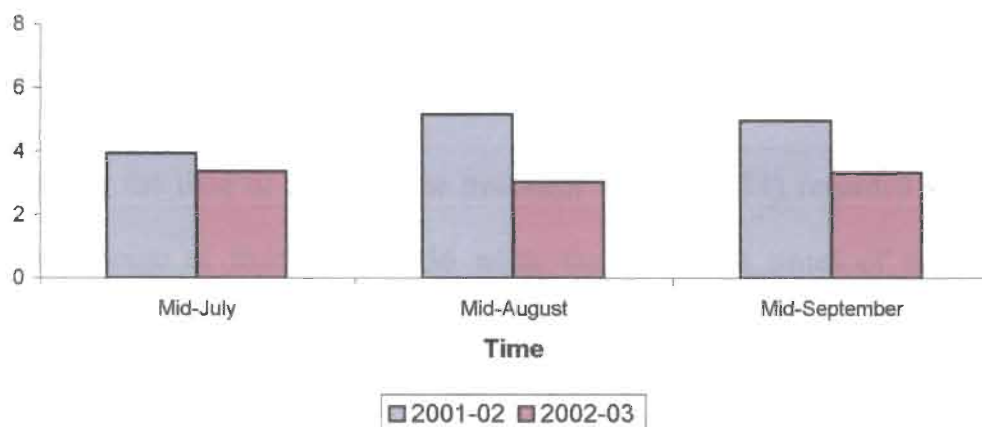
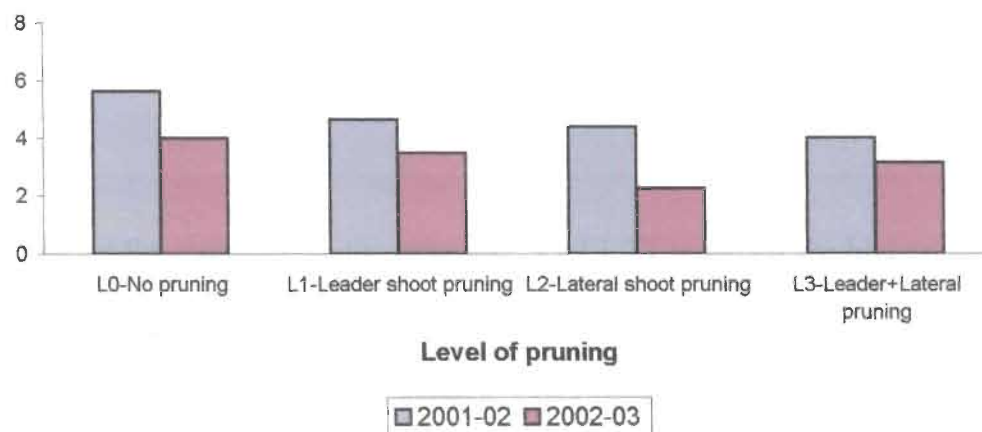
The data of the table showed significant difference between varieties, time of pruning, among the levels of pruning and their interaction for the character percentage of fruit set.

Between the varieties the variety BPP-6 (V2) recorded significantly the highest percentage of fruit set of 5.01 while the other variety BPP-4 (V1) recorded 4.33 percentage of fruit set.

Among the time of pruning, the treatment mid–August (T2) recorded significantly highest percentage of fruit set of 5.14 while the other two times of pruning mid–September (T3 4.93) followed mid-July pruning (T1) recorded the percentage of fruit set of 3.92.

Among the levels of pruning, the treatment control (L0) recorded significantly highest percentage of fruit set of 5.63 which was followed by Leader shoot pruning (L1 4.63) and Lateral shoot pruning (L2 4.39). The lowest percentage of fruit set of 4.02 was recorded by Leader+ Lateral shoot pruning (L3).

Among the interactions, the treatment V2 L1 T1 recorded the highest 9.21 of percentage of fruit set followed by V1 L1 T2 of 7.50. These treatments of interaction

Fig.14a: Effect of pruning on varieties for percentage of fruit set**Fig.14b: Effect of time of pruning on percentage of fruit set****Fig.14c: Effect of level of pruning on percentage of fruit set**

were significantly superior over all other corresponding interactions. The V1 L2 T2 recorded lowest percentage of fruit set of 2.07. The other treatments of interactions showed a range from 2.49 to 6.16 percentage of fruit set.

4.1.14.2 During 2002-03:

The data of the Table 4.4a and 4.4b showed significant difference between varieties, time of pruning, among the levels of pruning and their interaction for the character percentage of fruit set.

Between the varieties, the variety BPP-6 (V2) recorded significantly the highest percentage of fruit set of 4.01 while the other variety BPP-4 (V1) recorded 2.44 percentage of fruit set.

Among the time of pruning, the treatment mid-July (T1) recorded significantly highest percentage of fruit set of 3.36 while the other two times of pruning mid-September (T3 3.31) followed mid-August pruning (T2) recorded the percentage of fruit set of 3.01.

Among the levels of pruning, the treatment control (L0) recorded highest percentage of fruit set of 3.98, which was followed by Leader shoot pruning (L1 3.47). The lowest percentage of fruit set of 2.28 was recorded by Leader+ Lateral shoot pruning (L3).

Among the interactions, the treatment V2 L1 T1 recorded the highest percentage of fruit set of 8.71 followed by V2 L1 T3 of 5.90. These treatments of interaction were significantly superior over all other corresponding interactions. The treatment V2 L3 T2

recorded the lowest percentage of fruit set of 1.40. The other treatments of interactions showed a range from 1.74 to 5.60 of percentage of fruit set.

4.1.15 Number of fruits per panicle:

The data on number of fruits per panicle as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were collected and statistically analysed and presented in the Table 4.4a and 4.4b.

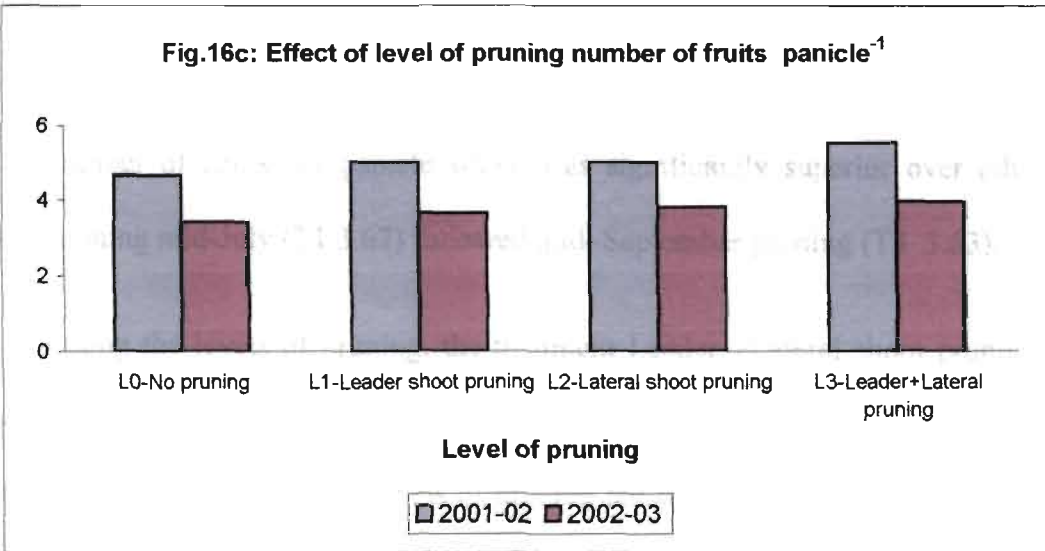
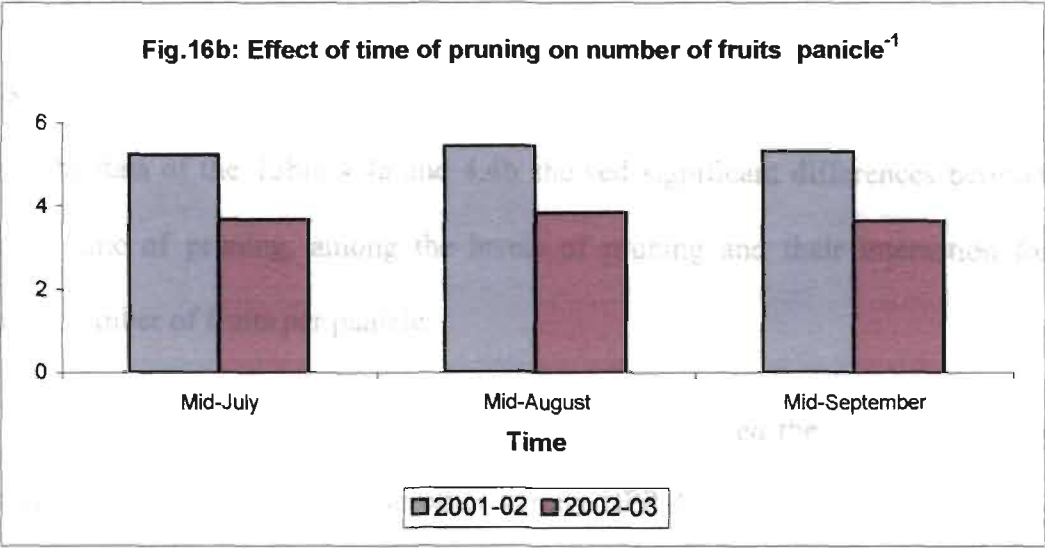
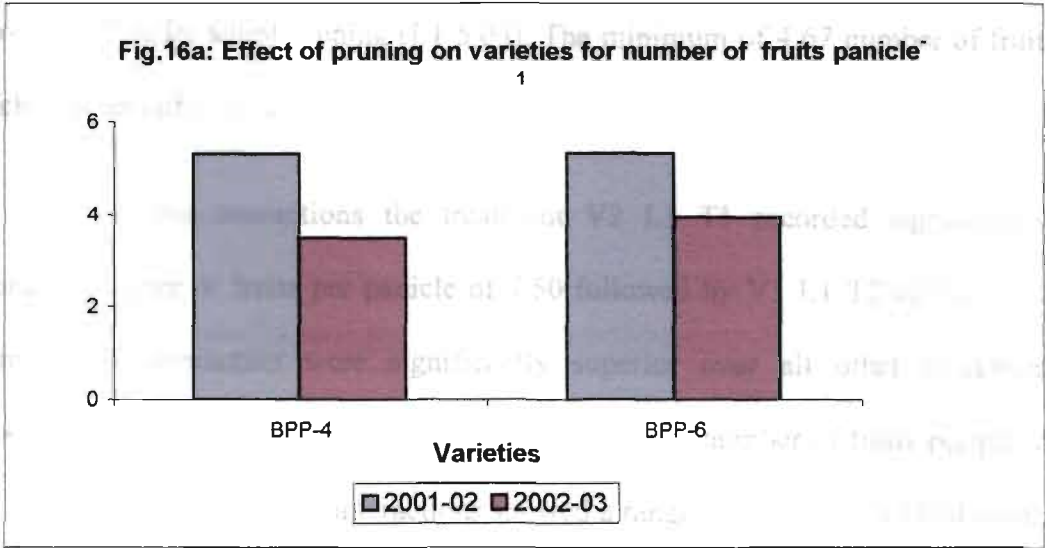
4.1.15.1 During 2001-02:

The data of the table showed significant difference among the levels of pruning, and their interaction and non-significant differences between varieties and time of pruning.

Between the varieties the non-significant differences were recorded. However, variety BPP-6 (V2) recorded the maximum number of fruits per panicle of 5.32 while the other variety BPP-4 (V1) recorded 5.31 number of fruits per panicle.

Among the time of pruning treatments non-significant differences were recorded. However, mid–August pruning (T2) recorded a maximum of 5.43 number of fruits per panicle while the other two times of pruning mid–September (T3 5.30) followed mid-July pruning (T1) recorded a 5.22 number of fruits per panicle.

Among the levels of pruning significant differences were recorded. The treatment Leader +Lateral shoot pruning (L3) recorded significantly maximum number of fruits per panicle of 5.53, which was significantly superior over other levels of pruning and it was



followed by Leader shoot pruning (L1 5.03). The minimum of 4.67 number of fruits per panicle was recorded by control (L0).

Among the interactions the treatment V2 L1 T1 recorded significantly the maximum number of fruits per panicle of 7.50 followed by V1 L1 T2 of 7.25. These treatments of interaction were significantly superior over all other corresponding interactions. The treatment V2 L3 T2 recorded minimum number of fruits per panicle of 3.60. The other treatments of interactions showed a range from 3.75 to 6.38 of number of fruits per panicle.

4.1.15.2 During 2002-03:

The data of the Table 4.4a and 4.4b showed significant differences between the varieties, time of pruning, among the levels of pruning and their interaction for the character number of fruits per panicle.

Between the varieties, the variety BPP-6 (V2) recorded the maximum number of fruits per panicle of 3.94 while the other variety BPP-4 (V1) recorded 3.48 number of fruits per panicle.

Among the time of pruning, the treatment mid–August (T2) recorded a maximum of 3.83 number of fruits per panicle which was significantly superior over other two times of pruning mid-July (T1 3.67) followed mid–September pruning (T3 3.63).

Among the levels of pruning, the treatment Leader +Lateral shoot pruning (L3) recorded significantly maximum number of fruits per panicle of 3.96, which was significantly superior over other levels of pruning but on par with Lateral shoot pruning

(L2 3.81). The minimum of 3.42 number of fruits per panicle was recorded by control (L0).

Among the interactions, the treatment V1 L1 T3 recorded significantly the maximum of 5.63 number of fruits per panicle followed by V2 L1 T1 of 5.25. These treatments of interaction were significantly superior over all other corresponding interactions. The V1 L2 T3 recorded minimum number of fruits per panicle of 2.75. The other treatments of interactions showed a range from 2.88 to 5.18 of number of fruits per panicle.

4.1.16 Number of nuts reached maturity m^{-2} :

The data on number of nuts reached maturity m^{-2} as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were recorded, statistically analysed and presented in the Table 4.5a and 4.5b.

4.1.16.1 During 2001-02:

The data of the table showed significant difference between varieties, time of pruning, among the levels of pruning and their interaction for the character number of nuts reached maturity m^{-2} .

Between the varieties, the variety BPP-4 (V1) recorded the highest number of nuts reached maturity per square meter of 48.58 while the other variety BPP-6 (V2) recorded number of nuts reached maturity per square meter of 46.01.

Among the time of pruning, the treatment mid–August (T2) recorded significantly highest number of nuts reached maturity m^{-2} of 50.83 which was significantly superior

Table 4.5a: Number of fruits per panicle, nut weight and nut yield per tree in cashew as influenced by pruning variety, time of pruning and level of pruning.

	Number of nuts reached maturity m ⁻²			Nut weight (g)		Nut yield tree ⁻¹ (kg)	
	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03	
Varieties:							
BPP-4 (V1)	48.58	31.45	4.43	4.40	2.602	2.449	
BPP-6 (V2)	46.01	23.13	5.31	5.28	2.777	2.304	
Time of Pruning:							
Mid-July (T1)	44.91	30.03					
Mid-August (T2)	50.83	25.55	4.96	4.44	2.853	2.565	
Mid-September (T3)	46.16	26.29	4.77	5.09	2.628	2.415	
			4.87	4.99	2.587	2.148	
Level of Pruning:							
Control (No pruning) (L0)	43.42	27.50					
Leader shoot pruning (L1)	45.98	26.88	4.68	4.44	2.383	2.233	
Lateral shoot pruning (L2)	45.56	23.91	4.87	4.96	2.945	2.628	
Leader + Lateral shoot pruning (L3)	54.23	30.88	4.89	4.86	2.688	2.445	
			5.04	5.11	2.741	2.200	
2001-2002							
	S Em	CD	S Em	CD	S Em	CD	
Varieties	0.61	1.27	0.04	0.09	0.026	0.054	
Time of pruning	0.75	1.55	0.05	0.11	0.032	0.065	
Levels of pruning	0.86	1.79	0.06	0.13	0.037	0.076	
2002-2003							
	S Em	CD	S Em	CD	S Em	CD	
Varieties	0.34	0.71	0.04	0.08	0.042	0.088	
Time of pruning	0.42	0.86	0.05	0.10	0.053	0.108	
Levels of pruning	0.48	0.99	0.06	0.12	0.060	0.125	

Fig.15a: Effect of pruning on varieties for number of nuts reached maturity m^{-2}

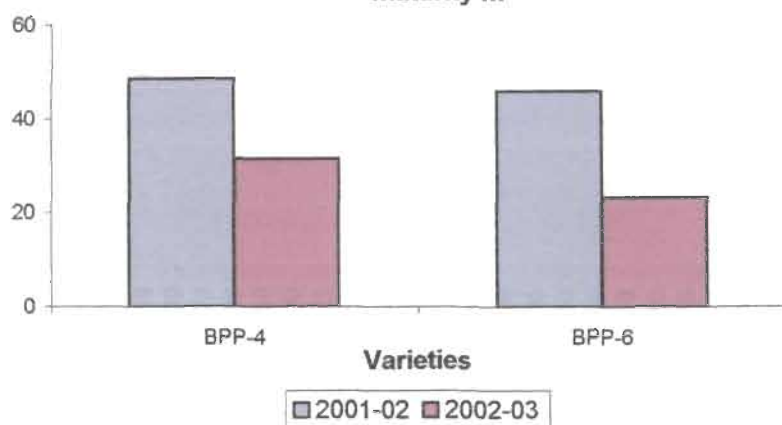


Fig.15b: Effect of time of pruning on number of nuts reached maturity m^{-2}

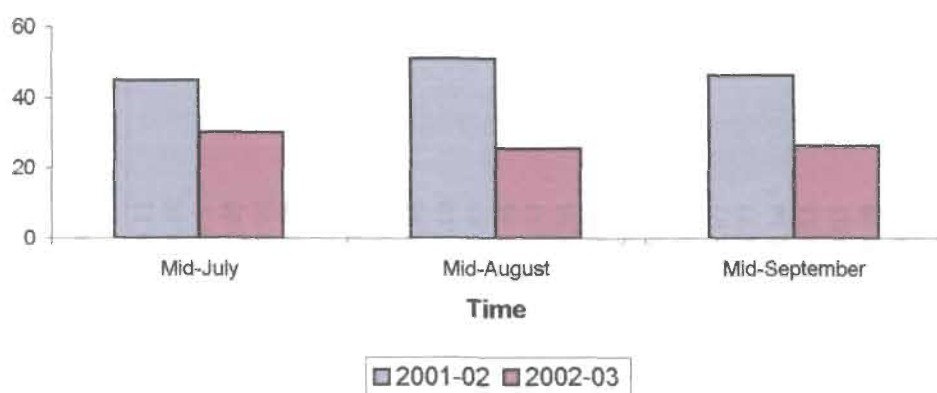


Fig.15c: Effect of level of pruning on number of nuts reached maturity m^{-2}

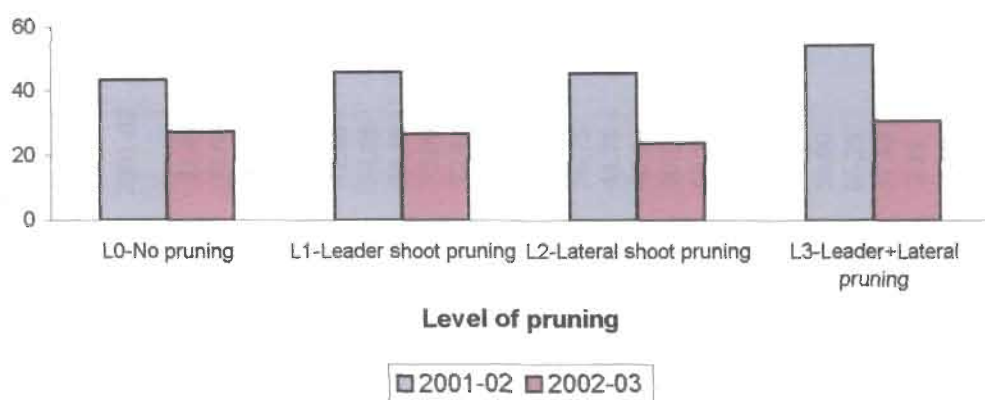


Table 4.5b: Number of nuts reached maturity m⁻², nut weight and nut yield tree⁻¹ in cashew as influenced by interactions of variety, time of pruning and level of pruning.

INTERACTION:	Number of nuts reached maturity m ⁻²			Nut weight (g)			Nut yield tree ⁻¹ (kg)	
	2001-02	2002-03		2001-02	2002-03		2001-02	2002-03
V1L0T1	23.00	28.13		4.11	4.51		1.350	1.690
V1L1T1	52.63	31.63		4.10	4.24		3.900	3.550
V1L2T1	60.00	33.25		4.3	3.75		3.775	3.050
V1L3T1	39.00	42.75		4.09	4.82		2.875	2.625
V1L0T2	26.00	18.63		3.94	4.82		1.300	1.400
V1L1T2	72.00	26.00		4.72	3.90		3.700	3.750
V1L2T2	54.00	26.63		5.00	3.42		3.325	2.575
V1L3T2	55.88	25.62		4.49	5.43		2.700	2.500
V1L0T3	35.00	25.13		3.91	4.56		1.300	1.675
V1L1T3	72.88	55.13		4.96	3.43		2.450	2.400
V1L2T3	64.63	27.38		5.10	5.24		2.400	2.150
V1L3T3	28.00	37.25		4.45	4.75		2.150	2.025
V2L0T1	23.38	20.38		4.36	3.57		1.400	1.600
V2L1T1	56.75	31.38		5.27	5.11		3.800	3.500
V2L2T1	44.75	20.25		5.95	5.46		3.450	2.375
V2L3T1	44.00	23.50		4.95	4.87		3.250	1.500
V2L0T2	30.13	22.62		5.68	5.95		1.250	1.800
V2L1T2	64.75	27.75		5.84	5.39		3.750	3.600
V2L2T2	47.00	20.37		6.12	4.17		3.550	2.425
V2L3T2	54.38	24.00		5.07	5.43		3.225	2.175
V2L0T3	27.13	21.75		4.77	6.14		2.350	1.850
V2L1T3	56.00	23.38		6.14	6.72		2.500	2.375
V2L2T3	66.25	23.13		4.53	4.54		2.450	2.250
V2L3T3	37.62	19.00		5.03	5.96		2.350	2.200
SEm	2.12	1.18		0.20	0.10		0.089	0.148
CD (0.05)	4.39	2.45		0.30	0.30		0.186	0.307

over other two times of pruning mid–September (T3 46.16) followed mid-July (T1) recorded the number of nuts reached maturity per square meter of 44.91.

Among the levels of pruning, the treatment Leader + Lateral shoot pruning (L3) recorded significantly highest number of nuts reached maturity per square meter of 54.23 which was followed by Leader shoot pruning 45.98 (L1). The lowest number of nuts reached maturity per square meter of 43.42 was recorded by control (L0).

Among the interactions, the highest of 72.88 number of nuts reached maturity per square meter was recorded by V1 L1 T3 followed by V1 L1 T2 of 72.00. These treatments of interaction were significantly superior over all other corresponding interactions. The treatment V1L0T1 recorded the lowest number of nuts reached maturity m^{-2} of 23.0. The other treatments of interactions showed a range from 23.38 to 66.25 number of nuts reached maturity m^{-2} .

4.1.16.2 During 2002-03:

The data of the Table 4.5a and 4.5b showed significant difference between varieties, time of pruning, among the levels of pruning and their interaction for the character number of nuts reached maturity m^{-2} .

Between the varieties, the variety BPP-4 (V1) recorded the highest number of nuts reached maturity per square meter of 31.45 while the other variety BPP-6 (V2) recorded 23.13 number of nuts reached maturity m^{-2} .

Among the time of pruning, the treatment mid–July (T1) recorded significantly highest number of nuts reached maturity per square meter of 30.03 which was

significantly superior over other two times of pruning mid-September (T3 26.29) followed mid-July (T1 25.55) recorded the number of nuts reached maturity m^{-2} .

Among the levels of pruning, the treatment Leader + Lateral shoot pruning (L3) recorded significantly highest number of nuts reached maturity per square meter of 30.88 which was followed by control (L0 27.50) and Leader shoot pruning (L1 26.88). The lowest number of nuts reached maturity m^{-2} of 23.91 was recorded by Lateral shoot pruning (L2).

Among the interactions, the highest of 55.13 number of nuts reached maturity per square meter was recorded by V1 L1 T3 followed by V1 L3 T1 of 42.75. These treatments of interaction were significantly superior over all other corresponding interactions. The lowest of 18.63 was recorded by V1L0T2 of number of nuts reached maturity m^{-2} . The other treatments of interactions showed a range from 19.00 to 37.25 number of nuts reached maturity m^{-2} .

4.1.17 Nut weight:

The data on nut weight as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were recorded, statistically analysed and presented in the Table 4.5a and 4.5b.

4.1.17.1 During 2001-02:

The data of the table showed significant difference between varieties, time of pruning, among the levels of pruning and their interaction for the character nut weight.

Fig.17a: Effect of pruning on varieties for nut weight

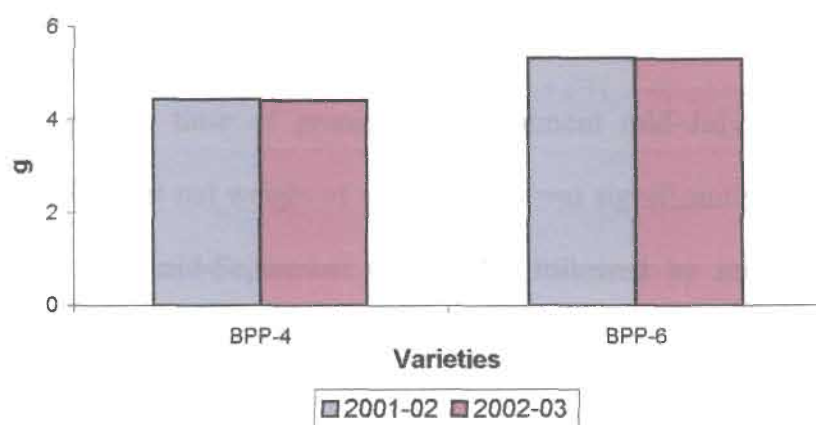


Fig.17b: Effect of time of pruning on nut weight

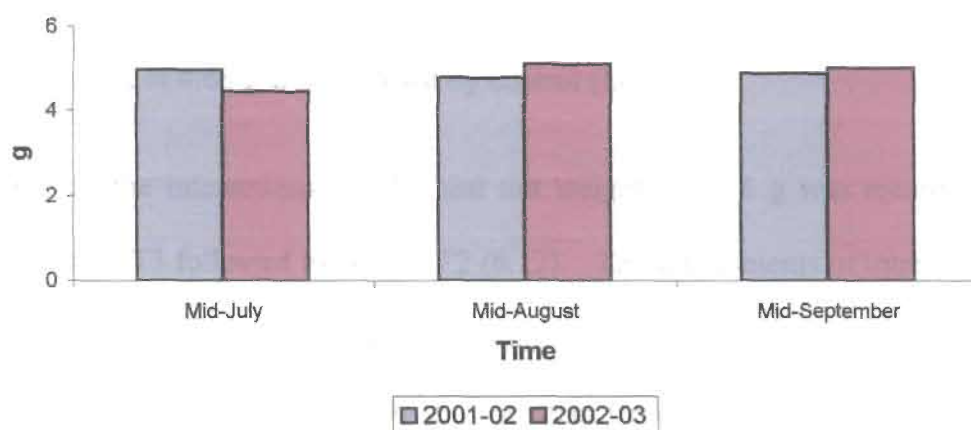
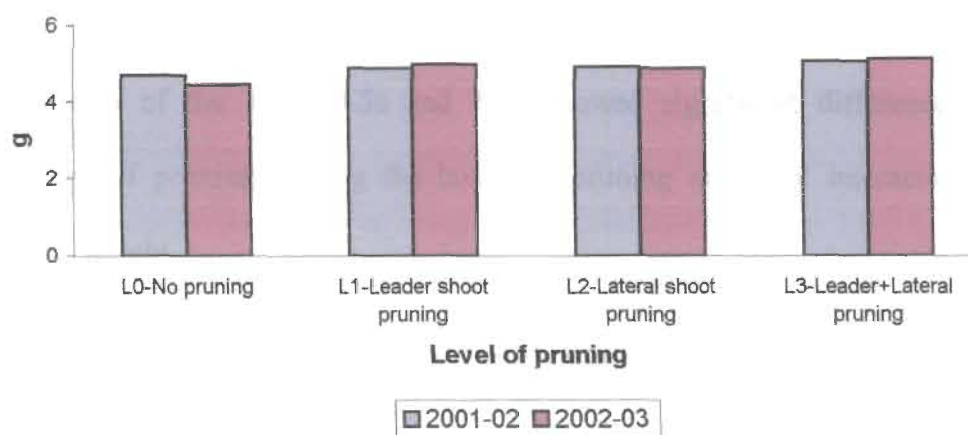


Fig.17c: Effect of level of pruning on nut weight



Between the varieties, the variety BPP-6 (V2) recorded the highest nut weight of 5.31 g while the other variety BPP-4 (V1) recorded the nut weight of 4.43 g.

Among the time of pruning, the treatment mid-July pruning (T1) recorded significantly highest nut weight of 4.96 g which was significantly superior over other two times of pruning mid-September (T3 4.87g) followed by mid-August pruning (T2) recorded the nut weight of 4.77 g.

Among the levels of pruning, the treatment Leader +Lateral shoot pruning (L3) recorded significantly highest nut weight of 5.04 g, which was significantly superior over all other levels of pruning and it was followed by Lateral shoot pruning (L2 4.89 g). The lowest nut weight of 4.68 g was recorded by control (L0).

Among the interactions, the highest nut weight of 6.14 g was recorded by the treatment V2 L1 T3 followed by V2 L2 T2 (6.12). These treatments of interaction were significantly superior over all other corresponding interactions. The treatment V1 L0T3 recorded the lowest nut weight of 3.91 g. The other treatments of interactions showed a range from 3.94 to 5.95 of nut weight.

4.1.17.2 During 2002-03:

The data of the Table 4.5a and 4.5b showed significant difference between varieties, time of pruning, among the levels of pruning and their interaction for the character nut weight.

Between the varieties, the variety BPP-6 (V2) recorded the highest nut weight of 5.28 g while the other variety BPP-4 (V1) recorded a nut weight 4.40 g.

Among the time of pruning, the treatment mid–August (T2) recorded significantly the highest nut weight of 5.09g which was significantly superior over other treatments mid-September (T3 4.99 g) and mid–July pruning (T1 4.44 g) but on par with each other for the nut weight.

Among the levels of pruning, the treatment Leader +Lateral shoot pruning (L3) recorded significantly highest nut weight of 5.11g, which was significantly superior over all other levels of pruning and it was followed by Leader shoot pruning (L1) 4.96 g of nut weight. The lowest nut weight of 4.44 g was recorded by control (L0).

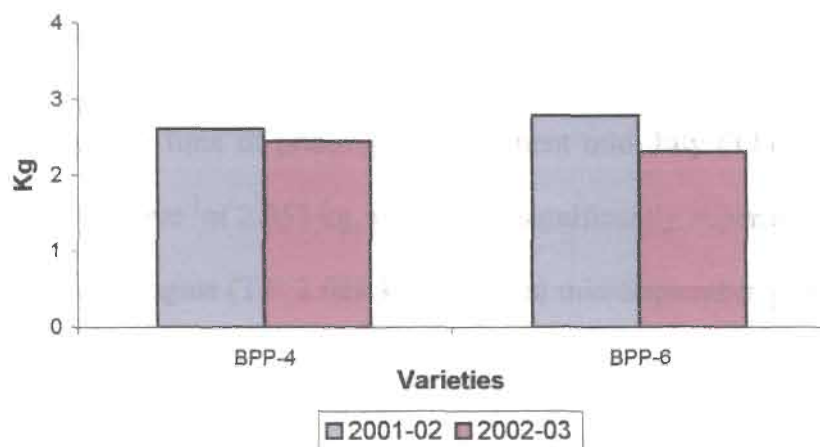
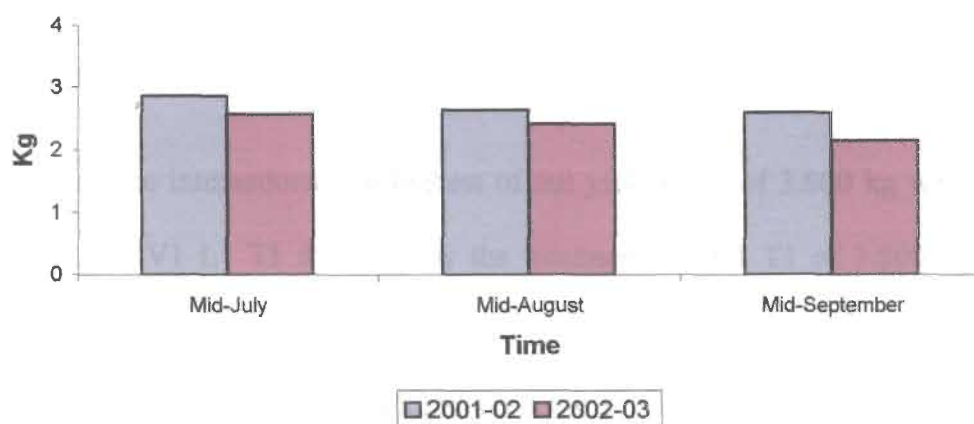
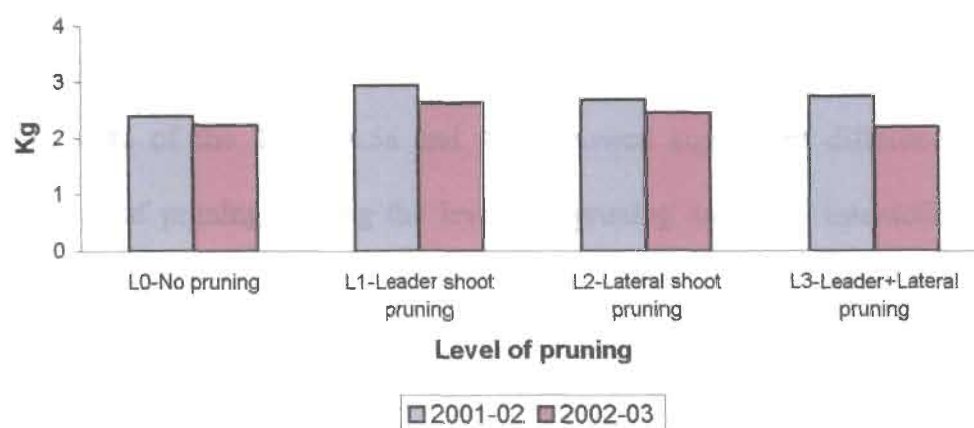
Among the interactions, the treatment V2 L1 T3 recorded the highest nut weight of 6.72 g followed 6.14 g was recorded by V2 L0 T3. These treatments of interaction were significantly superior over all other corresponding interactions. The treatment V1 L2T2 recorded the lowest nut weight of 3.42 g. The other treatments of interactions showed a range from 3.57 g to 5.96 g of nut weight.

4.1.18 Nut yield tree⁻¹ (kg):

The data on nut yield tree⁻¹ as influenced by varieties, level of pruning, time of pruning and their interactions during the years 2001-02 and 2002-03 were recorded, statistically analysed and presented in the Table 4.5a and 4.5b.

4.1.18.1 During 2001-02:

The data of the table showed significant difference between varieties, time of pruning, among the levels of pruning and their interaction for the character nut yield tree⁻¹.

Fig.18a: Effect of pruning on varieties for nut yield tree⁻¹Fig.18b: Effect of time of pruning on nut yield tree⁻¹Fig.18c: Effect of level of pruning on nut yield tree⁻¹

Between the varieties, the variety BPP-6 (V2) recorded the highest nut yield tree⁻¹ of 2.777 kg while the other variety BPP-4 (V1) recorded nut yield tree⁻¹ of 2.602 kg.

Among the time of pruning, the treatment mid-July (T1) recorded significantly highest nut yield tree⁻¹ of 2.853 kg, which was significantly superior over other two times of pruning mid-August (T2 2.628 kg) followed mid-September pruning (T3 2.587 kg) recorded the nut yield tree⁻¹.

Among the levels of pruning, the treatment Leader shoot pruning (L1) recorded significantly highest nut yield tree⁻¹ of 2.945 kg, which was significantly superior over all other levels of pruning and it was followed by Leader+ Lateral shoot pruning (L3 2.741 kg). The lowest nut yield tree⁻¹ of 2.383 kg was recorded by control (L0).

Among the interactions, the highest of nut yield tree⁻¹ of 3.900 kg was recorded by the treatment V1 L1 T1 followed by the treatment V2 L1 T1 of 3.800 kg. These treatments of interaction were significantly superior over all other corresponding interactions. The treatment V1 L0T1 recorded the lowest nut yield tree⁻¹ of 1.250 kg. The other treatments of interactions showed a range from 1.300 kg to 3.775 kg nut yield tree⁻¹.

4.1.18.2 During 2002-03:

The data of the Table 4.5a and 4.5b showed significant difference between varieties, time of pruning, among the levels of pruning and their interaction for the character nut yield tree⁻¹.

Between the varieties, the variety BPP-6 (V2) recorded the significantly highest nut yield tree⁻¹ of 2.449 kg while the other variety BPP-6 (V2) recorded 2.304 kg nut yield tree⁻¹.

Among the time of pruning, the treatment mid-July (T1) recorded significantly highest nut yield tree⁻¹ of 2.565 kg which was significantly superior over other two times of pruning mid-August (T2 2.415 kg) followed mid-September (T3 2.148 kg) recorded the nut yield tree⁻¹.

Among the levels of pruning, the treatment Leader shoot pruning (L1) recorded significantly the highest nut yield tree⁻¹ of 2.628 kg which was significantly superior over all other levels of pruning and it was followed by Lateral shoot pruning (L2 2.445 kg). The lowest nut yield tree⁻¹ of 2.200 kg was recorded by Leader+ Lateral shoot pruning (L3).

Among the interactions, significantly the highest nut yield tree⁻¹ of 3.750 kg was recorded by the treatment V1 L1 T2 followed by V2 L1 T2 of 3.600 kg. These treatments of interaction were significantly superior over all other corresponding interactions. The lowest nut yield tree⁻¹ of 1.400 kg was recorded by the treatment V1L0T2. The other treatments of interactions showed a range from 1.500 to 3.550 kg nut yield tree⁻¹.

4.2. EFFECT OF PACLOBUTRAZOL:

4.2.1 Incremental growth in plant height (cm):

The data on incremental growth in plant height as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 statistically analyzed and presented in the Table 4.6.

4.2.1.1 During 2001-02:

The data of the table showed significant differences among the varieties and paclobutrazol concentrations and non-significant differences for their interactions for the character incremental growth in plant height.

Between the varieties, BPP-4 (V1) recorded the lowest incremental growth in plant height of 16.56 cm while the other variety BPP-6 (V2) recorded an incremental growth in plant height of 28.37 cm.

Among the concentrations of paclobutrazol in comparison with control (C0), 8 g a.i.tree⁻¹ (C4) recorded the lowest incremental growth in plant height of 21.05 cm, which was statistically on par with 6 g a.i.tree⁻¹ (C3 21.33 cm) and 4 g a.i.tree⁻¹ (C2 22.32cm). The treatment 2 g a.i.tree⁻¹ (C1) recorded significantly higher increment of plant height of 22.62 cm but was lower than the control (C0 25.00 cm).

Among the interactions non-significant differences were recorded. However, the lowest incremental growth in plant height of 14.77 cm was recorded by V1C4. The maximum incremental growth in plant height of 31.33 cm was recorded by control (V2C0). The other treatments of interaction showed an incremental growth in plant height ranging from 17.73 cm to 28.17 cm.

Table 4.6: Incremental growth in plant height, stem girth, mean canopy spread and number of shoots m⁻² in cashew as influenced by variety, paclobutrazol and their interactions.

	Incremental growth in plant height (cm)			Incremental growth in stem girth (cm)			Incremental growth in mean canopy spread (cm)			Number of shoots m ⁻²		
	height (cm)			girth (cm)			canopy spread (cm)					
	2001-02	2002-03		2001-02	2002-03		2001-02	2002-03		2001-02	2002-03	
Varieties:												
BPP-4 (V1)	16.56	11.24		2.47	2.85		101.40	63.86		35.62	28.85	
BPP-6 (V2)	28.37	14.63		2.02	3.07		140.60	60.85		33.43	26.65	
Concentrations of paclobutrazol:												
Control (Water spray)(C0)	25.00	25.72		2.02	2.08		126.80	117.20		32.29	22.92	
2 g a.i. per tree (C1)	22.62	15.38		2.40	1.83		110.80	70.30		34.04	27.13	
4 g a.i. per tree (C2)	22.32	11.75		2.43	1.58		122.30	48.60		38.17	33.20	
6 g a.i. per tree (C3)	21.33	6.52		2.50	4.33		123.30	40.30		35.92	28.33	
8 g a.i. per tree (C4)	21.05	5.30		1.88	4.98		121.80	35.40		32.21	27.17	
Interaction Effects:												
V1C0	18.67	18.50		2.03	2.42		117.70	105.50		33.00	24.50	
V1C1	17.73	15.83		2.30	2.15		90.00	96.40		36.42	27.25	
V1C2	16.47	11.83		2.67	1.66		103.50	37.30		39.00	36.92	
V1C3	15.17	6.27		2.63	3.00		101.70	36.50		37.25	29.33	
V1C4	14.77	3.77		2.73	5.00		100.70	43.50		32.42	26.25	
V2C0	31.33	32.93		1.73	1.75		142.10	128.70		31.58	21.33	
V2C1	27.50	14.93		1.73	1.50		131.50	44.30		31.67	27.00	
V2C2	28.17	11.67		2.13	1.50		141.10	59.80		37.33	29.50	
V2C3	27.50	6.77		2.23	5.66		144.90	44.20		34.58	27.33	
V2C4	27.33	6.83		2.27	4.97		143.50	27.30		32.00	28.08	
2001-2002												
	S Em	CD		S Em	CD		S Em	CD		S Em	CD	
Varieties	0.42	0.88		0.06	0.13		1.59	3.35		0.39	0.84	
Concentrations of paclobutrazol	0.88	1.39		0.10	0.21		2.52	5.30		0.63	1.32	
Interaction	0.94	NS		0.14	NS		3.57	NS		0.89	1.87	
2002-2003												
	S Em	CD		S Em	CD		S Em	CD		S Em	CD	
Varieties	0.76	1.59		0.18	0.39		1.88	NS		0.61	1.27	
Concentrations of paclobutrazol	1.20	2.51		0.29	0.62		2.97	6.24		0.95	2.01	
Interaction	1.69	3.56		0.42	0.87		4.20	8.83		1.35	2.84	

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Fig.19a: Effect of paclobutrazol on varieties for plant height increment

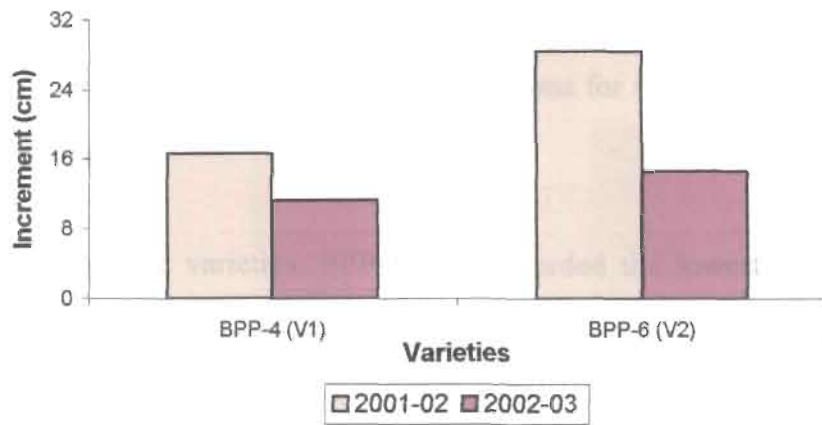


Fig.19b: Effect of paclobutrazol concentrations on plant height increment

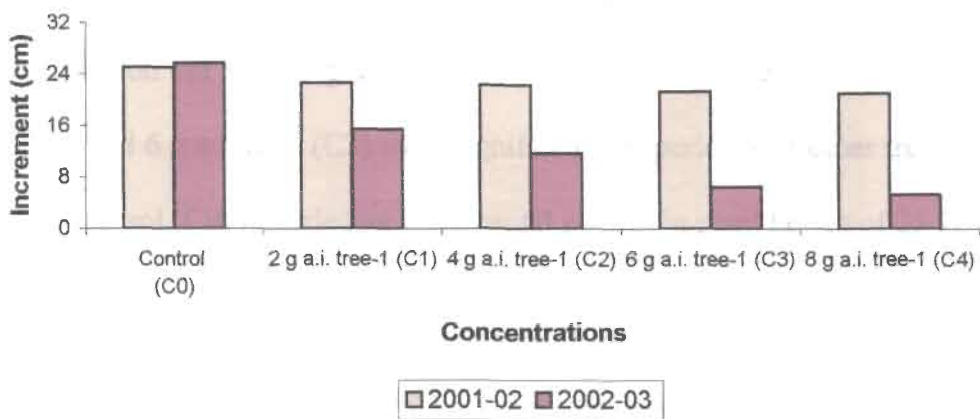
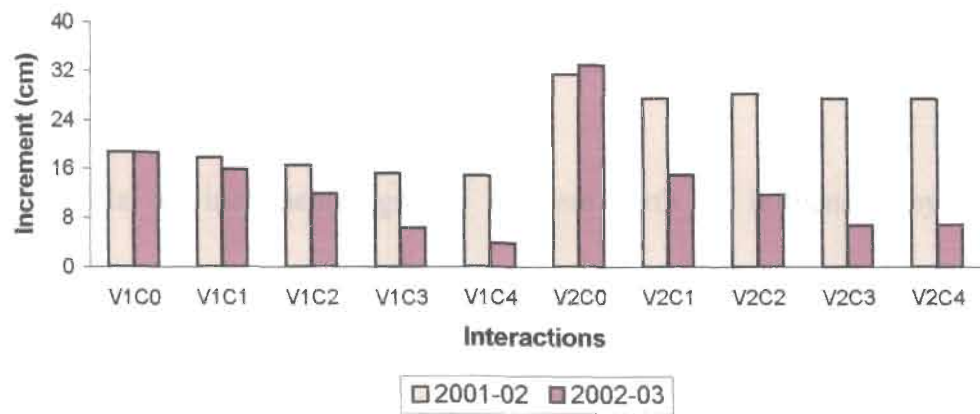


Fig.19c: Effect of interactions of varieties & paclobutrazol concentrations on plant height increment



4.2.1.2 During 2002-03:

The data of the Table 4.6 showed significant differences among the varieties, paclobutrazol concentrations and their interactions for the character incremental growth in plant height.

Between the varieties, BPP-4 (V1) recorded the lowest incremental growth in height of 11.24 cm while the other variety BPP-6 (V2) recorded an increment of 14.63 cm.

Among the concentrations of paclobutrazol in comparison with control, 8 g a.i.tree⁻¹ (C4) recorded the lowest incremental growth in plant height of 5.30 cm, which was statistically on par with 6 g a.i.tree⁻¹ (C3 6.52 cm). These two treatments of 8 g a.i.tree⁻¹ (C4) and 6 g a.i.tree⁻¹ (C3) were significantly superior over other treatments and control. The control (C0) recorded an incremental growth in plant height of 25.72 cm.

Among the interactions V1C4 recorded the significantly the lowest incremental growth in plant height with 3.77 cm which was on par with V1C3 (6.27 cm), V2C3 (6.77 cm) and V2C4 (6.83 cm). The maximum incremental growth in plant height of 32.93 cm was recorded by V2C0 (Control). The other treatments of interaction showed an increment of ranging from 11.67 cm to 18.50 cm.

4.2.2 Incremental growth in stem girth (cm):

The data on incremental growth in stem girth as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.6.

Fig.20a: Effect of paclobutrazol on varieties for stem girth increment

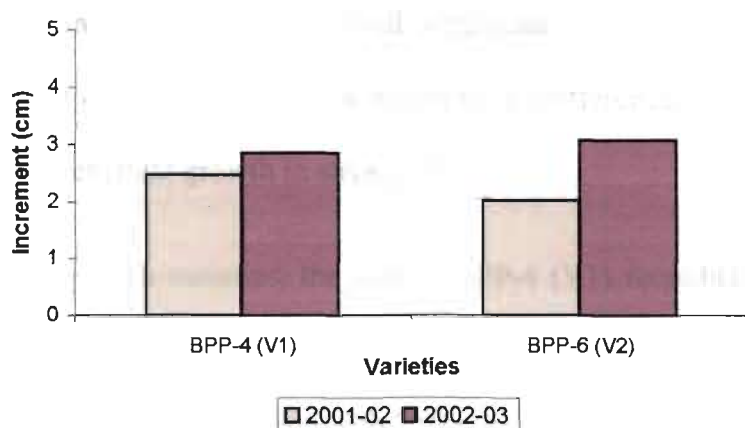


Fig.20b: Effect of paclobutrazol concentrations on stem girth increment

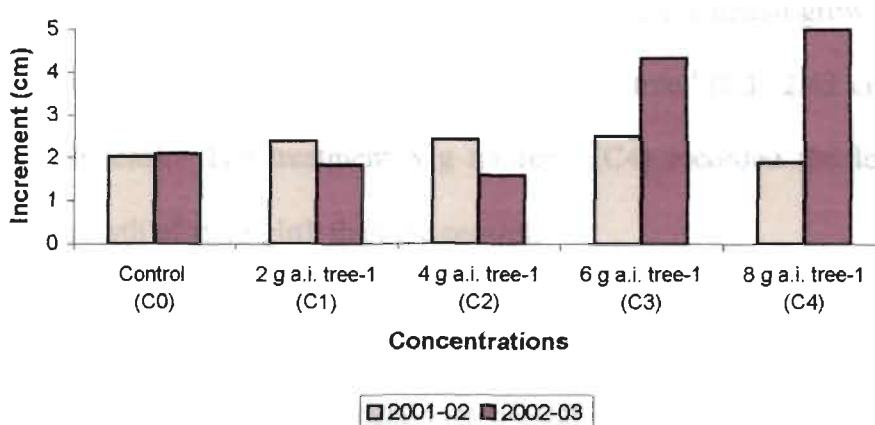
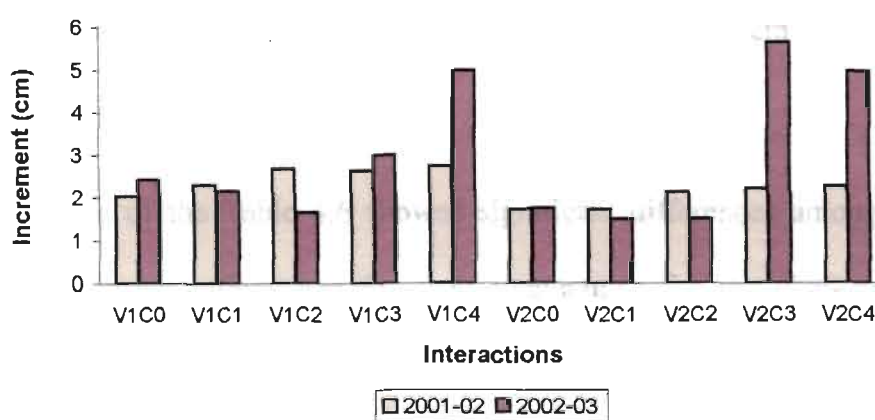


Fig.20c: Effect of interactions of varieties & paclobutrazol concentrations on stem girth increment



4.2.2.1 During 2001-02:

The data of the table showed significant differences among the varieties and paclobutrazol concentrations and non-significant differences for their interactions for the character incremental growth in stem girth.

Between the varieties, the variety BPP-4 (V1) recorded the highest incremental growth in stem girth with 2.47 cm while the other variety BPP-6 (V2) recorded an incremental growth in stem girth with 2.02 cm.

Among the concentrations of paclobutrazol in comparison with control (C0 2.02 cm), 6 g a.i.tree⁻¹ (C3) recorded significantly the highest incremental growth in stem girth of 2.50 cm, which was statistically on par with 4 g a.i.tree⁻¹ (C3 2.43 cm) and 2 g a.i. tree⁻¹ (C2 2.40 cm). The treatment 8 g a.i.tree⁻¹ (C4) recorded the lowest 1.88 cm incremental growth of stem girth than the control.

Among the interactions, non-significant differences were recorded. However, the treatment V1C4 recorded the highest incremental growth in stem girth of 2.73 cm followed by V1C2 (2.67 cm) and V1C3 (2.63 cm). The lowest incremental growth in stem girth of 1.73 cm was recorded by V2C0 (Control). The other treatments of interaction showed an increment of ranging from 2.13 cm to 2.30 cm.

4.2.2.2 During 2002-03:

The data of the Table 4.6 showed significant differences among the varieties, paclobutrazol concentrations and for their interactions for the character incremental growth in stem girth.

Between the varieties, the variety BPP-6 (V2) recorded significantly the highest incremental growth in stem girth of 3.07 cm while the other variety BPP-6 (V2) recorded an incremental growth in stem girth with 2.85 cm.

Among the concentrations of paclobutrazol in comparison with control (C0 2.08), 8 g a.i.tree⁻¹ (C4) recorded significantly the highest incremental growth in stem girth of 4.98 cm, which was followed by 6 g a.i.tree⁻¹ (C3 4.33 cm). The lowest increment in stem girth of 1.58 cm was recorded by 6 g a.i.tree⁻¹ (C2).

Among the interactions, significant highest incremental growth in stem girth of 5.66 cm was recorded by V2C3, which was on par with V1C4 (5.00 cm) and V2C4 (4.97 cm). The lowest incremental growth in stem girth of 1.50 cm was recorded by control (V2C0) and V2C1. The other treatments of interaction showed an incremental growth in stem girth ranging from 2.15 cm to 3.00 cm.

4.2.3. Incremental growth in mean canopy spread (cm):

The data on incremental growth in mean canopy spread as influenced by varieties, paclobutrazol concentration and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.6.

4.2.3.1 During 2001-02:

The data of the table showed significant differences among the varieties and paclobutrazol concentrations and non-significant differences were recorded for their interactions for the character incremental growth in mean canopy spread.

Fig.21a: Effect of paclobutrazol on varieties for mean canopy spread increment

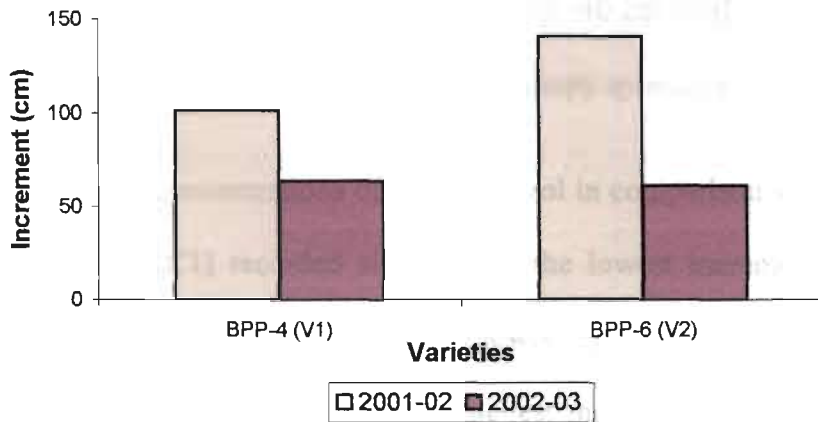


Fig.21b: Effect of paclobutrazol concentrations on mean canopy spread increment

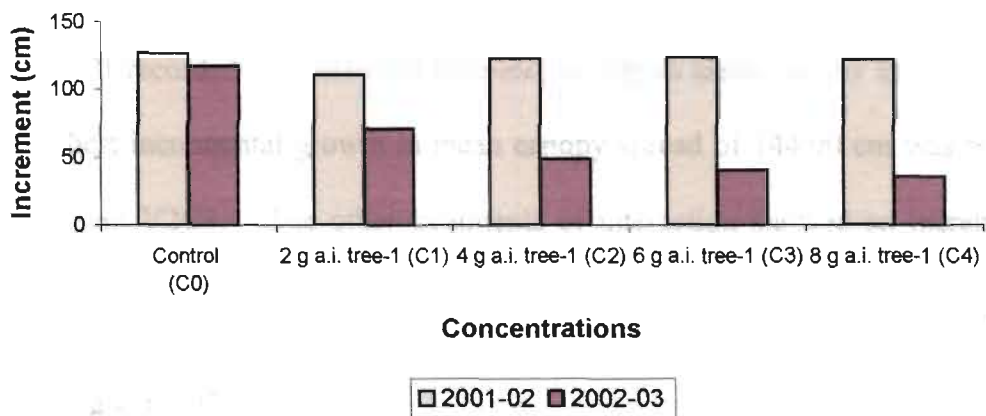
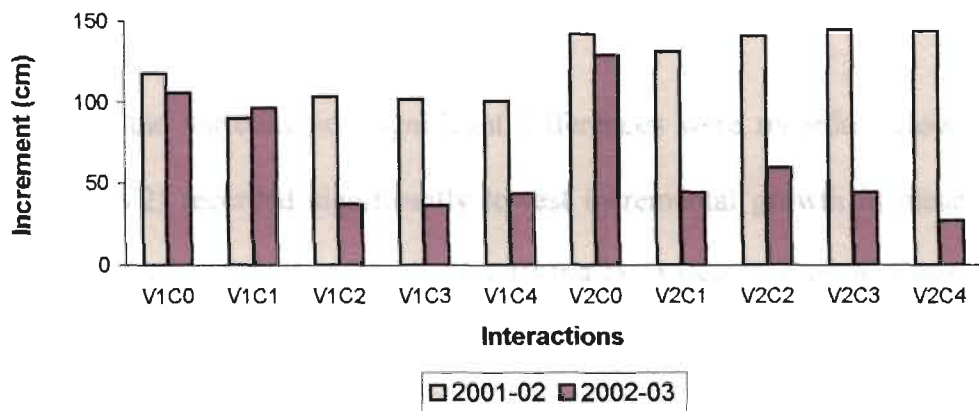


Fig.21c: Effect of interactions of varieties & paclobutrazol concentrations on mean canopy spread increment



Between the varieties, the variety BPP-4 (V1) recorded significantly lowest incremental growth in mean canopy spread of 101.40 cm while the other variety BPP-6 (V2) recorded an incremental growth in mean canopy spread of 140.60 cm.

Among the concentrations of paclobutrazol in comparison with control (C0 126.8 cm), 2 g a.i.tree⁻¹ (C1) recorded significantly the lowest incremental growth in mean canopy spread of 110.8 cm and it was followed by 8 g a.i.tree⁻¹ (C4 121.8 cm). The treatment 6 g a.i.tree⁻¹ (C3) recorded the highest mean canopy spread of 123.3 cm but lower than the control (C0).

Among the interactions, non-significant differences were recorded. However, the treatment V2C1 recorded the lowest incremental growth in mean canopy spread of 90.00 cm. The highest incremental growth in mean canopy spread of 144.90 cm was recorded by the treatment V2C3. The other treatments of interaction showed an increment of mean canopy spread ranging from 101.70 cm to 143.50 cm.

4.2.3.2 During 2002-03:

The data of the Table 4.6 showed significant differences among the paclobutrazol concentrations and their treatments of interactions and non-significant differences between the varieties for the character incremental growth in mean canopy spread.

Between the varieties non-significant differences were recorded. However, the variety BPP-6 (V2) recorded significantly lowest incremental growth in mean canopy spread with 60.85 cm while the other variety BPP-4 (V1) recorded an incremental mean canopy spread with 63.86 cm.

Among the concentrations of paclobutrazol in comparison with control (C0), 8 g a.i.tree⁻¹ (C4) recorded significantly the lowest incremental growth in mean canopy spread of 35.4 cm followed by 6 g a.i.tree⁻¹ (C3 40.3 cm). The treatment 2 g a.i.tree⁻¹ (C1) recorded the highest mean canopy spread of 70.3 cm but lower than the control (C0 117.2 cm).

Among the interactions the significant differences were recorded. The treatment V2C4 recorded lowest increment in mean canopy spread of 27.30 cm followed by V1C3 (36.50 cm). The highest 96.40 cm incremental growth in mean canopy spread was recorded by V1C1. The other treatments of interaction showed an incremental growth in mean canopy spread ranging from 37.30 cm to 59.8 cm.

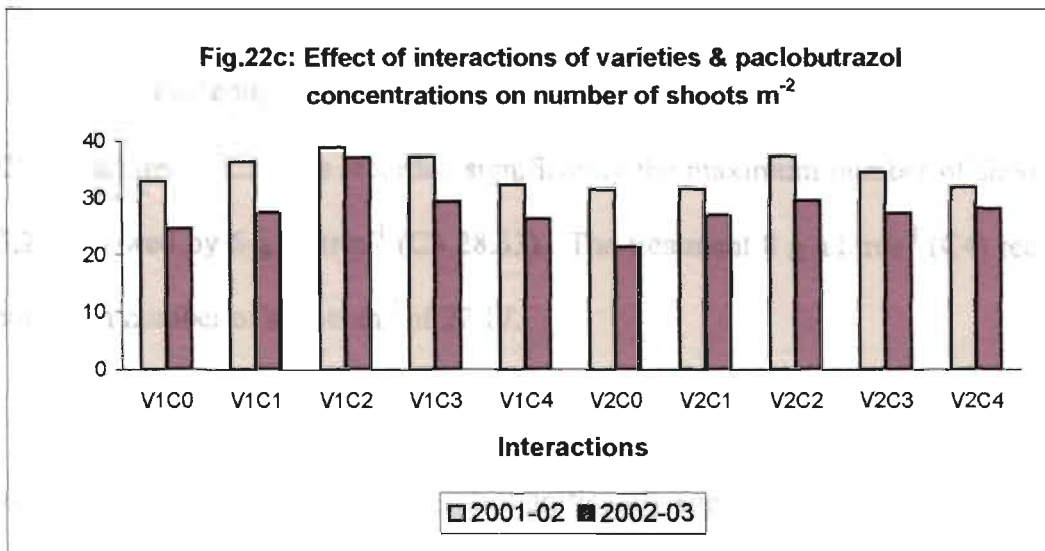
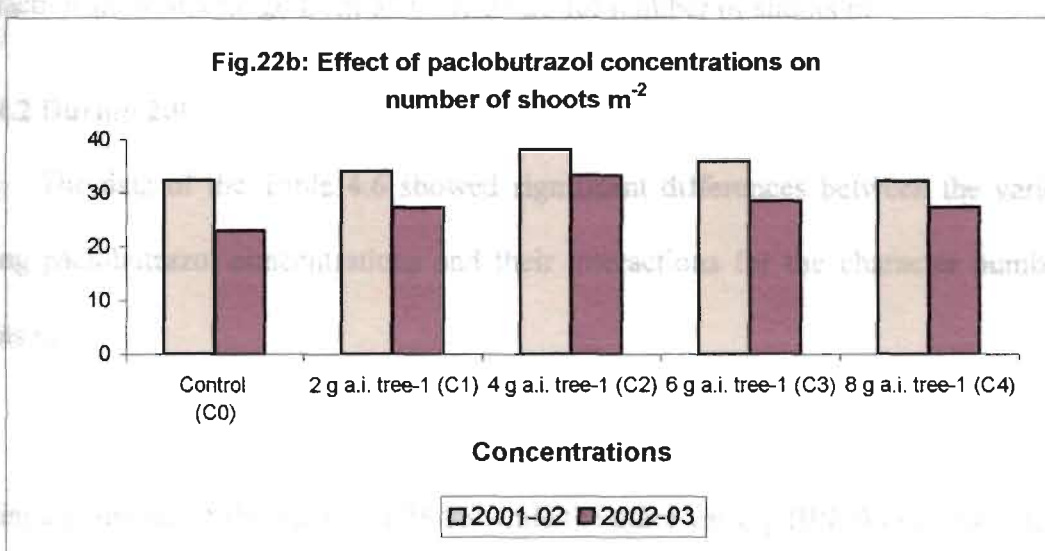
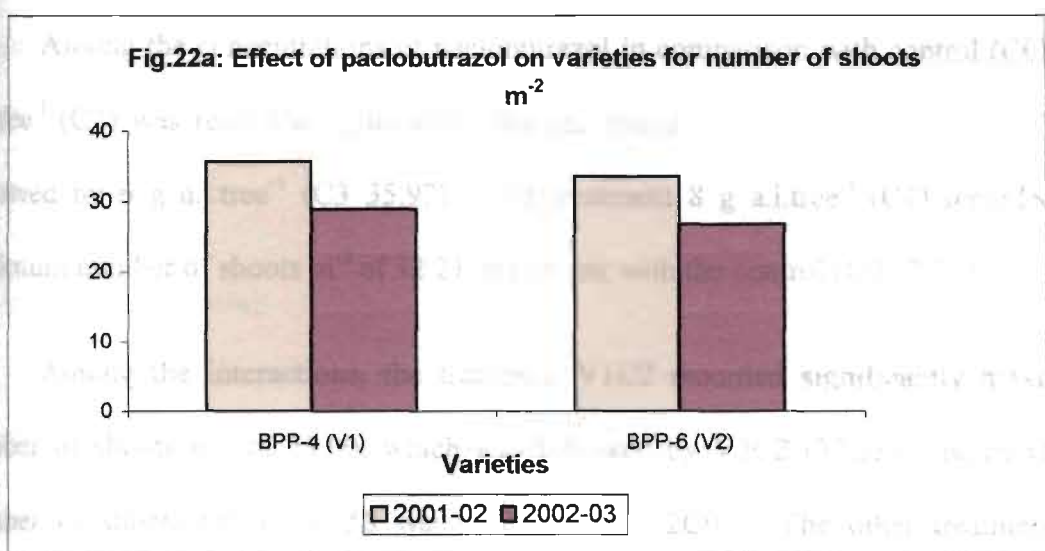
4.2.4 Number of shoots m⁻²:

The data on number of shoots m⁻² as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.6.

4.2.4.1 During 2001-02:

The data of the table showed significant differences between the varieties, among paclobutrazol concentrations and their interactions for the character number of shoots m⁻².

Between the varieties, the variety BPP-4 (V1) recorded significantly the maximum number of shoots m⁻² of 35.62 while the other variety BPP-6 (V2) recorded the number of shoots m⁻² of 33.43.



Among the concentrations of paclobutrazol in comparison with control (C0), 4 g a.i.tree⁻¹ (C2) was recorded significantly the maximum number of shoots m⁻² of 38.17 followed by 6 g a.i.tree⁻¹ (C3 35.92). The treatment 8 g a.i.tree⁻¹ (C4) recorded the minimum number of shoots m⁻² of 32.21 and on par with the control (C0 32.29).

Among the interactions, the treatment V1C2 recorded significantly maximum number of shoots m⁻² of 39.00, which was followed by V2C2 (37.33). The minimum number of shoots m⁻² of 31.58 was recorded by V2C0. The other treatments of interaction showed a range from 32.00 to 37.25 for number of shoots m⁻².

4.2.4.2 During 2002-03:

The data of the Table 4.6 showed significant differences between the varieties, among paclobutrazol concentrations and their interactions for the character number of shoots m⁻².

Between the varieties, the variety BPP-4 (V1) recorded significantly the maximum number of shoots m⁻² of 28.85 while the other variety BPP-6 (V2) recorded the number of shoots m⁻² of 26.65.

Among the concentrations of paclobutrazol in comparison with control (C0 22.92), 4 g a.i.tree⁻¹ (C2) was recorded significantly the maximum number of shoots m⁻² of 33.20 followed by 6 g a.i.tree⁻¹ (C3 28.33). The treatment 8 g a.i.tree⁻¹ (C4) recorded the minimum number of shoots m⁻² of 27.17.

Among the interactions, the treatment V1C2 recorded significantly maximum number of shoots m⁻² of 36.92, which was significantly superior over all other treatments

followed by V2C2 (29.50). The minimum number of shoots m^{-2} of 21.33 was recorded by V2C0. The other treatments of interaction showed a range from 24.50 to 29.33 for number of shoots m^{-2} .

4.2.5 Shoot length (cm):

The data on shoot length as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table. 4.7.

4.2.5.1 During 2001-02:

The data of the table showed significant differences among the paclobutrazol concentrations and non-significant differences between varieties and their interactions, for the character shoot length.

Between the varieties non-significant differences were recorded. However, the variety BPP-6 (V2) recorded the maximum shoot length of 17.60 cm while the other variety BPP-4 (V1) recorded the shoot length of 17.53 cm.

Among the concentrations of paclobutrazol 2 g a.i.tree⁻¹ (C1) was recorded significantly the maximum shoot length of 18.17 cm followed by 4 g a.i.tree⁻¹ (C2 17.38 cm) but lower than the control (C0 20.38 cm). The treatment 8 g a.i.tree⁻¹ (C4) recorded the minimum shoot length of 14.75 cm.

Among the interactions the non-significant differences were recorded. However, the treatment V2C0 recorded significantly maximum shoot length of 22.83 cm, which was followed by V2C1 (18.42 cm). The minimum shoot length of 14.58 cm was recorded

Table 4.7: Shoot length, number of leaves m⁻², leaf area per shoot (cm²), and chlorophyll-a content in cashew as influenced by variety, paclobutrazol and their interactions.

	Shoot length (cm)		Number of leaves m ²		Leaf area per shoot (cm ²)		Chlorophyll-a content (mg/g)	
	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03
Varieties:								
BPP-4 (V1)	17.53	15.55	321.13	334.61	628.83	581.04	1.423	1.336
BPP-6 (V2)	17.60	15.73	327.46	346.61	546.31	529.47	1.292	1.247
Concentrations of paclobutrazol:								
Control (Water spray)(C0)	20.38	18.96	360.80	371.73	721.57	677.49	1.234	1.220
2 g a.i. per tree (C1)	18.17	17.29	368.50	352.45	667.74	596.21	1.303	1.300
4 g a.i. per tree (C2)	17.38	16.92	350.93	335.13	562.63	556.11	1.259	1.256
6 g a.i. per tree (C3)	17.17	15.38	285.50	324.72	543.59	515.78	1.267	1.258
8 g a.i. per tree (C4)	14.75	9.67	256.26	319.02	442.33	430.69	1.725	1.425
Interaction Effects:								
V1C0	17.92	19.00	354.67	363.03	615.75	749.84	1.404	1.399
V1C1	17.92	17.33	365.67	345.97	781.41	652.22	1.424	1.424
V1C2	17.58	17.75	352.37	330.67	636.30	639.96	1.296	1.301
V1C3	16.33	14.33	281.83	317.97	550.97	514.70	1.079	1.064
V1C4	14.92	9.33	252.17	315.40	359.73	348.53	1.911	1.492
V2C0	22.83	18.92	366.93	380.43	627.38	605.15	1.064	1.042
V2C1	18.42	17.25	371.33	358.93	554.07	540.21	1.181	1.176
V2C2	17.17	16.08	349.50	339.60	488.96	472.25	1.223	1.210
V2C3	15.00	16.41	289.17	331.47	536.22	516.86	1.454	1.452
V2C4	14.58	10.00	260.37	322.63	524.93	512.86	1.540	1.357
2001-2002								
	S Em	CD	S Em	CD	S Em	CD	S Em	CD
Varieties	0.89	NS	4.34	NS	14.65	30.79	0.004	0.008
Concentrations of paclobutrazol	1.39	2.95	6.86	14.40	23.17	48.68	0.006	0.012
Interaction	1.99	NS	9.69	NS	32.71	68.85	0.008	0.017
2002-2003								
	S Em	CD	S Em	CD	S Em	CD	S Em	CD
Varieties	0.93	NS	3.64	7.65	9.59	20.15	0.003	0.007
Concentrations of paclobutrazol	1.41	2.95	5.76	12.10	15.16	31.86	0.005	0.011
Interaction	1.41	NS	8.15	NS	21.45	45.06	0.007	0.015

Fig.23a: Effect of paclobutrazol on varieties for shoot length

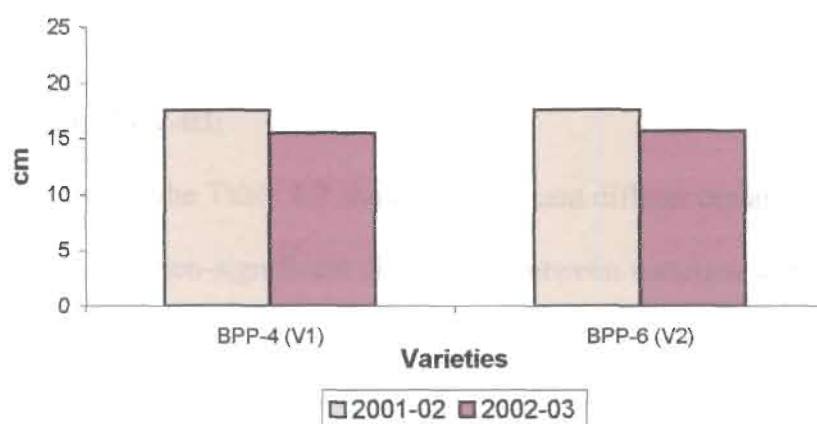


Fig.23b: Effect of paclobutrazol concentrations on shoot length

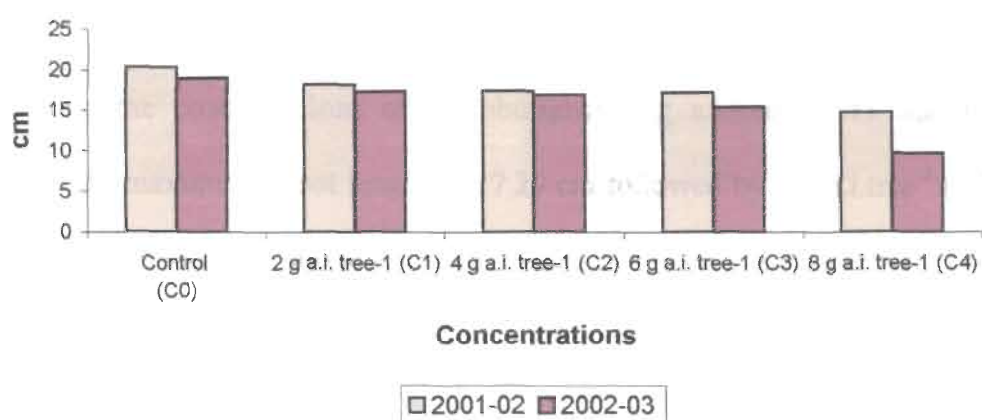
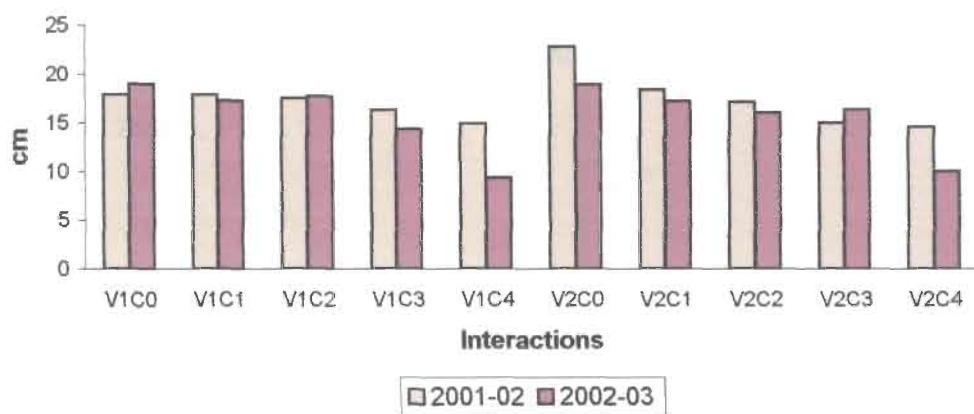


Fig.23c: Effect of interactions of varieties & paclobutrazol concentrations on shoot length



by V2C4. The other treatments of interaction showed a range from 14.92 cm to 18.42 cm of the shoot length.

4.2.5.2 During 2002-03:

The data of the Table 4.7 showed significant differences among the paclobutrazol concentrations and non-significant differences between varieties and their interactions for the character shoot length.

Between the varieties non-significant differences were recorded. However, the variety BPP-6 (V2) recorded the maximum shoot length of 15.73 cm while the other variety BPP-4 (V1) recorded the shoot length of 15.55 cm.

Among the concentrations of paclobutrazol 2 g a.i.tree⁻¹ (C1) was recorded significantly the maximum shoot length of 17.29 cm followed by 4 g a.i.tree⁻¹ (C2 15.58 cm) but lower than the control (C0 18.96 cm). The treatment 8 g a.i.tree⁻¹ (C4) recorded the minimum shoot length of 9.67 cm.

Among the interactions the non-significant differences were recorded. However, the treatment V1C0 recorded significantly maximum shoot length of 19.00 cm, which was followed by V2C0 (18.92 cm). The minimum shoot length of 9.33 cm was recorded by V1C4. The other treatments of interactions showed a range from 10.00 cm to 17.75 cm for the shoot length.

Plate 4: Effect of paclobutrazol on shoot length of BPP-4

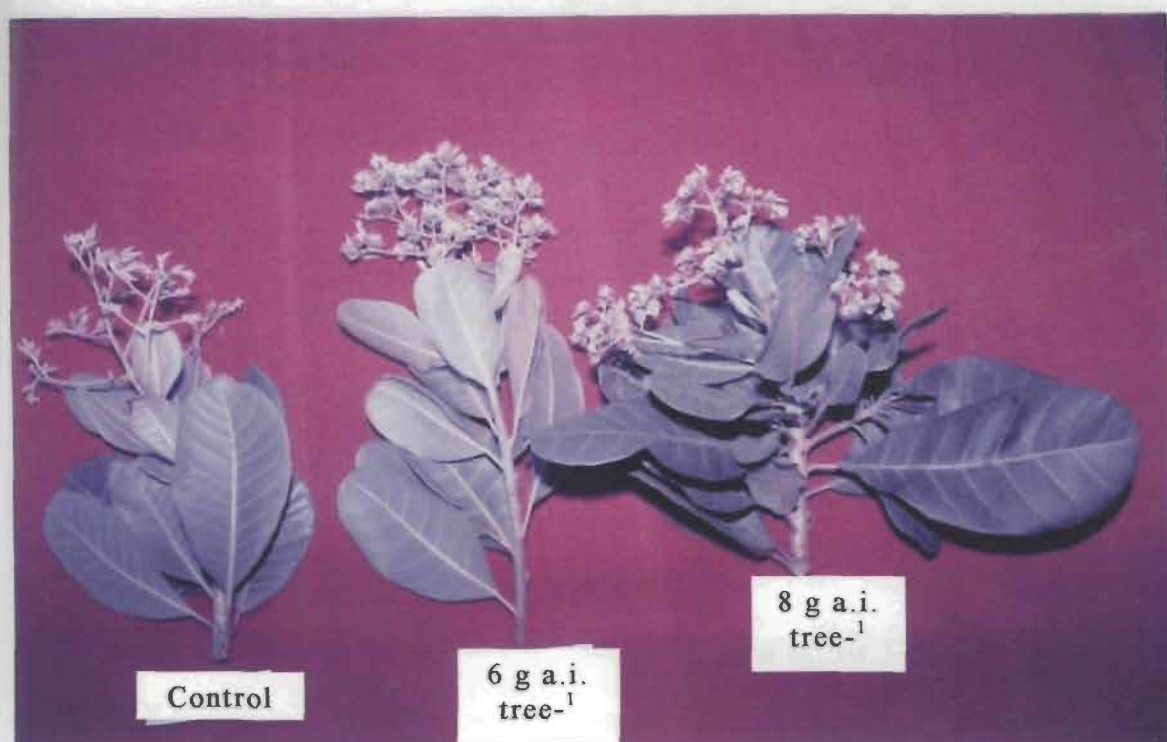
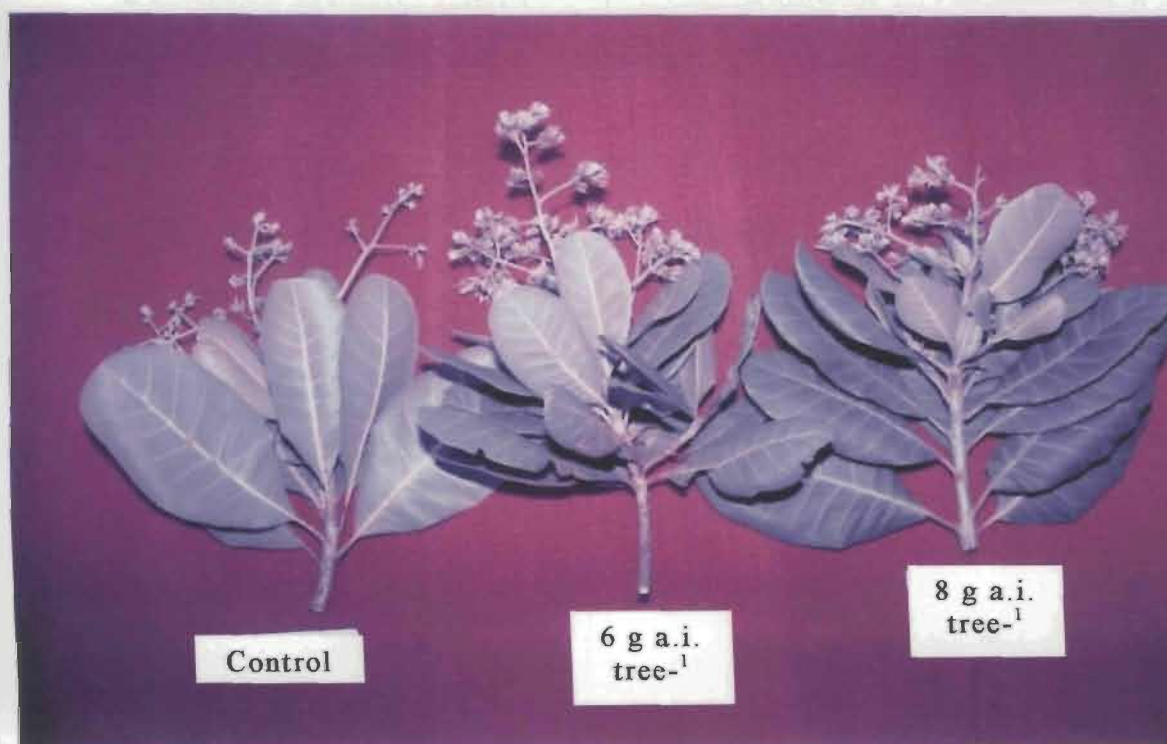


Plate 4a: Effect of paclobutrazol on shoot length of BPP-6



4.2.6 Number of leaves m^{-2} :

The data on number of leaves m^{-2} as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table. 4.7.

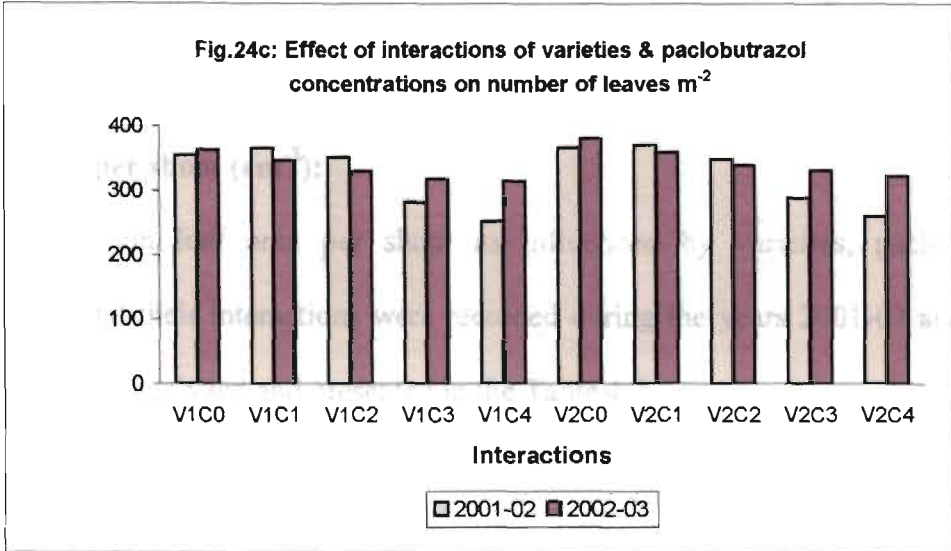
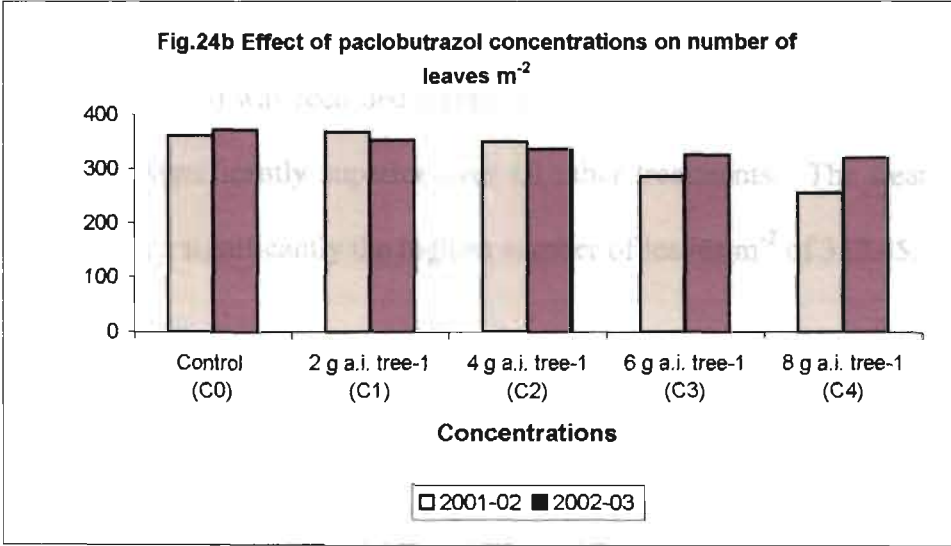
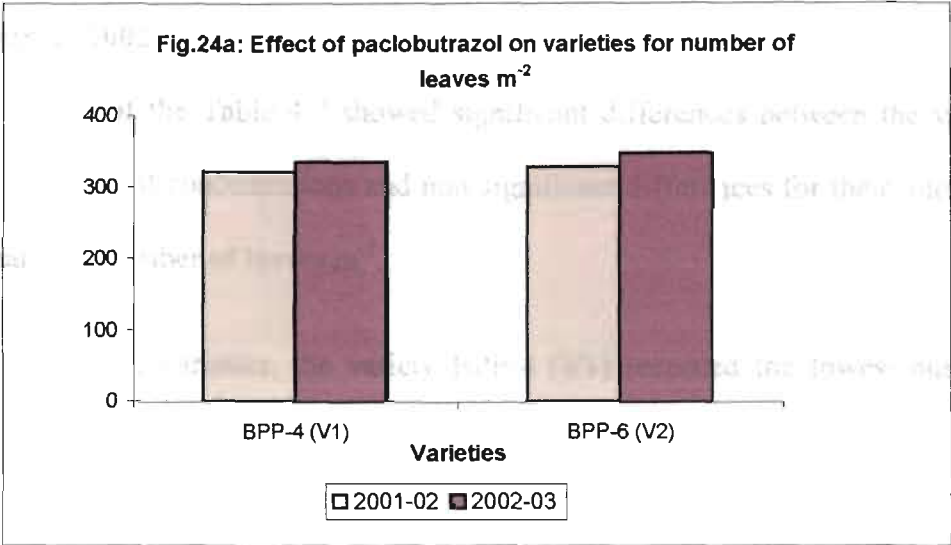
4.2.6.1 During 2001-02:

The data of the table showed significant differences among the paclobutrazol concentrations and non-significant differences between varieties and their interactions for the character number of leaves m^{-2} .

Between the varieties non-significant differences were recorded. However, the variety BPP-4 (V1) recorded the lowest number of leaves m^{-2} of 321.43 while the other variety BPP-6 (V2) recorded the number of leaves m^{-2} of 327.46.

Among the concentrations of paclobutrazol in comparison with the control (C0 360.80), 8 g a.i.tree⁻¹ (C4) was recorded significantly the lowest number of leaves m^{-2} of 256.26, which was significantly superior over all other treatments. The treatment 2 g a.i.tree⁻¹ (C1) recorded the highest number of leaves m^{-2} of 368.50.

Among the interactions the non-significant differences recorded however, the treatment V1C4 recorded significantly lowest number of leaves m^{-2} of 252.17, which was followed by V2C4 (260.37). The highest number of leaves m^{-2} of 371.33 was recorded by V2C1. The other treatments of interaction showed a range for number of leaves m^{-2} from 281.83 to 371.33.



4.2.6.2 During 2002-03:

The data of the Table 4.7 showed significant differences between the varieties, among paclobutrazol concentrations and non-significant differences for their interactions for the character number of leaves m^{-2} .

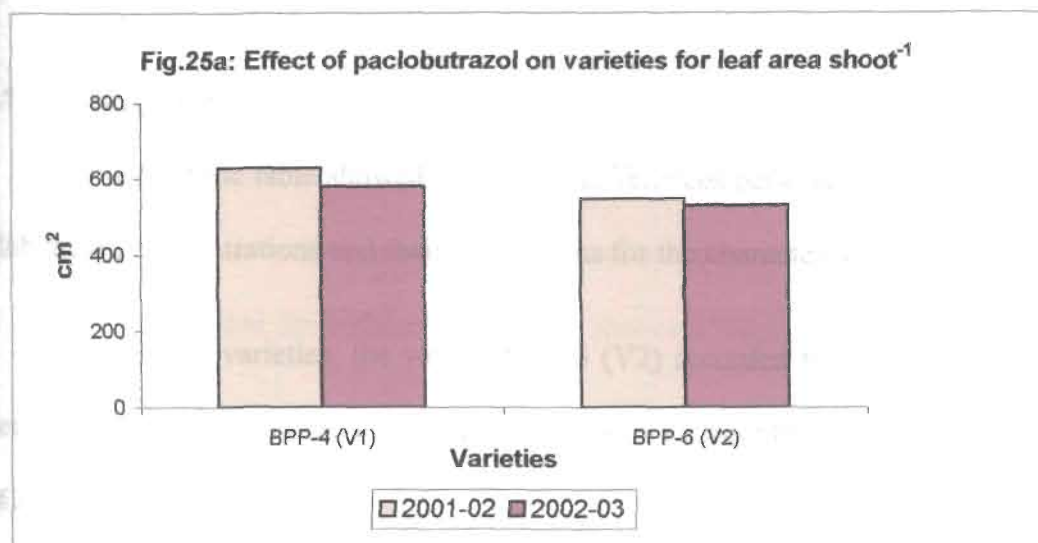
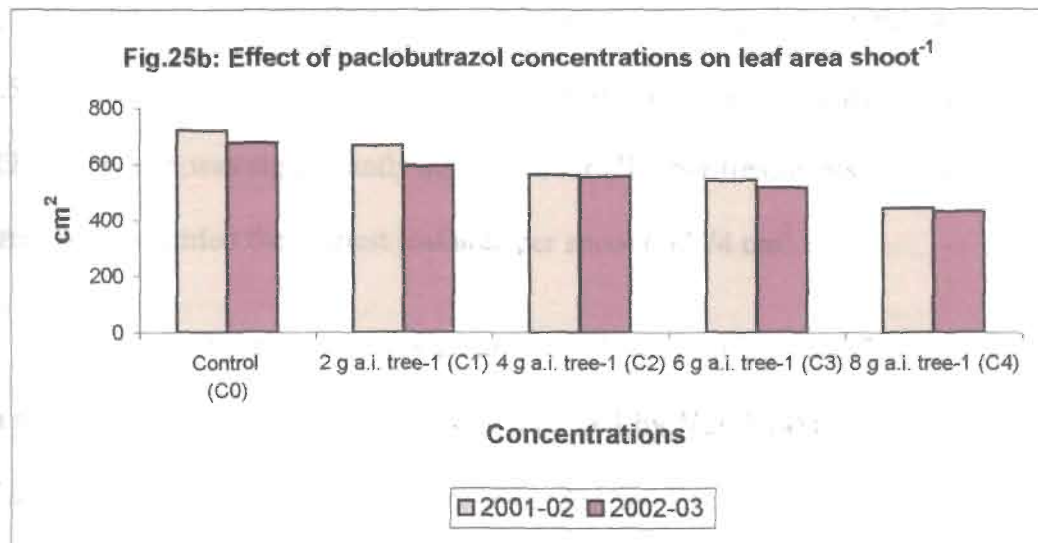
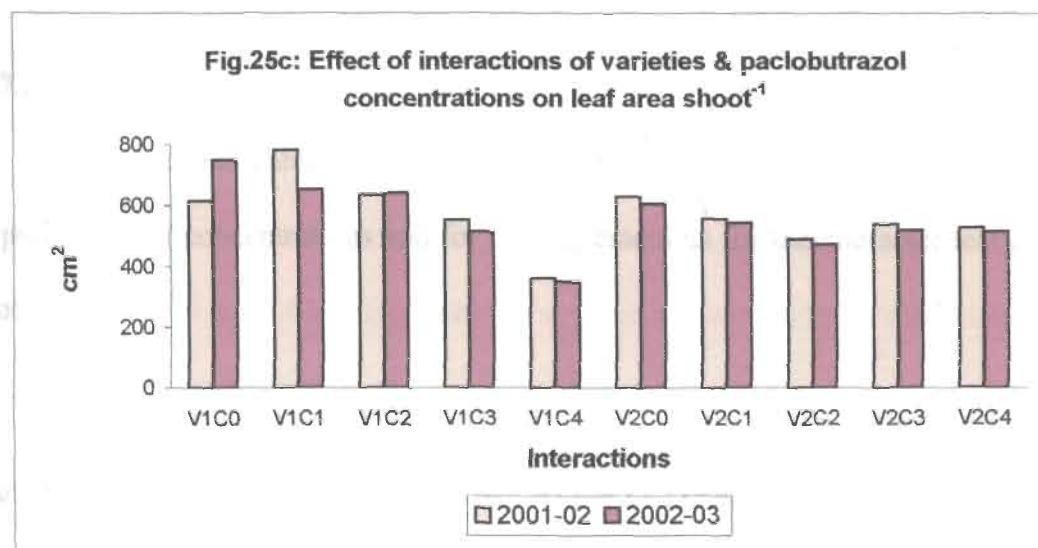
Between the varieties, the variety BPP-4 (V1) recorded the lowest number of leaves m^{-2} of 334.61 while the other variety BPP-6 (V2) recorded the number of leaves m^{-2} of 346.61.

Among the concentrations of paclobutrazol in comparison with the control (C0 371.73), 8 g a.i.tree⁻¹ (C4) was recorded significantly the lowest number of leaves m^{-2} of 319.02, which was significantly superior over all other treatments. The treatment 2 g a.i.tree⁻¹ (C1) recorded significantly the highest number of leaves m^{-2} of 352.45.

Among the interactions the non-significant differences were recorded however, the treatment V1C4 recorded significantly lowest number of leaves m^{-2} of 315.40, which was followed by V1C3 (317.97). The highest number of leaves m^{-2} of 358.93 was recorded by V2C1. The other treatments of interaction showed a range for number of leaves m^{-2} from 322.63 to 345.97.

4.2.7 Leaf area per shoot (cm^{-2}):

The data on leaf area per shoot as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.7.

Fig.25a: Effect of paclobutrazol on varieties for leaf area shoot⁻¹Fig.25b: Effect of paclobutrazol concentrations on leaf area shoot⁻¹Fig.25c: Effect of interactions of varieties & paclobutrazol concentrations on leaf area shoot⁻¹

4.2.7.1 During 2001-02:

The data of the table showed significant differences between varieties, among the paclobutrazol concentrations and their interactions for the character leaf area per shoot.

Between the varieties, the variety BPP-6 (V2) recorded the lowest leaf area per shoot of 546.31 cm^2 , while the other variety BPP-4 (V1) recorded the leaf area per shoot of 628.83 cm^2 .

Among the concentrations of paclobutrazol in comparison with the control (C0 721.57 cm^2) 8 g a.i.tree⁻¹ (C4) was recorded significantly the lowest leaf area per shoot of 442.33 cm^2 which was significantly superior over all other treatments. The treatment 2 g a.i.tree⁻¹ (C1) recorded the highest leaf area per shoot 667.74 cm^2 .

Among the interactions, the treatment V1C4 recorded significantly lowest leaf area per shoot of 359.73 cm^2 , which was followed by V2C2 (488.96 cm^2). The highest leaf area per shoot of 815.74 cm^2 was recorded by V1C0. The other treatments of interaction showed a range for leaf area per shoot from 524.93 cm^2 to 781.41 cm^2 .

4.2.7.2 During 2002-03:

The data of the Table 4.7 showed significant differences between varieties, among the paclobutrazol concentrations and for their interactions for the character leaf area per shoot.

Between the varieties, the variety BPP-6 (V2) recorded the lowest leaf area per shoot of 529.47 cm^2 while the other variety BPP-4 (V1) recorded the leaf area per shoot of 581.04 cm^2 .

Among the concentrations of paclobutrazol in comparison with the control (C0 677.49 cm²), 8 g a.i.tree⁻¹ (C4) was recorded significantly the lowest leaf area per shoot of 430.69 cm² which was significantly superior over all other treatments. The treatment 2 g a.i.tree⁻¹ (C1) recorded the highest leaf area per shoot of 596.21 cm².

Among the interactions, the treatment V1C4 recorded significantly lowest leaf area per shoot of 348.53 cm², which was followed by V2C2 (472.25 cm²). The highest leaf area per shoot of 749.84 cm² was recorded by V1C0. The other treatments of interaction showed a range from 512.86 cm² to 652.22 cm² for the leaf area per shoot.

4.2.8 Leaf chlorophyll-a content (mg/g):

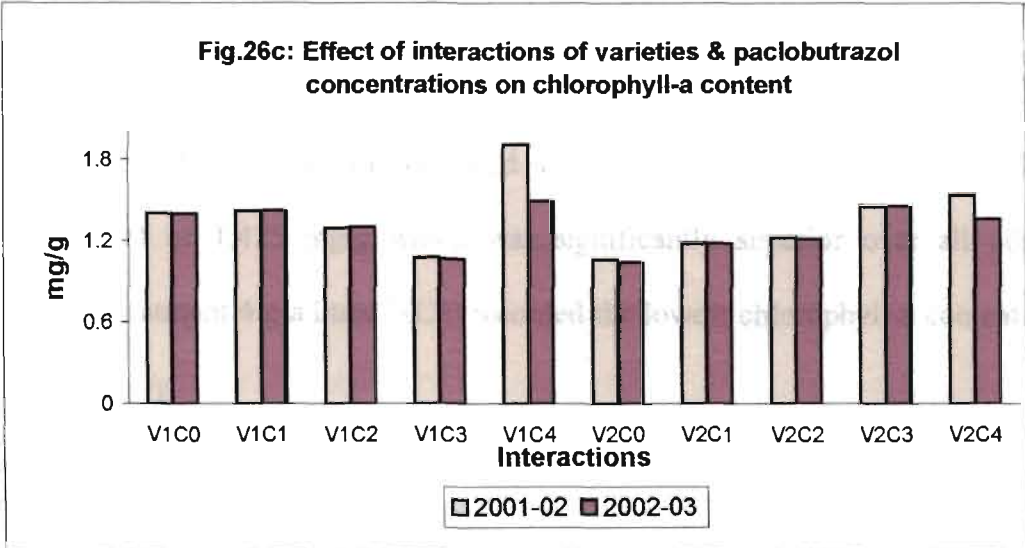
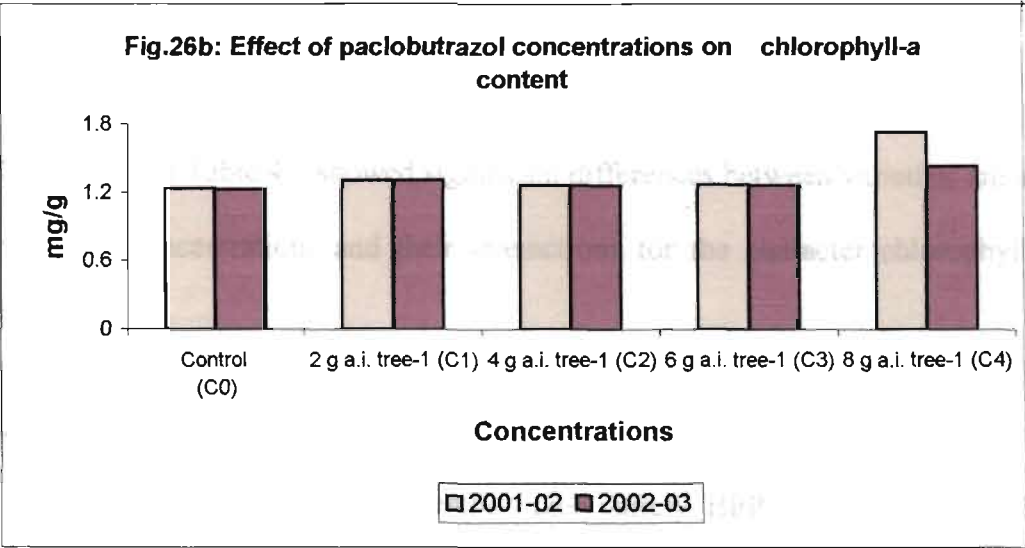
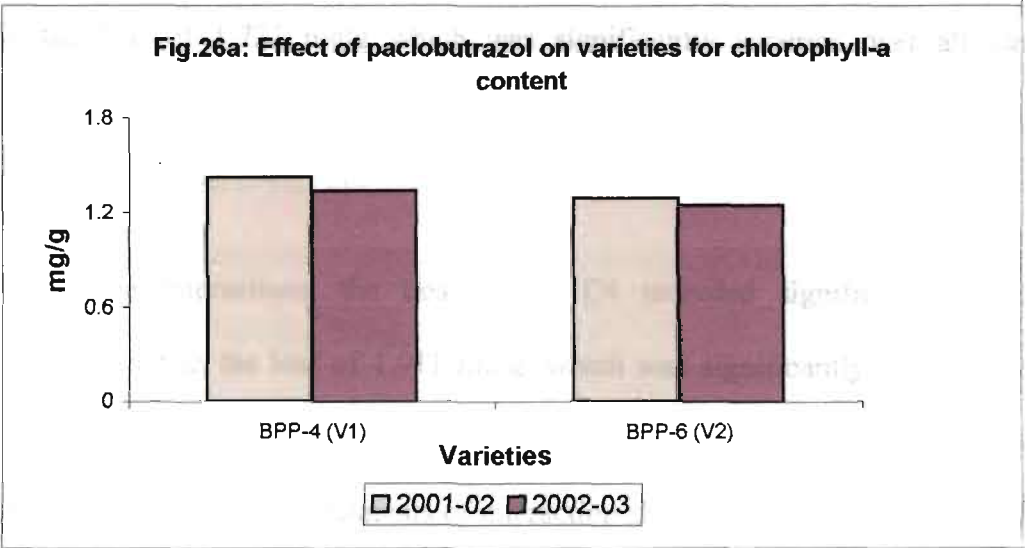
The data on leaf chlorophyll-a content as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.7.

4.2.8.1 During 2001-02:

The data of the Table showed significant differences between varieties, among the paclobutrazol concentrations and their interactions for the character chlorophyll-a content in the leaf.

Between the varieties, the variety BPP-4 (V1) recorded the highest chlorophyll-a content in the leaf of 1.423 mg/g while the other variety BPP-6 (V2) recorded the chlorophyll-a content in the leaf of 1.292 mg/g.

Among the concentrations of paclobutrazol in comparison with the control (C0 1.234 mg/g) 8 g a.i.tree⁻¹ (C4) was recorded significantly the highest chlorophyll-a



content in the leaf of 1.725 mg/g which was significantly superior over all other treatments. The treatment 4 g a.i.tree⁻¹ (C2) recorded the lowest chlorophyll-a content in the leaf of 1.259 mg/g.

Among the interactions, the treatment V1C4 recorded significantly highest chlorophyll-a content in the leaf of 1.911 mg/g, which was significantly superior over control (1.404 mg/g). The lowest chlorophyll-a content in the leaf of 1.079 mg/g was recorded by V1C3. The other treatments of interaction showed a range of chlorophyll-a content in the leaf from 1.181 mg/g to 1.540 mg/g.

4.2.8.2 During 2002-03:

The data of the Table 4.7 showed significant differences between varieties, among the paclobutrazol concentrations and their interactions for the character chlorophyll-a content in the leaf.

Between the varieties, the variety BPP-4 (V1) recorded the highest chlorophyll-a content in the leaf of 1.336 mg/g while the other variety BPP-6 (V2) recorded the chlorophyll-a content in the leaf of 1.247 mg/g.

Among the concentrations of paclobutrazol in comparison with the control (C0 1.220 mg/g), 8 g a.i.tree⁻¹ (C4) was recorded significantly the highest chlorophyll-a content in the leaf of 1.425 mg/g which was significantly superior over all other treatments. The treatment 4 g a.i.tree⁻¹ (C2) recorded the lowest chlorophyll-a content in the leaf of 1.256 mg/g.

Among the interactions the treatment V1C4 recorded significantly highest chlorophyll-a content in the leaf of 1.492 mg/g, which was significantly superior over control (1.399 mg/g). The lowest chlorophyll-a content in the leaf of 1.210 was recorded by V2C1. The other treatments of interaction showed a range of chlorophyll-a content in the leaf from 1.210 mg/g to 1.452 mg/g.

4.2.9 Leaf chlorophyll-b content (mg/g):

The data on leaf chlorophyll-b content as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.8.

4.2.9.1 During 2001-02:

The data of the table showed significant differences between varieties, among the paclobutrazol concentrations and their interactions for the character chlorophyll-b content in the leaf.

Between the varieties, the variety BPP-4 (V1) recorded the highest chlorophyll-b content in the leaf of 1.448 mg/g while the other variety BPP-6 (V2) recorded the chlorophyll-b content in the leaf of 1.365 mg/g.

Among the concentrations of paclobutrazol in comparison with the control (C0 1.308 mg/g), 8 g a.i.tree⁻¹ (C4) was recorded significantly the highest chlorophyll-b content in the leaf of 1.665 mg/g which was significantly superior over all other treatments. The treatment 6 g a.i.tree⁻¹ (C3) recorded the lowest chlorophyll-b content in the leaf of 1.243 mg/g.

Table 4.8: Chlorophyll-b content, number of flowering shoots m⁻², number of non-flowering shoots m⁻², and number of panicles m⁻¹ in cashew as influenced by variety, paclobutrazol and their interactions.

	Chlorophyll-b content (mg/g)		Number of flowering shoots m ⁻²		Number of non-flowering shoots m ⁻²		Number of panicles m ⁻¹	
	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03
Varieties:								
BPP-4 (V1)	1.448	1.433	20.55	20.34	2.48	7.17	25.10	22.11
BPP-6 (V2)	1.365	1.342	21.20	21.55	4.87	4.53	24.60	23.20
Concentrations of paclobutrazol:								
Control (Water spray) (C0)	1.308	1.302	16.88	13.80	4.83	9.75	18.58	14.88
2 g a.i. per tree (C1)	1.398	1.369	21.54	19.87	4.46	7.00	25.37	21.67
4 g a.i. per tree (C2)	1.318	1.325	22.33	23.90	4.38	3.79	26.87	25.96
6 g a.i. per tree (C3)	1.243	1.318	25.71	25.90	2.46	3.75	27.75	28.42
8 g a.i. per tree (C4)	1.665	1.624	22.92	21.27	2.25	4.95	25.67	22.38
Interaction Effects:								
V1C0	1.063	1.079	16.25	11.43	4.58	13.67	18.67	12.17
V1C1	1.578	1.531	24.33	20.27	2.08	9.25	26.42	21.50
V1C2	1.304	1.320	22.17	25.10	2.25	3.58	26.08	26.25
V1C3	1.121	1.307	22.92	24.53	1.91	3.50	25.67	28.25
V1C4	1.974	1.929	27.08	20.37	1.58	5.83	28.67	22.42
V2C0	1.553	1.525	17.50	16.17	5.08	5.83	18.50	17.58
V2C1	1.218	1.207	18.75	19.47	6.83	4.75	24.33	21.83
V2C2	1.333	1.330	22.50	22.70	6.50	4.00	27.67	25.67
V2C3	1.365	1.329	28.50	27.27	3.00	4.00	29.83	28.58
V2C4	1.356	1.319	18.75	22.17	2.92	4.08	22.67	22.33
2001-2002								
	S Em	CD	S Em	CD	S Em	CD	S Em	CD
Varieties	0.003	0.007	1.21	NS	0.22	0.46	0.94	NS
Concentrations of paclobutrazol	0.005	0.010	1.91	4.03	0.35	0.74	1.48	3.11
Interaction	0.007	0.015	2.71	5.69	0.49	1.04	2.09	4.40
2002-2003								
	S Em	CD	S Em	CD	S Em	CD	S Em	CD
Varieties	0.008	0.017	0.57	NS	0.38	0.79	0.55	NS
Concentrations of paclobutrazol	0.013	0.027	0.92	1.92	0.60	1.26	0.87	1.84
Interaction	0.018	0.038	1.29	2.72	0.85	1.78	1.23	2.60

Fig.27a: Effect of paclobutrazol on varieties for chlorophyll-b content

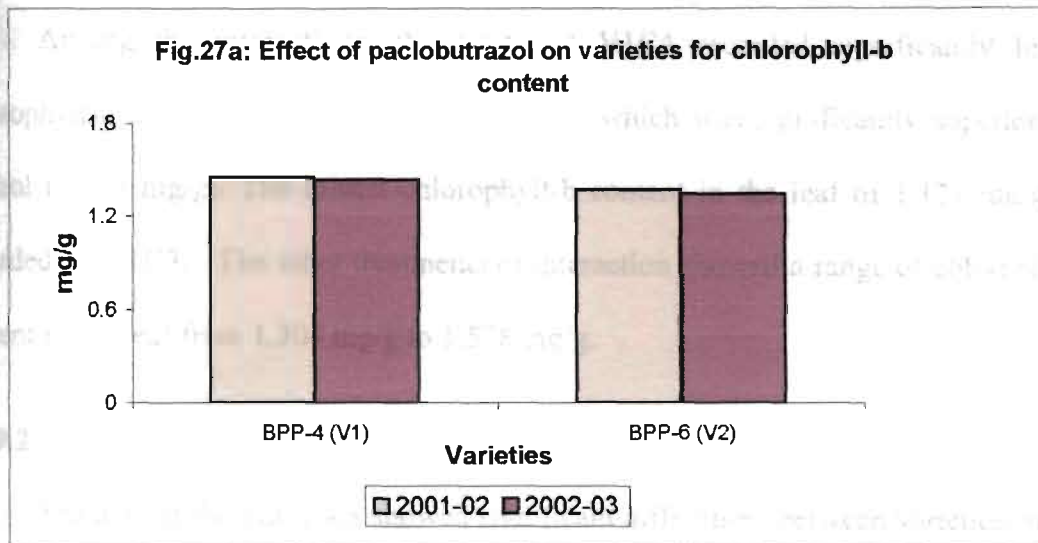


Fig.27b: Effect of paclobutrazol concentrations on chlorophyll-b content

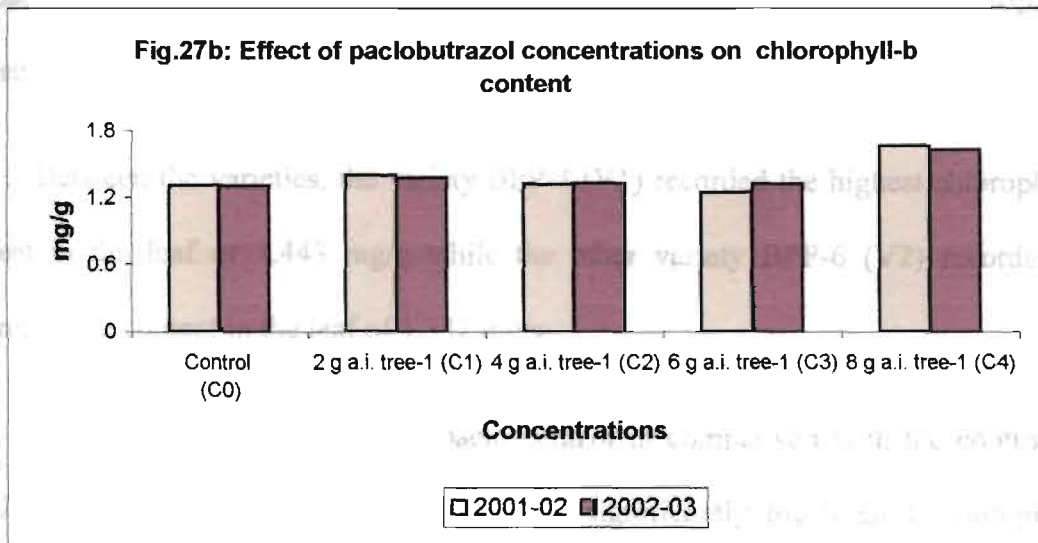
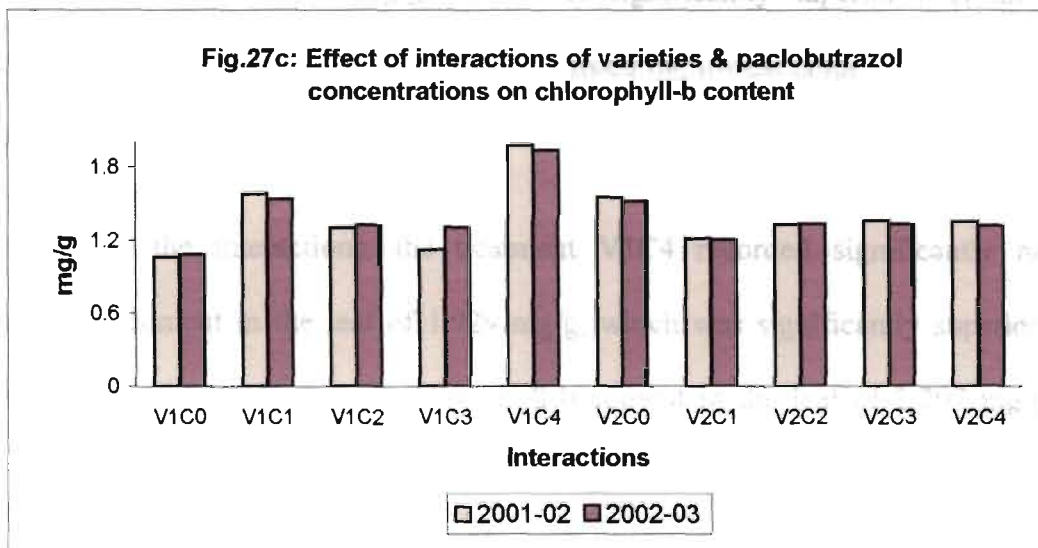


Fig.27c: Effect of interactions of varieties & paclobutrazol concentrations on chlorophyll-b content



Among the interactions, the treatment V1C4 recorded significantly highest chlorophyll-b content in the leaf of 1.974 mg/g, which was significantly superior over control (1.063 mg/g). The lowest chlorophyll-b content in the leaf of 1.121 mg/g was recorded by V1C3. The other treatments of interaction showed a range of chlorophyll-b content in the leaf from 1.304 mg/g to 1.578 mg/g.

4.2.9.2 During 2002-03:

The data of the Table 4.8 showed significant differences between varieties, among the paclobutrazol concentrations and for their interactions for the character chlorophyll-b content in the leaf.

Between the varieties, the variety BPP-4 (V1) recorded the highest chlorophyll-b content in the leaf of 1.443 mg/g while the other variety BPP-6 (V2) recorded the chlorophyll-b content in the leaf of 1.342 mg/g.

Among the concentrations of paclobutrazol in comparison with the control (C0 1.302 mg/g), 8 g a.i.tree⁻¹ (C4) was recorded significantly the highest chlorophyll-b content in the leaf of 1.624 mg/g which was significantly superior over all other treatments. The treatment 6 g a.i.tree⁻¹ (C3) recorded the lowest chlorophyll-b content in the leaf of 1.318 mg/g.

Among the interactions, the treatment V1C4 recorded significantly highest chlorophyll-b content in the leaf of 1.929 mg/g, which was significantly superior over control (1.079 mg/g). The lowest chlorophyll-b content in the leaf of 1.207 mg/g was recorded by V1C1. The other treatments of interaction showed a range of chlorophyll-b content in the leaf from 1.307 mg/g to 1.531 mg/g.

4.2.10 Number of flowering shoots m^{-2} :

The data on number of flowering shoots m^{-2} as influenced by varieties, paclobutrazol concentration and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.8.

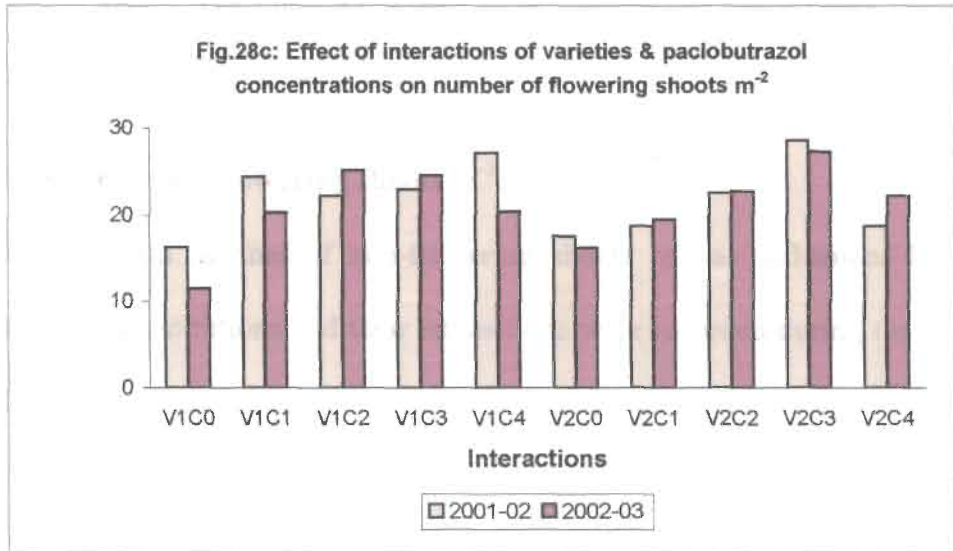
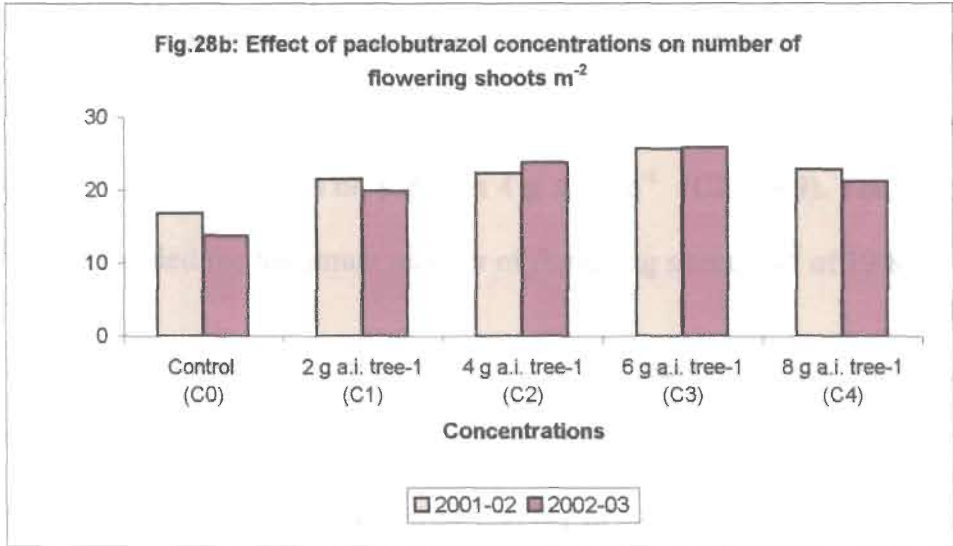
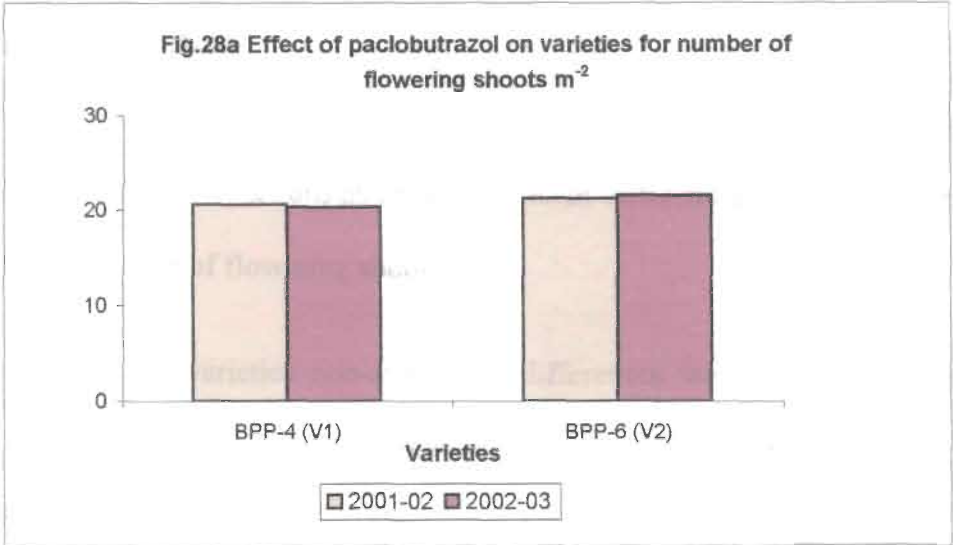
4.2.10.1 During 2001-02:

The data of the table showed significant differences among the paclobutrazol concentrations, their interactions and non-significant differences between varieties for the character number of flowering shoots m^{-2} .

Between the varieties non-significant differences were recorded. However, the variety BPP-4 (V1) recorded the maximum number of flowering shoots m^{-2} of 22.55 while the other variety BPP-6 (V2) recorded the number of flowering shoots m^{-2} of 21.20.

Among the concentrations of paclobutrazol in comparison with the control (C0 16.88), 6 g a.i.tree⁻¹ (C3) was recorded significantly the maximum number of flowering shoots m^{-2} of 25.71 which was on par with 4 g a.i.tree⁻¹ (C2 22.33) and 8 g a.i.tree⁻¹ (C4 22.92). The treatment 2 g a.i.tree⁻¹ (C1) recorded the minimum number of flowering shoots m^{-2} of 21.54.

Among the interactions, the treatment V2C3 recorded significantly maximum number of flowering shoots m^{-2} of 28.50 which was superior over control but on par with V1C4 (27.08) and V1C1 (24.33). The lowest number of flowering shoots m^{-2} of 16.25 was recorded by V1C0. The other treatments of interaction showed a range for number of flowering shoots m^{-2} 17.50 to 22.92.



4.2.10.2 During 2002-03:

The data of the Table 4.8 showed significant differences among the paclobutrazol concentrations, their interactions and non-significant differences between the varieties for the character number of flowering shoots m^{-2} .

Between the varieties non-significant differences were recorded. However, the variety BPP-6 (V2) recorded the maximum number of flowering shoots m^{-2} of 21.55 while the other variety BPP-4 (V1) recorded the number of flowering shoots m^{-2} of 20.34.

Among the concentrations of paclobutrazol in comparison with the control (C0 13.8), 6 g a.i.tree⁻¹ (C3) was recorded significantly the maximum number of flowering shoots m^{-2} of 25.90, which was on par with 4 g a.i.tree⁻¹ (C2 23.9). The treatment 2 g a.i.tree⁻¹ (C1) recorded the minimum number of flowering shoots m^{-2} of 19.87.

Among the interactions, the treatment V2C3 recorded significantly maximum number of flowering shoots m^{-2} of 27.27 which was superior over control (V2C0 16.17) but on par with V1C2 (25.10). The lowest number of flowering shoots m^{-2} of 11.43 was recorded by V1C0. The other treatments of interaction showed a range for number of flowering shoots m^{-2} 19.47 to 24.53.

4.2.11 Number of non-flowering shoots m^{-2} :

The data on number of non-flowering shoots m^{-2} as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table. 4.8.

Fig.29a: Effect of paclobutrazol on varieties for number of non-flowering shoots m^{-2}

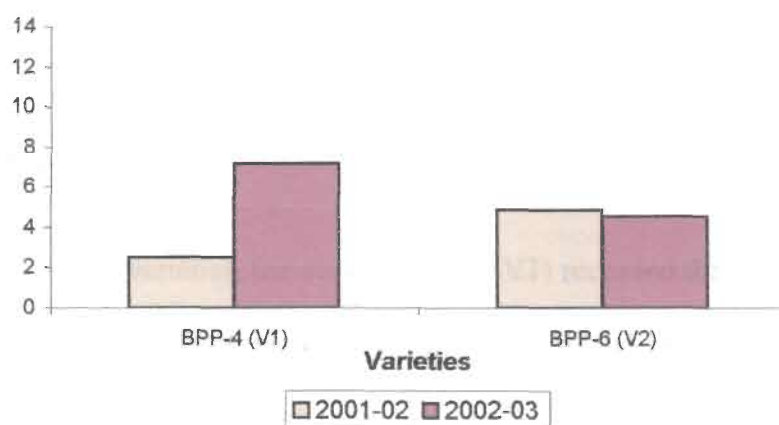


Fig.29b: Effect of paclobutrazol concentrations on number of non-flowering shoots m^{-2}

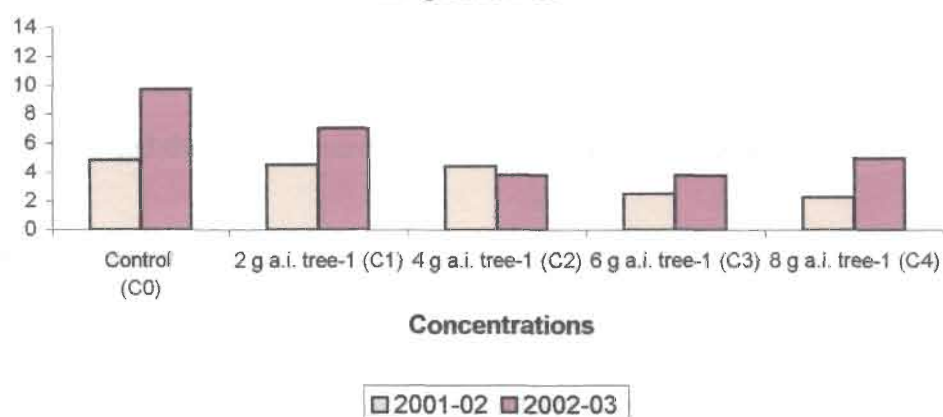
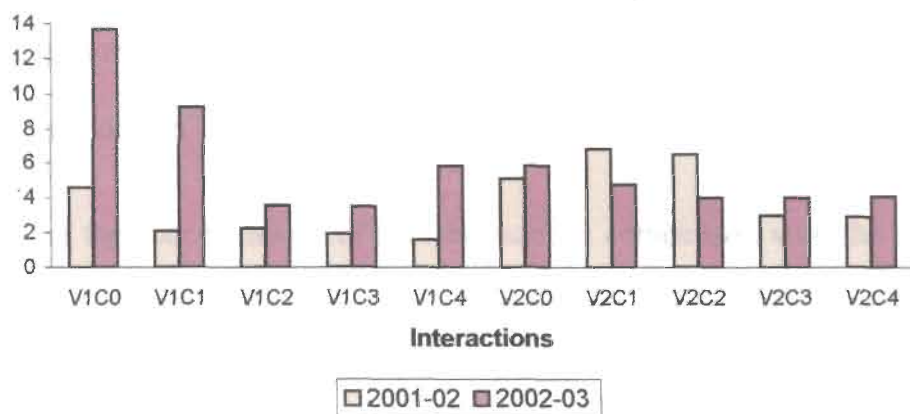


Fig.29c: Effect of interactions of varieties & paclobutrazol concentrations on number of non-flowering shoots m^{-2}



4.2.11.1 During 2001-02:

The data of the table showed significant differences between varieties, among the paclobutrazol concentrations and their interactions for the character number of non-flowering shoots m^{-2} .

Between the varieties, the variety BPP-4 (V1) recorded the lowest number of non-flowering shoots m^{-2} of 2.48 while the other variety BPP-6 (V2) recorded the number of non-flowering shoots m^{-2} of 4.87.

Among the concentrations of paclobutrazol in comparison with the control (C0 4.83), 8 g a.i.tree⁻¹ (C4) was recorded significantly the lowest number of non-flowering shoots m^{-2} of 2.25 which was on par with 6 g a.i. tree⁻¹ (C3 2.46). The treatment 2 g a.i.tree⁻¹ (C1) recorded the highest number of non-flowering shoots m^{-2} of 4.46.

4.2.11.2 During 2002-03:

The data of the Table 4.8 showed significant differences between varieties, among the paclobutrazol concentrations and for their interactions for the character number of non-flowering shoots m^{-2} .

Between the varieties the variety BPP-6 (V2) recorded the lowest number of non-flowering shoots m^{-2} of 4.53 while the other variety BPP-4 (V1) recorded the number of non-flowering shoots m^{-2} of 7.17.

Among the concentrations of paclobutrazol in comparison with the control (C0 9.75), 6 g a.i.tree⁻¹ (C3) was recorded significantly the lowest number of non-flowering

shoots m^{-2} of 3.75, which was on par with 4 g a.i.tree⁻¹ (C2 3.79). The treatment 2 g a.i.tree⁻¹ (C1) recorded the highest number of non-flowering shoots m^{-2} of 7.00.

Among the interactions the treatment V1C3 recorded significantly lowest number of non-flowering shoots m^{-2} of 3.50, which was superior over control (V1C0 13.67). The highest number of non-flowering shoots m^{-2} of 9.25 was recorded by V1C1. The other treatments of interaction showed a range for number of non-flowering shoots m^{-2} 3.58 to 5.83.

4.2.12 Number of panicles m^{-2} :

The data on number of panicles m^{-2} as influenced by varieties, paclobutrazol concentration and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.8.

4.2.12.1 During 2001-02:

The data of the table showed significant differences, among the paclobutrazol concentrations and their interactions and non-significant differences between varieties for the character number of panicles m^{-2} .

Between the varieties non-significant differences were recorded however, the variety BPP-4 (V1) recorded the maximum number of panicles m^{-2} of 25.10 while the other variety BPP-6 (V2) recorded the number of number of panicles m^{-2} of 24.60.

Among the concentrations of paclobutrazol in comparison with the control (C0 18.58), 6 g a.i.tree⁻¹ (C3) was recorded significantly the maximum number of panicles

Plate 5: Effect of paclobutrazol on flowering and fruit set in BPP-4



Control



2 g a.i. tree⁻¹



6 g a.i. tree⁻¹



4 g a.i. tree⁻¹



8 g a.i. tree⁻¹



6 g a.i. tree⁻¹

m^{-2} of 27.75 which was followed by 4 g a.i.tree⁻¹ (C2 26.87). The minimum number of panicles m^{-2} of 25.37 was recorded by 2 g a.i.tree⁻¹ (C1).

Among the interactions, the treatment V2C3 recorded significantly maximum number of panicles m^{-2} of 29.83, which was superior over control (V2C0 18.50), which was followed by V1C4 (28.67). The lowest number of panicles m^{-2} of 18.50 was recorded by V2C0. The other treatments of interaction showed a range for number of panicles m^{-2} 18.67 to 27.67.

4.2.12.2 During 2002-03:

The data of the Table 4.8 showed significant differences, among the paclobutrazol concentrations and their interactions and non-significant differences between varieties for the character number of panicles m^{-2} .

Between the varieties non-significant differences were recorded however, the variety V2 (BPP-6) recorded the maximum number of panicles m^{-2} of 23.20 while the other variety V1 (BPP-4) recorded the number of number of panicles m^{-2} of 22.11.

Among the concentrations of paclobutrazol in comparison with the control (C0 14.88), 6 g a.i.tree⁻¹ (C3) was recorded significantly the maximum number of panicles m^{-2} of 28.42 which was followed by 4 g a.i.tree⁻¹ (C2 25.96). The minimum number of panicles m^{-2} of 21.67 was recorded by 2 g a.i.tree⁻¹ (C1).

Among the interactions the treatment V2C3 recorded significantly maximum number of panicles m^{-2} of 28.58, which was superior over control (V2C0 17.58) which was followed by V1C3 (28.25). The lowest number of panicles m^{-2} of 21.50 was recorded

Fig.31a: Effect of paclobutrazol on varieties for number of panicles m^{-2}

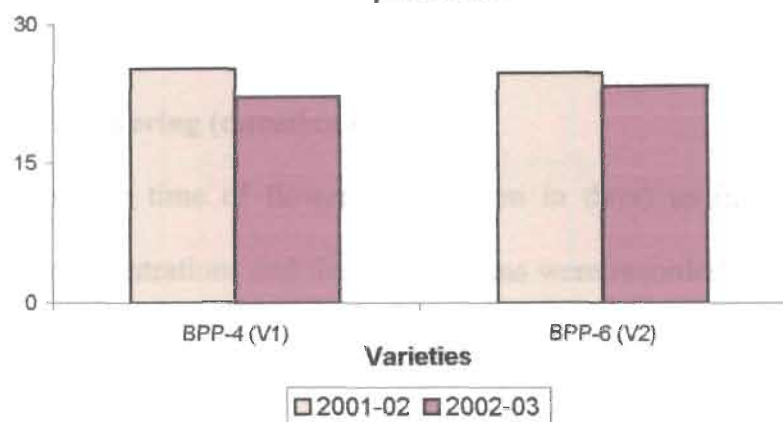


Fig.31b: Effect of paclobutrazol concentrations on number of panicles m^{-2}

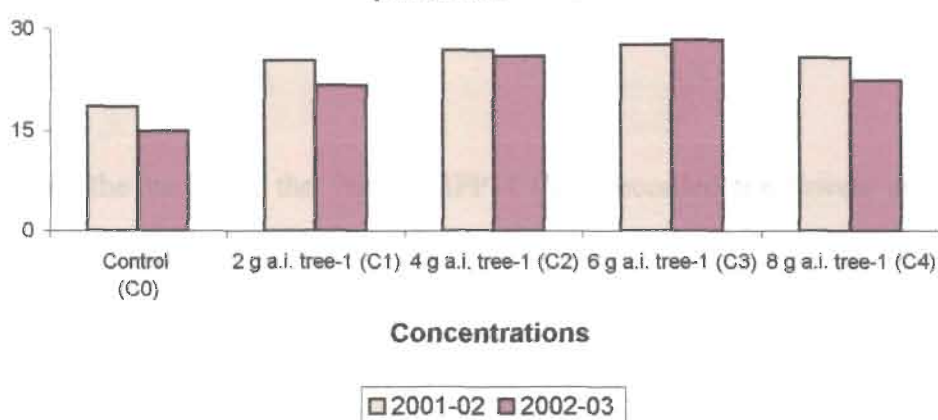
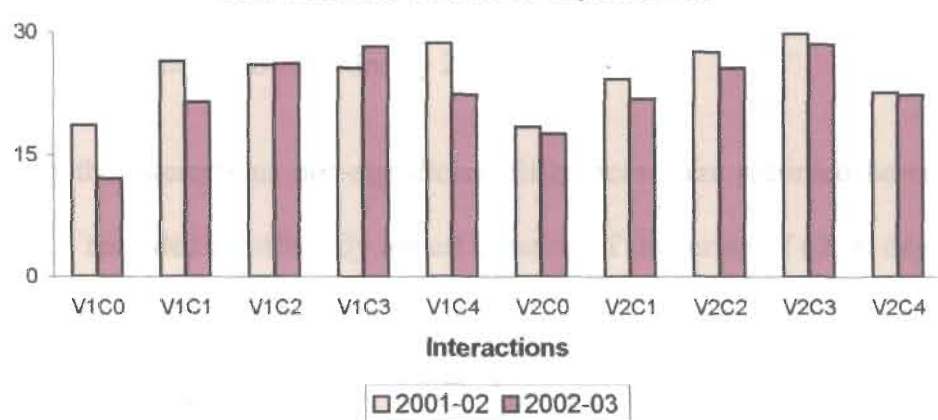


Fig.31c: Effect of interactions of varieties & paclobutrazol concentrations on number of panicles m^{-2}



by V1C1. The other treatments of interaction showed a range for number of panicles m^{-2} from 21.83 to 26.25.

4.2.13 Time of flowering (duration in days):

The data on time of flowering (duration in days) as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.9.

4.2.13.1 During 2001-02:

The data of the table showed significant differences between varieties, among the paclobutrazol concentrations and non-significant differences among their interactions for the character time of flowering.

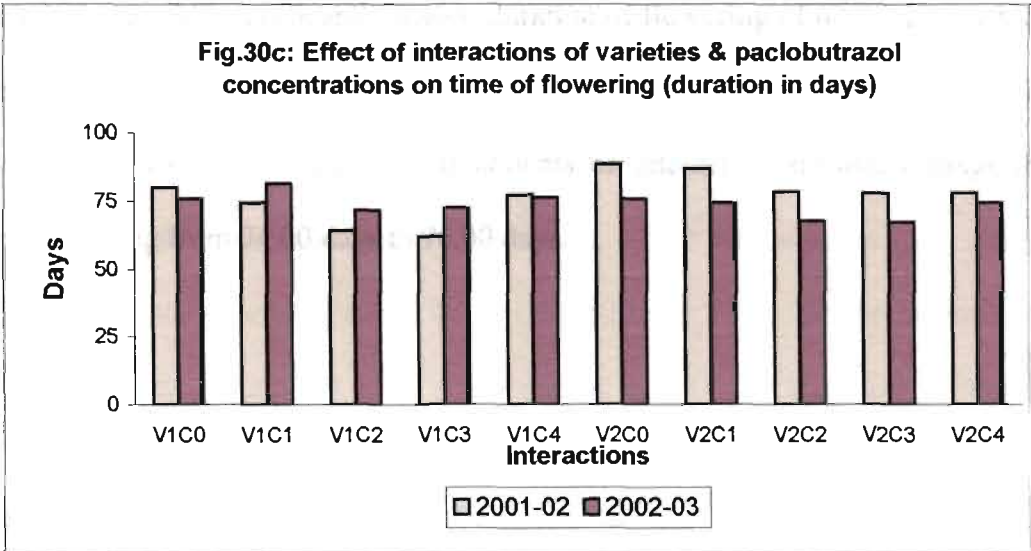
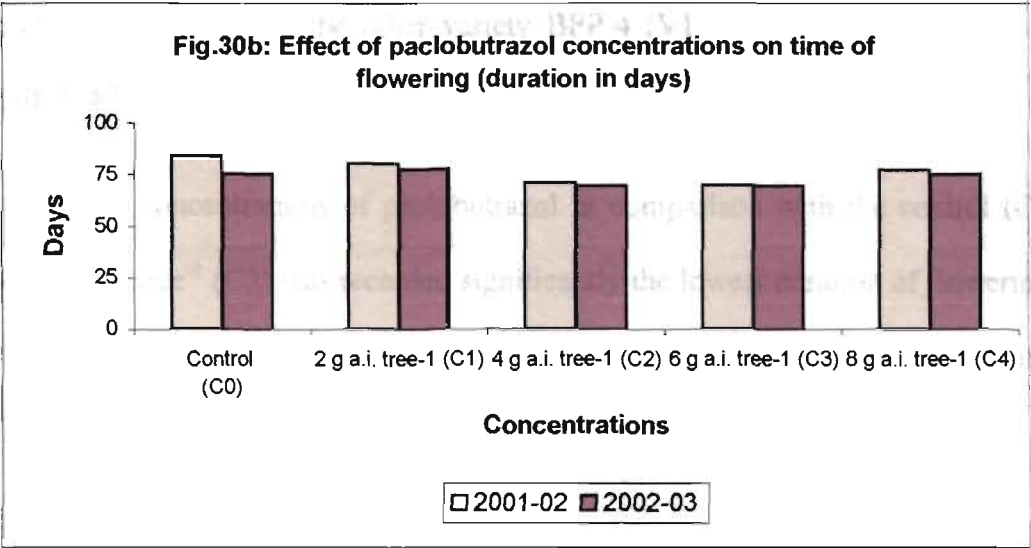
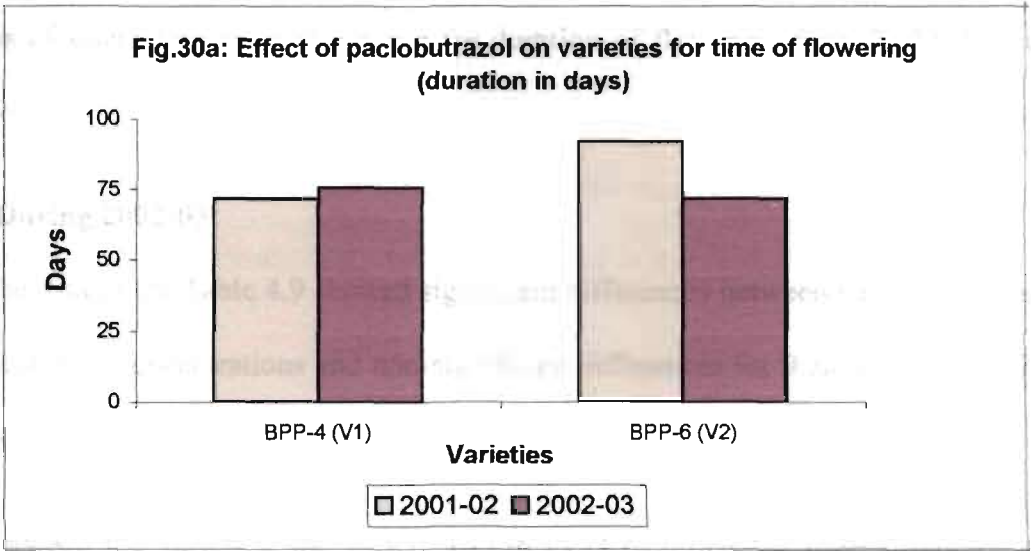
Between the varieties, the variety BPP-4 (V1) recorded the lowest duration of flowering of 71.47 days while the other variety BPP-6 (V2) recorded the duration of flowering of 81.73 days.

Among the concentrations of paclobutrazol in comparison with the control (C0 84.17 days), 6 g a.i.tree⁻¹ (C3) was recorded significantly the lowest duration of flowering of 69.83 days, which was followed by 4 g a.i.tree⁻¹ (C2 71.17 days). The highest duration of flowering of 80.50 days was recorded by 2 g a.i.tree⁻¹ (C1).

Among the interactions non-significant differences were recorded however, the treatment V1C3 recorded significantly lowest duration of flowering of 62.00 days, which was superior over control (V2C0 80.00 days) which was followed by V1C2 (64.00 days). The highest duration of flowering of 86.67 days was recorded by V2C1. The other

Table 4.9: Time of flowering, number of hermaphrodite flowers panicle⁻¹, sex ratio and percentage fruit set in cashew as influenced by variety, paclobutrazol and their interactions.

	Time of flowering (days)		Number of hermaphrodite flowers panicle ⁻¹		Sex ratio (male to hermaphrodite flowers)		Percentage fruit set	
	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03
Varieties:								
BPP-4 (V1)	71.47	75.33	74.05	77.62	6.68	6.90	3.50	4.28
BPP-6 (V2)	91.73	71.53	81.59	75.05	6.57	8.48	4.29	4.63
Concentrations of paclobutrazol:								
Control (Water spray)(C0)	84.17	75.33	49.58	48.80	10.36	12.38	2.84	3.27
2 g a.i. per tree (C1)	80.50	77.50	63.13	56.00	6.96	9.91	2.71	4.57
4 g a.i. per tree (C2)	71.17	69.33	85.42	73.58	3.77	6.97	3.30	5.37
6 g a.i. per tree (C3)	69.83	69.50	91.63	96.00	4.22	4.87	5.49	4.94
8 g a.i. per tree (C4)	77.33	75.00	99.35	107.29	7.81	4.32	5.15	4.14
Interaction Effects:								
V1C0	80.00	75.33	42.83	41.37	10.37	11.16	3.30	3.42
V1C1	74.33	81.00	61.42	45.25	6.33	10.62	2.45	5.16
V1C2	64.00	71.33	80.00	77.83	4.03	5.69	2.92	4.61
V1C3	62.00	72.00	88.08	106.58	4.04	4.07	4.10	4.13
V1C4	77.00	76.00	97.92	117.08	8.65	2.98	4.73	4.12
V2C0	88.33	75.33	56.33	56.25	10.34	13.61	2.36	3.12
V2C1	86.67	74.00	64.83	66.75	7.59	9.19	2.97	3.99
V2C2	78.33	67.33	90.83	69.33	3.51	8.25	3.68	6.13
V2C3	77.67	67.00	95.17	85.42	4.40	5.67	6.88	5.76
V2C4	77.67	74.00	100.79	97.50	6.99	5.65	5.58	4.16
2001-2002								
Varieties	S Em	CD	S Em	CD	S Em	CD	S Em	CD
Concentrations of paclobutrazol	2.87	6.05	1.65	3.48	0.16	NS	0.17	0.36
Interaction	4.55	9.56	2.62	5.49	0.26	0.55	0.27	0.57
	6.44	NS	3.70	NS	0.37	0.77	0.38	0.80
2002-2003								
Varieties	1.40	2.95	0.88	1.86	0.27	0.57	0.16	0.35
Concentrations of paclobutrazol	2.22	4.66	1.39	2.93	0.43	0.89	0.37	0.77
Interaction	3.14	NS	1.97	4.15	0.61	1.27	0.26	0.55



treatments of interaction showed a range for duration of flowering from 74.33 days to 78.33 days.

4.2.13.2 During 2002-03:

The data of the Table 4.9 showed significant differences between varieties, among the paclobutrazol concentrations and non-significant differences for their interactions for the character time of flowering.

Between the varieties, the variety BPP-6 (V2) recorded the lowest duration of flowering of 71.53 days while the other variety BPP-4 (V1) recorded the duration of flowering of 75.83 days.

Among the concentrations of paclobutrazol in comparison with the control (C0 75.33 days), 4 g a.i.tree⁻¹ (C2) was recorded significantly the lowest duration of flowering of 69.33 days, which was followed by 6 g a.i.tree⁻¹ (C3 69.33 days). The highest duration of flowering of 77.50 days was recorded by 2 g a.i.tree⁻¹ (C1).

Among the interactions non-significant differences were recorded however, the treatment V2C3 recorded significantly lowest duration of flowering of 67.00 days, which was superior over control (V2C0 75.33 days). The highest duration of flowering of 81.00 days was recorded by V1C1. The other treatments of interaction showed a range for duration of flowering from 74.00 days to 76.00 days.

4.2.14 Number of hermaphrodite flowers panicle⁻¹:

The data on number of hermaphrodite flowers panicle⁻¹ as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.9.

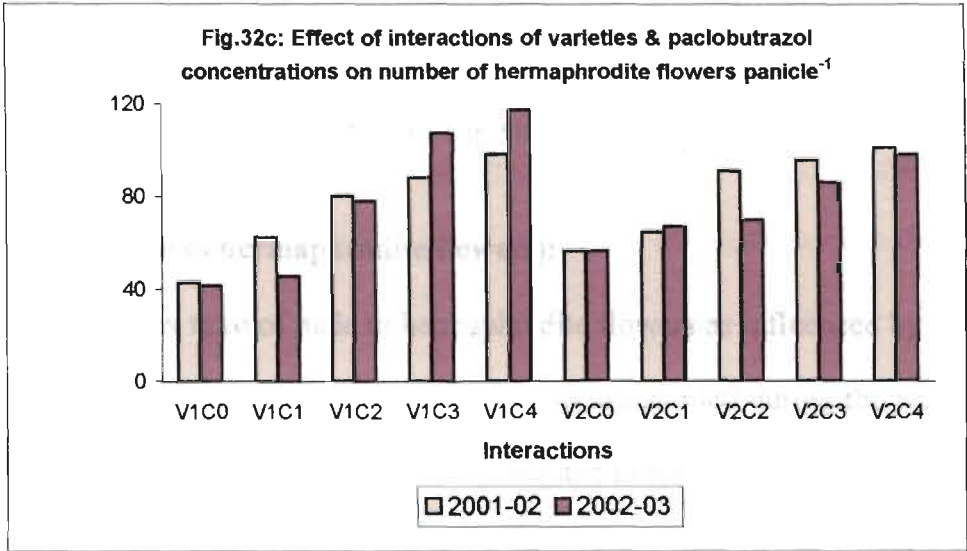
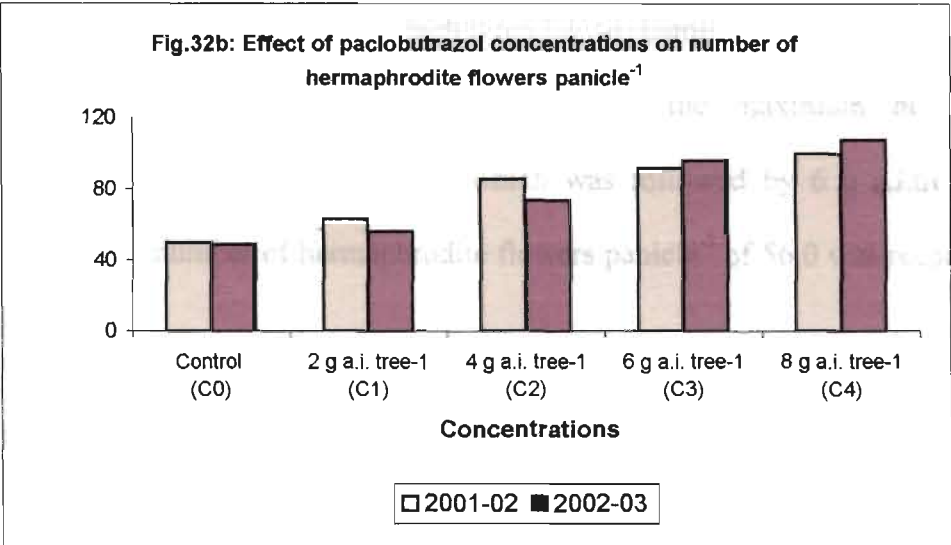
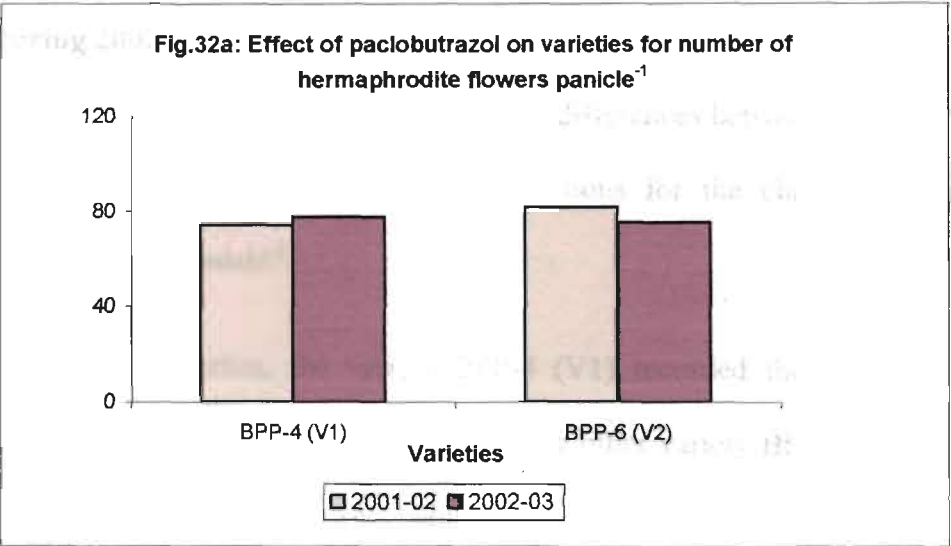
4.2.14.1 During 2001-02:

The data of the table showed significant differences between varieties, among paclobutrazol concentrations and non-significant differences among their interactions for the character number of hermaphrodite flowers panicle⁻¹.

Between the varieties, the variety BPP-6 (V2) recorded 81.59 the maximum number of hermaphrodite flowers panicle⁻¹ while the other variety BPP-4 (V1) recorded 74.05 number of hermaphrodite flowers panicle⁻¹ of 74.05.

Among the concentrations of paclobutrazol in comparison with the control (49.58), 8g a.i.tree⁻¹(C4) was recorded significantly the maximum number of hermaphrodite flowers panicle⁻¹ of 99.35 which was followed by 6 g a.i.tree⁻¹ (C2 91.63). The minimum number of hermaphrodite flowers panicle⁻¹ of 63.13 was recorded by 2 g a.i.tree⁻¹ (C1).

Among the interactions, the treatment V2C4 recorded significantly maximum number of hermaphrodite flowers panicle⁻¹ of 100.79, which was superior over control (V2C0 56.33), which was followed by V1C4 (97.92). The lowest number of hermaphrodite flowers panicle⁻¹ of 61.42 was recorded by V1C1. The other treatments of interaction showed a range for number of hermaphrodite flowers panicle⁻¹ of 64.83 to 97.92.



4.2.14.2 During 2002-03:

The data of the Table 4.9 showed significant differences between varieties, among the paclobutrazol concentrations and their interactions for the character number of hermaphrodite flowers panicle⁻¹.

Between the varieties, the variety BPP-4 (V1) recorded the maximum 77.62 number of hermaphrodite flowers panicle⁻¹ while the other variety BPP-6 (V2) recorded 75.05 number of hermaphrodite flowers panicle⁻¹.

Among the concentrations of paclobutrazol in comparison with the control (48.80) 8g a.i.tree⁻¹ (C4) was recorded significantly the maximum number of hermaphrodite flowers panicle⁻¹ of 107.29, which was followed by 6 g a.i.tree⁻¹ (C2 96.0). The minimum number of hermaphrodite flowers panicle⁻¹ of 56.0 was recorded by 2 g a.i.tree⁻¹ (C1).

Among the interactions, the treatment V1C4 recorded significantly maximum number of hermaphrodite flowers panicle⁻¹ of 117.08, which was superior over control (V2C0 41.37). The lowest number of hermaphrodite flowers panicle⁻¹ of 45.25 was recorded by V1C1. The other treatments of interaction showed a range for number of hermaphrodite flowers panicle⁻¹ of 77.83 to 106.58.

4.2.15 Sex ratio (male to hermaphrodite flowers):

The data on sex ratio of male to hermaphrodite flowers as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table 4.9.

4.2.15.1 During 2001-02:

The data on the table showed significant differences among the paclobutrazol concentrations, for their interactions and non-significant between varieties for the character sex ratio of male to hermaphrodite flowers.

Between the varieties non-significant differences were recorded. However, the variety BPP-6 (V2) recorded the lowest sex ratio of 6.57 while the other variety BPP-4 (V1) recorded 6.68 of sex ratio of male to hermaphrodite flowers.

Among the concentrations of paclobutrazol in comparison with the control (49.58), 4 g a.i.tree⁻¹(C2) was recorded significantly the lowest sex ratio of 3.77, which was significantly superior over control (10.36). The highest sex ratio of 7.81 was recorded by 8 g a.i.tree⁻¹ (C4).

Among the interactions, the treatment V2C2 recorded significantly lowest sex ratio of 3.51, which was superior over control (V2C0 10.34). The highest sex ratio of 8.65 was recorded by V1C4. The other treatments of interaction showed a range of sex ratio of 4.03 to 7.59.

4.2.15.2 During 2002-03:

The data on the Table 4.9 showed significant differences among the varieties, paclobutrazol concentrations and their interactions for the character sex ratio of male to hermaphrodite flowers.

Between the varieties, the variety BPP-4 (V1) recorded the lowest sex ratio of 6.90 while the other variety BPP-6 (V2) recorded sex ratio of male to hermaphrodite flowers per panicle of 8.48.

Among the concentrations of paclobutrazol 8g a.i.tree⁻¹ (C4) was recorded significantly the lowest sex ratio of 4.32 followed by 6g a.i.tree⁻¹ of 4.87 which was significantly superior over control (C0 12.38). The highest sex ratio of 9.91 was recorded by 2 g a.i.tree⁻¹ (C1).

Among the interactions, the treatment V1C4 recorded significantly lowest sex ratio of 2.98 followed by V1C3 (4.07) and it was superior over control (V1C0 11.16). The highest sex ratio of 10.62 was recorded by V1C1. The other treatments of interaction showed a range from 5.62 to 9.19 of sex ratio of male to hermaphrodite flowers.

4.2.16 Percentage of fruit set:

The data on percentage of fruit set as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table 4.9.

4.2.16.1 During 2001-02:

The data on the table showed significant differences between varieties, among the paclobutrazol concentrations and their interactions for the character percentage of fruit set.

Between the varieties the varietyBPP-6 (V2) recorded the maximum percentage of fruit set of 4.29 while the other variety BPP-4 (V1) recorded the percentage of fruit set of 3.50.

Among the concentrations of paclobutrazol in comparison with the control (2.84), 6g a.i.tree⁻¹ (C3) was recorded significantly the maximum percentage of fruit set of 5.49,

Fig.33a: Effect of paclobutrazol on varieties for sex ratio (male to hermaphrodite flowers)

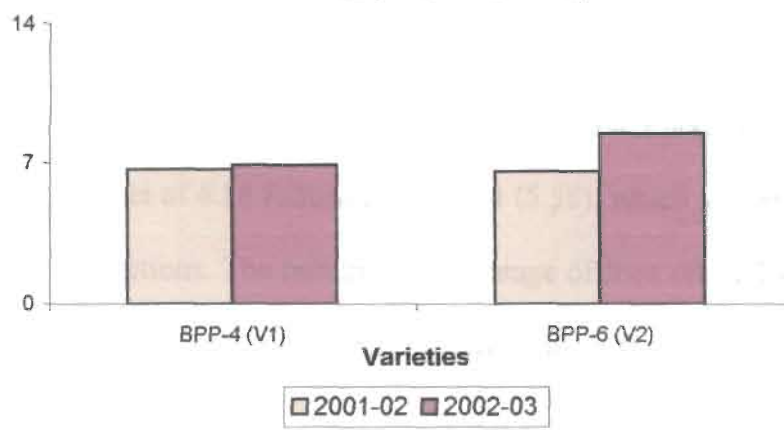


Fig.33b: Effect of paclobutrazol concentrations on sex ratio (male to hermaphrodite flowers)

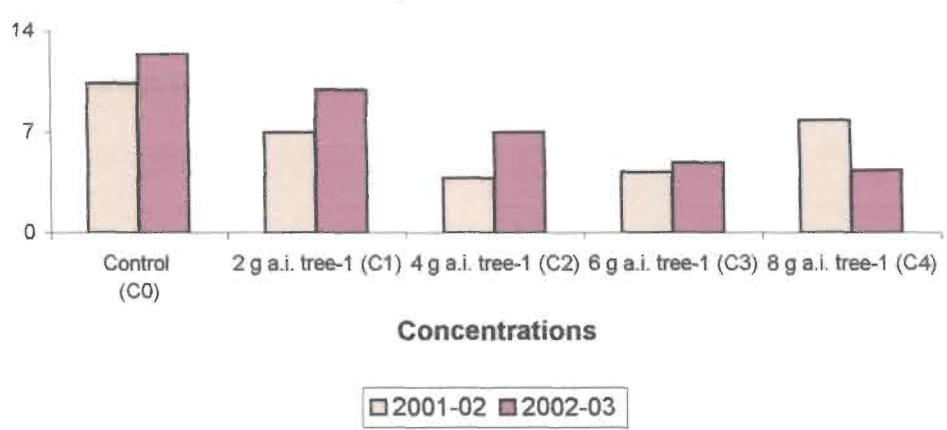
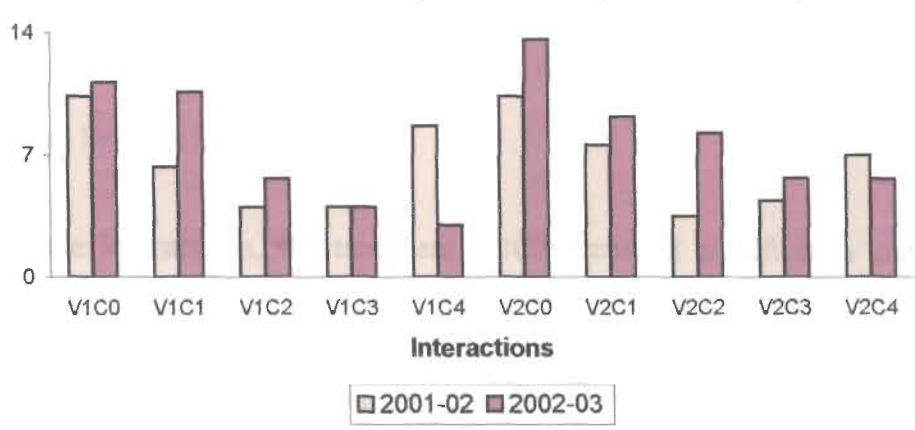


Fig.33c: Effect of interactions of varieties & paclobutrazol concentrations on sex ratio (male to hermaphrodite flowers)



which was on par with 8g a.i.tree⁻¹ (C4 5.15). The minimum percentage of fruit set of 2.71 was recorded by 2 g a.i.tree⁻¹ (C1).

Among the interactions, the treatment V2C3 recorded significantly maximum percentage of fruit set of 6.88 followed by V2C4 (5.58), which was significantly superior over all other interactions. The minimum percentage of fruit set of 2.45 was recorded by V1C1. The other treatments of interaction showed percentage fruit set a range from 2.92 to 5.58.

4.2.16.2 During 2002-03:

The data on the Table 4.9 showed significant differences among the varieties, paclobutrazol concentrations and their interactions for the character percentage of fruit set.

Between the varieties, the variety BPP-6 (V2) recorded the maximum percentage of fruit set of 4.63 while the other variety BPP-4 (V1) recorded the percentage of fruit set of 4.28.

Among the concentrations of paclobutrazol in comparison with the control (3.27), 4g a.i.tree⁻¹ (C2) was recorded significantly the maximum percentage of fruit set of 5.37, which was on par with 6g a.i.tree⁻¹ (C3 4.94). The minimum percentage of fruit set of 4.14 was recorded by 8 g a.i.tree⁻¹ (C4).

Among the interactions, the treatment V2C2 recorded significantly maximum percentage of fruit set of 6.13 followed by V2C3 (5.76), which was significantly superior over control (V2C0 3.12). The minimum percentage of fruit set of 3.99 was recorded by

Fig.34a: Effect of paclobutrazol on varieties for percentage of fruit set

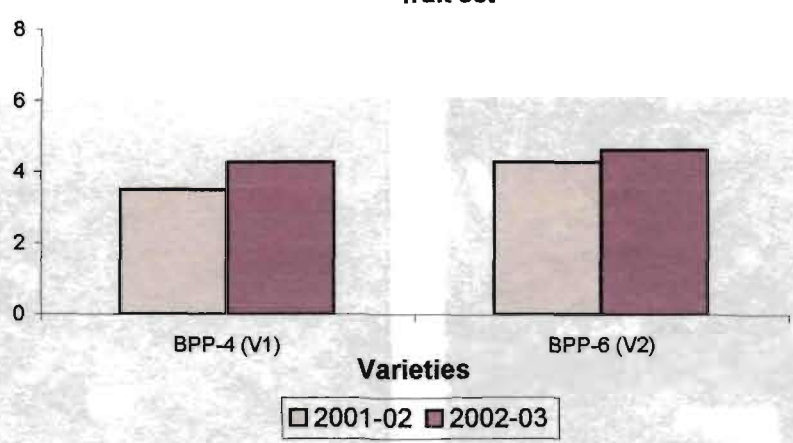


Fig.34b: Effect of paclobutrazol concentrations on percentage of fruit set

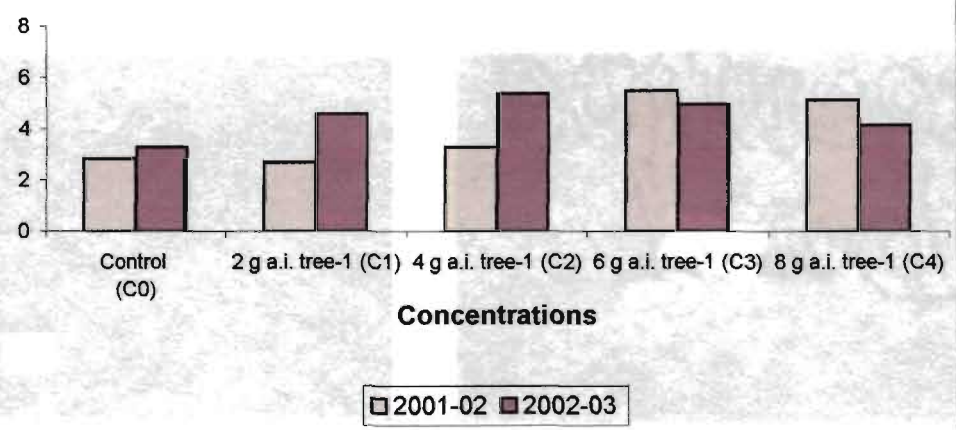


Fig.34c: Effect of interactions of varieties & paclobutrazol concentrations on percentage of fruit set

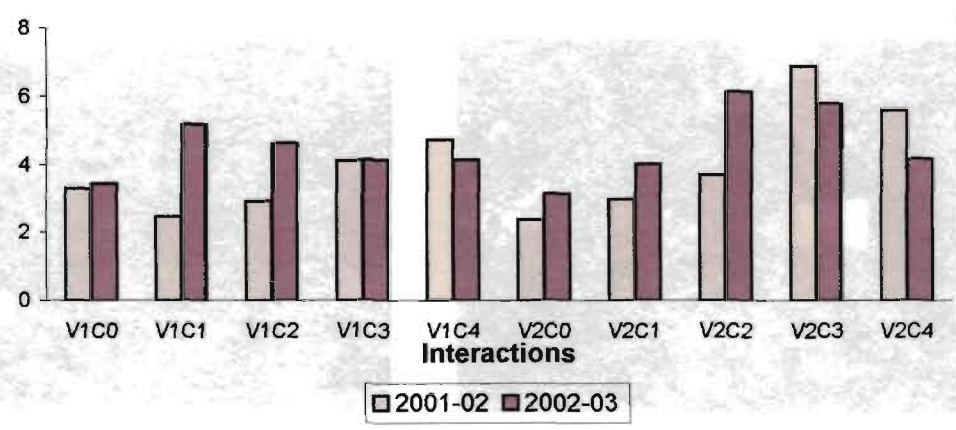


Plate 6: Effect of paclobutrazol on flowering and fruitset in BPP-6



Control



2 g a.i. tree⁻¹



6 g a.i. tree⁻¹



4 g a.i. tree⁻¹



8 g a.i. tree⁻¹



6 g a.i. tree⁻¹

V2C1. The other treatments of interaction showed a range of percentage fruit set of 3.42 to 5.16.

4.2.17 Number of nuts reached maturity m^{-2} :

The data on number of nuts reached maturity m^{-2} as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table 4.10.

4.2.17.1 During 2001-02:

The data on the table showed significant differences between varieties, among the paclobutrazol concentrations and non-significant differences among their interactions for the character number of nuts reached maturity m^{-2} .

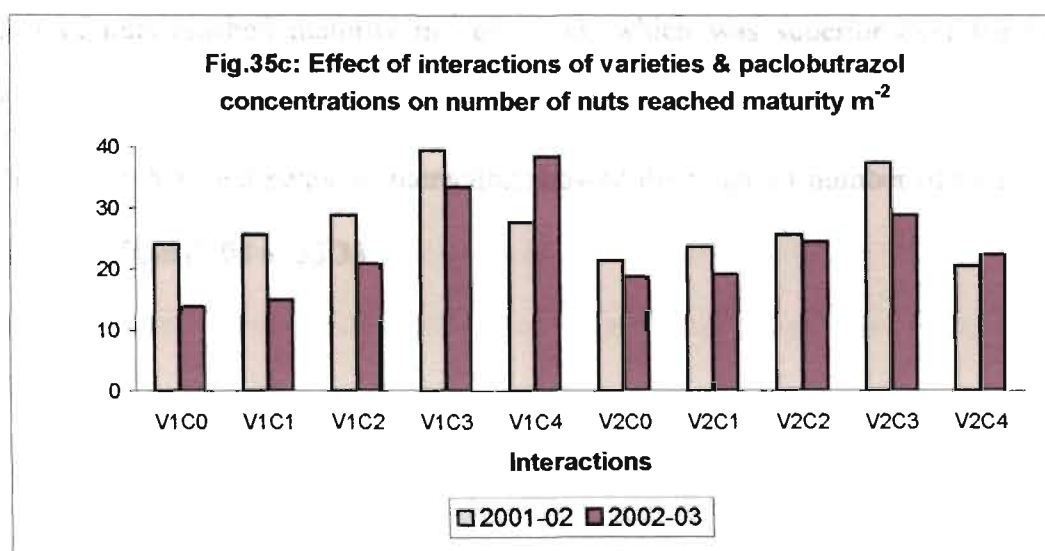
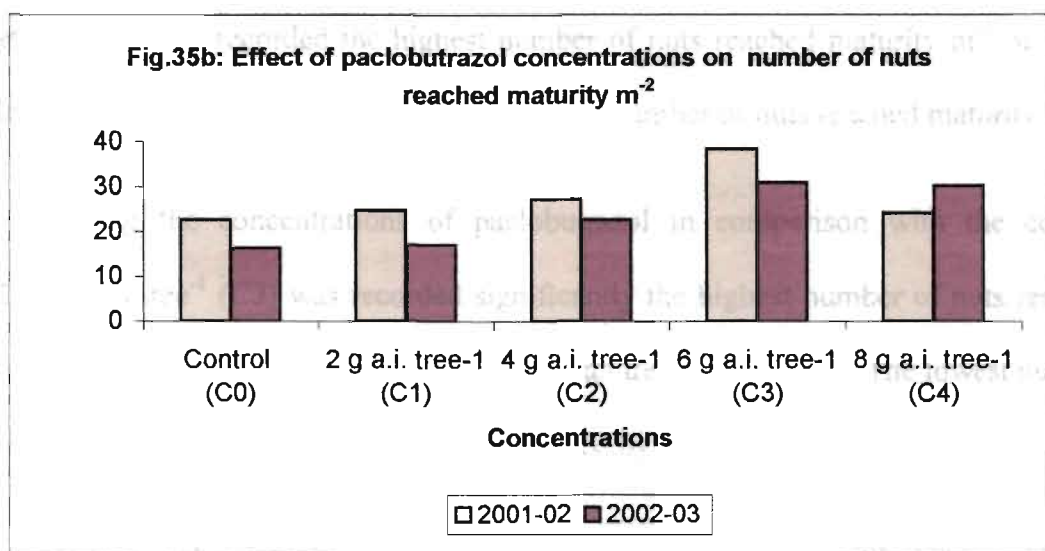
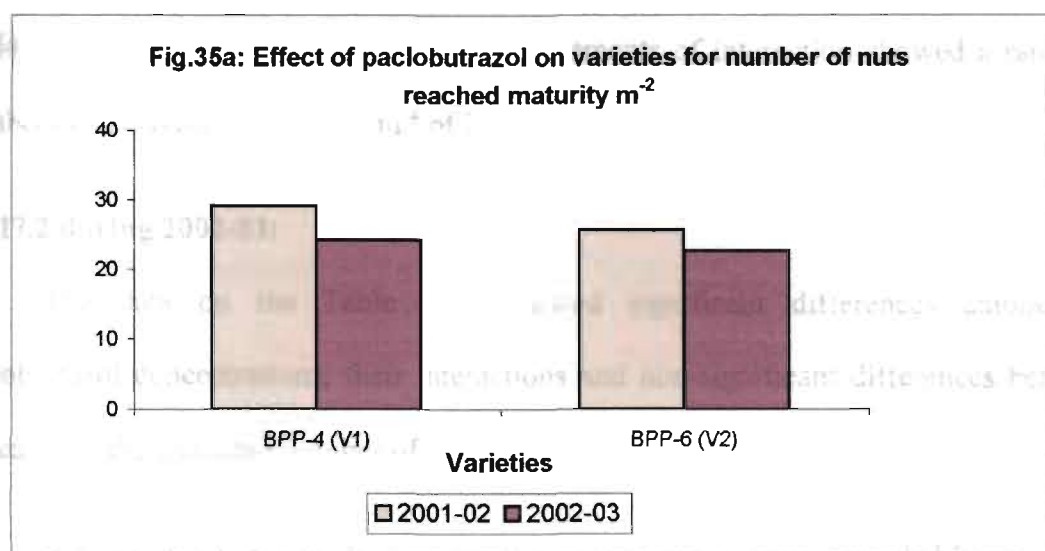
Between the varieties, the variety BPP-4 (V1) recorded the highest number of nuts reached maturity m^{-2} of 29.16 while the other variety BPP-6 (V2) recorded 25.71 number of nuts reached maturity m^{-2} .

Among the concentrations of paclobutrazol in comparison with the control (22.76), 6g a.i.tree⁻¹ (C3) was recorded significantly the highest number of nuts reached maturity m^{-2} of 38.40, which was significantly superior over all other treatments. The lowest number of nuts reached maturity m^{-2} of 24.10 was recorded by 8 g a.i.tree⁻¹ (C4).

Among the interactions the non-significant differences were recorded. However the treatment V1C3 recorded significantly highest number of nuts reached maturity m^{-2} of 39.47 followed by V2C3 (37.33). The lowest number of nuts reached maturity m^{-2} of

Table 4.10: Number of fruits per panicle, number of nuts reached maturity m⁻², nut weight and nut yield tree⁻¹ in cashew as influenced by variety, paclobutrazol and their interactions

	Number of fruits panicle ⁻¹			Number of nuts reached maturity m ⁻²			Nut weight (g)			Nut yield tree ⁻¹ (kg)		
	2001-02	2002-03		2001-02	2002-03		2001-02	2002-03		2001-02	2002-03	
Varieties:												
BPP-4 (V1)	2.45	3.13		29.16	24.23		5.48	4.98		1.701	1.669	
BPP-6 (V2)	2.80	3.50		25.71	22.67		5.83	5.49		1.696	1.363	
Concentrations of paclobutrazol:												
Control (Water spray)(C0)		1.58		22.76	16.25		4.92	4.89		0.678	0.725	
2 g a.i. per tree (C1)	1.71	2.67		24.69	17.00		5.62	5.56		1.450	1.216	
4 g a.i. per tree (C2)	3.00	4.00		27.23	22.63		6.13	5.59		1.825	1.467	
6 g a.i. per tree (C3)	3.58	4.79		38.40	31.04		6.48	5.67		2.500	2.591	
8 g a.i. per tree (C4)	3.45	3.54		24.10	30.33		5.13	4.45		2.040	1.583	
Interaction Effects:												
V1C0	1.42	1.42		24.13	13.75		4.50	4.91		0.723	0.650	
V1C1	1.50	2.33		25.71	14.92		5.23	5.19		1.183	1.233	
V1C2	2.33	3.75		28.83	20.83		6.06	5.30		1.833	1.683	
V1C3	3.58	4.67		39.47	33.33		6.47	5.91		2.767	2.983	
V1C4	3.42	3.50		27.67	38.33		5.17	3.59		2.000	1.800	
V2C0	1.33	1.75		21.38	18.75		5.33	4.88		0.633	0.800	
V2C1	1.92	3.00		23.67	19.08		6.00	5.94		1.717	1.200	
V2C2	3.67	4.25		25.67	24.42		6.20	5.88		1.817	1.250	
V2C3	3.58	4.92		37.33	28.75		6.50	5.43		2.233	2.200	
V2C4	3.50	3.58		20.54	22.33		5.10	5.31		2.080	1.367	
2001-2002												
	S Em	CD		S Em	CD		S Em	CD		S Em	CD	
Varieties	0.10	0.22		0.71	1.48		0.06	0.12		0.058	0.121	
Concentrations of paclobutrazol	0.16	0.34		1.12	2.35		0.09	0.19		0.091	0.191	
Interaction	0.23	0.49		1.58	NS		0.13	0.28		0.129	0.270	
2002-2003												
Varieties	0.09	0.19		0.83	NS		0.06	0.12		0.075	0.151	
Concentrations of paclobutrazol	0.14	0.30		1.31	2.75		0.25	0.53		0.083	0.175	
Interaction	0.20	NS		1.85	3.89		0.36	0.75		0.118	0.247	



20.54 was recorded by V2C4. The other treatments of interaction showed a range of number of nuts reached maturity m^{-2} of 23.67 to 27.67.

4.2.17.2 during 2002-03:

The data on the Table 4.10 showed significant differences among the paclobutrazol concentrations, their interactions and non-significant differences between varieties for the character number of nuts reached maturity m^{-2} .

Between the varieties the non-significant differences were recorded however the variety BPP-4 (V1) recorded the highest number of nuts reached maturity m^{-2} of 24.23 while the other variety BPP-6 (V2) recorded 22.67 number of nuts reached maturity m^{-2} .

Among the concentrations of paclobutrazol in comparison with the control (16.25), 6g a.i.tree⁻¹ (C3) was recorded significantly the highest number of nuts reached maturity m^{-2} of 31.04, which was on par with 8g a.i.tree⁻¹ (C4 30.33). The lowest number of nuts reached maturity m^{-2} of 17.00 was recorded by 2 g a.i.tree⁻¹ (C1).

Among the interactions, the treatment V1C4 recorded significantly highest number of nuts reached maturity m^{-2} of 38.33, which was superior over the control (V1C0 13.75). The lowest number of nuts reached maturity m^{-2} of 14.92 was recorded by V1C1. The other treatments of interaction showed the range of number of nuts reached maturity m^{-2} from 19.08 to 33.33.

4.2.18 Number of fruits panicle⁻¹:

The data on number of fruits per panicle as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table 4.10.

4.2.18.1 During 2001-02:

The data on the table showed significant differences between varieties, among the paclobutrazol concentrations and their interactions for the character number of fruits panicle⁻¹.

Between the varieties, the variety BPP-6 (V2) recorded significantly the highest number of fruits per panicle of 2.80 while the other variety BPP-4 (V1) recorded a number of fruits per panicle of 2.45.

Among the concentrations of paclobutrazol in comparison with the control (1.37) 6g a.i.tree⁻¹ (C3) was recorded significantly the highest number of fruits per panicle of 3.58 which was on par with the 8g a.i.tree⁻¹ (C4 3.45). The lowest number of fruits per panicle of 1.71 was recorded by 2 g a.i.tree⁻¹ (C1).

Among the interactions, the treatment V2C2 recorded significantly highest number of fruits per panicle of 3.67, which was significantly superior over control (V2C0 1.33). The lowest number of fruits per panicle of 1.50 was recorded by V1C1. The other treatments of interaction showed a range of number of fruits per panicle of 1.92 to 2.33.

Fig.36a: Effect of paclobutrazol on varieties for number of fruits panicle⁻¹

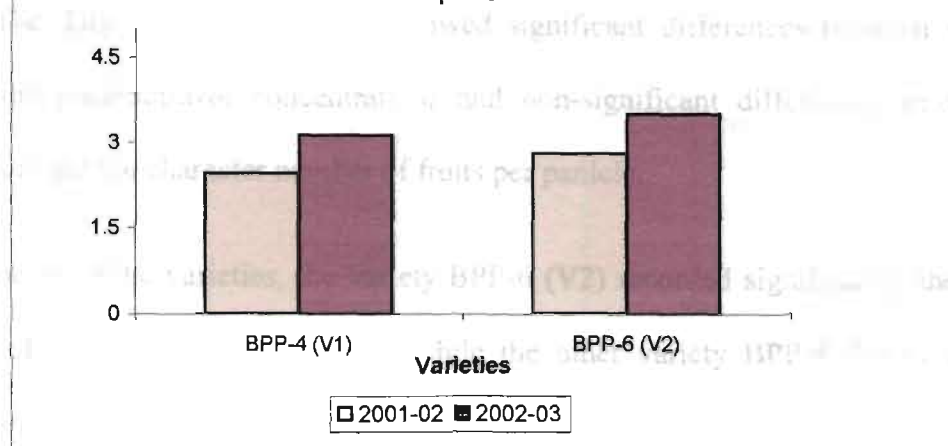


Fig.36b: Effect of paclobutrazol concentrations on number of fruits panicle⁻¹

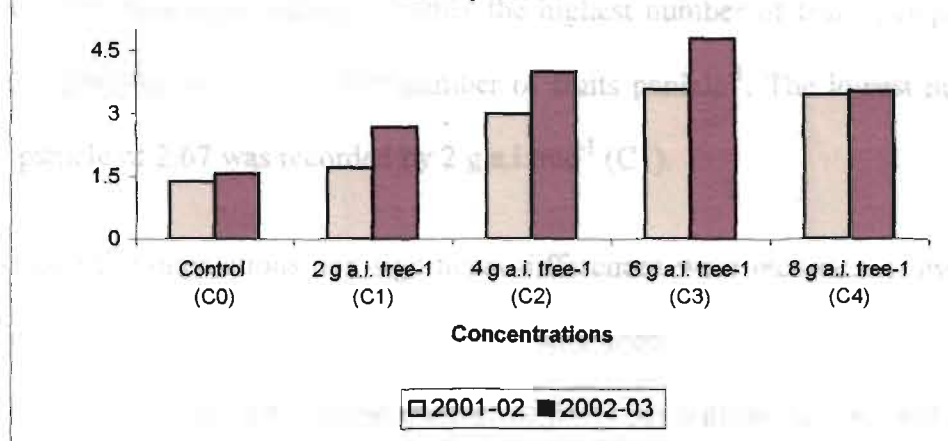
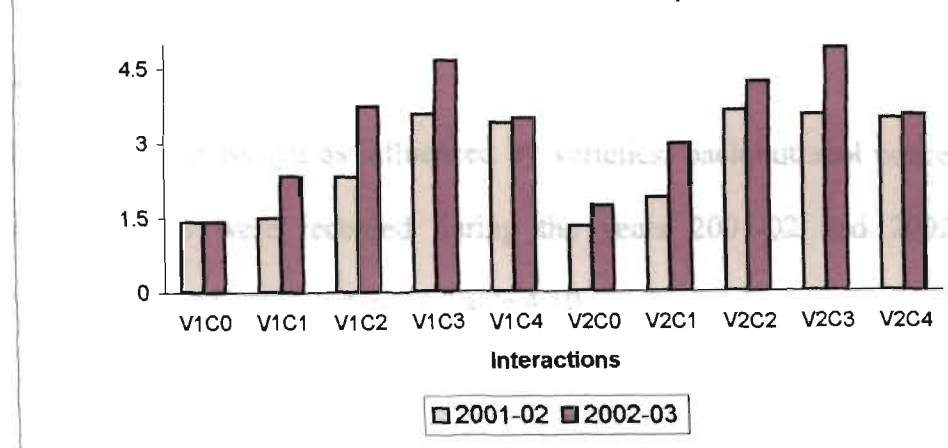


Fig.36c: Effect of interactions of varieties & paclobutrazol concentrations on number of fruits panicle⁻¹



4.2.18.2 During 2002-03:

The data on the Table 4.10 showed significant differences between varieties, among the paclobutrazol concentrations and non-significant differences among their interactions for the character number of fruits per panicle.

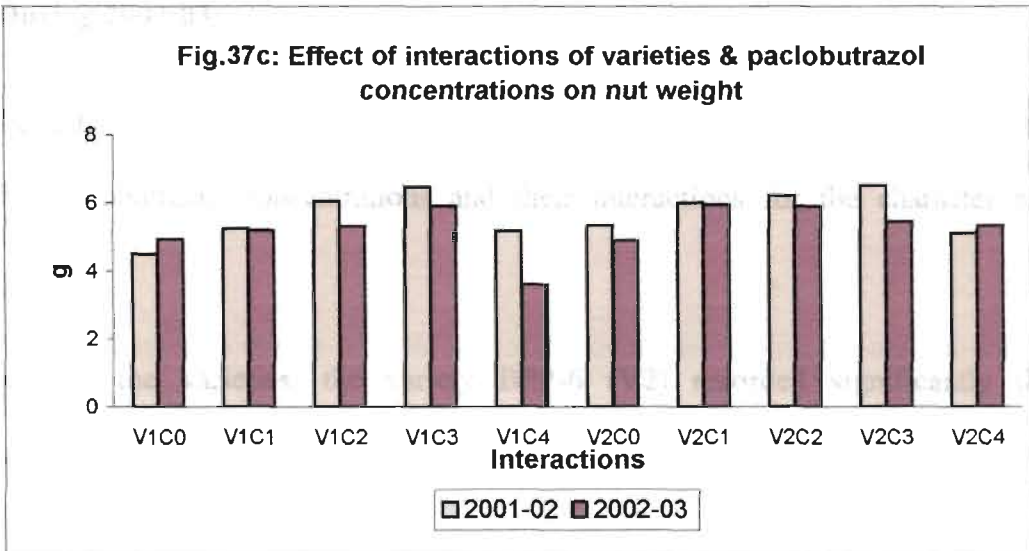
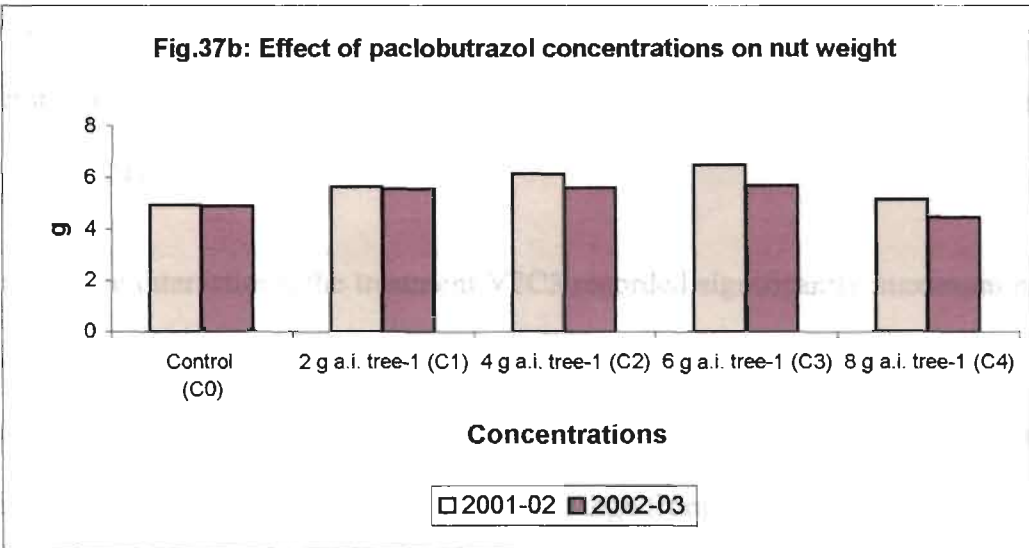
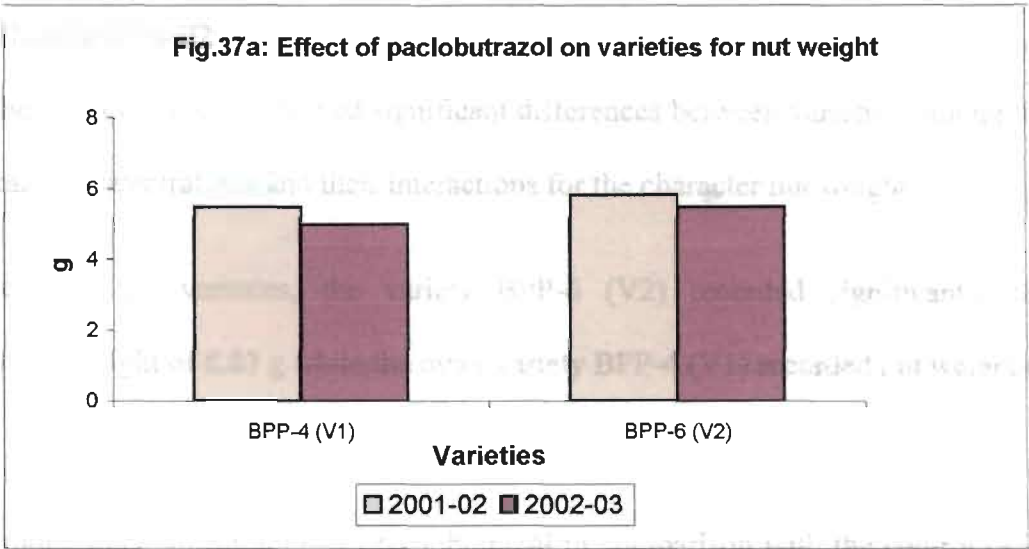
Between the varieties, the variety BPP-6 (V2) recorded significantly the highest number of fruits per panicle of 3.50 while the other variety BPP-4 (V1) recorded a number of fruits per panicle of 3.13.

Among the concentrations of paclobutrazol in comparison with the control (1.58) 6g a.i.tree⁻¹ (C3) was recorded significantly the highest number of fruits per panicle of 4.79 followed by 4g a.i.tree⁻¹ of 4.00 number of fruits panicle⁻¹. The lowest number of fruits per panicle of 2.67 was recorded by 2 g a.i.tree⁻¹ (C1).

Among the interactions non-significant differences were recorded. However, the highest number of fruits per panicle of 4.92 was recorded by the treatment V2C3 followed by V1C3 (4.67). The lowest number of fruits per panicle of 2.33 was recorded by V1C1. The other treatments of interaction showed number of fruits panicle⁻¹ of the range from 3.00 to 4.67.

4.2.19 Nut weight (g):

The data on nut weight as influenced by varieties, paclobutrazol concentrations and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.10.



4.2.19.1 During 2001-02:

The data on the table showed significant differences between varieties, among the paclobutrazol concentrations and their interactions for the character nut weight.

Between the varieties, the variety BPP-6 (V2) recorded significantly the maximum nut weight of 5.83 g while the other variety BPP-4 (V1) recorded nut weight of 5.48 g.

Among the concentrations of paclobutrazol in comparison with the control (4.92 g), 6g a.i.tree⁻¹ (C3) was recorded significantly the maximum nut weight of 6.48 g, which was superior over all other treatments. The minimum nut weight of 5.13g was recorded by 8 g a.i.tree⁻¹ (C4).

Among the interactions, the treatment V2C3 recorded significantly maximum nut weight of 6.50 g, which was significantly superior over control (6.00g) but on par with V1C3 (6.47 g). The minimum nut weight of 5.10 g was recorded by V2C4. The other treatments of interaction showed a nut weight in the range from 5.17 g to 6.20 g.

4.2.19.2 During 2002-03:

The data on the Table 4.10 showed significant differences between varieties, among the paclobutrazol concentrations and their interactions for the character nut weight.

Between the varieties, the variety BPP-6 (V2) recorded significantly the maximum nut weight of 5.49 g while the other variety BPP-4 (V1) recorded nut weight of 4.78 g.

Among the concentrations of paclobutrazol in comparison with the control (4.89 g), 6 g a.i.tree⁻¹ (C3) was recorded significantly the maximum nut weight of 5.67 g, which was superior over all other treatments. The minimum nut weight of 4.45 g was recorded by 8 g a.i.tree⁻¹ (C4).

Among the interactions, the treatment V2C1 recorded significantly maximum nut weight of 5.94 g, which was significantly superior over control (4.88 g) but on par with V1C3 (5.91g). The minimum nut weight of 3.59 g was recorded by V2C4. The other treatments of interaction showed nut weight in the range from 5.19 g to 5.88 g.

4.2.20 Nut yield tree⁻¹ (kg):

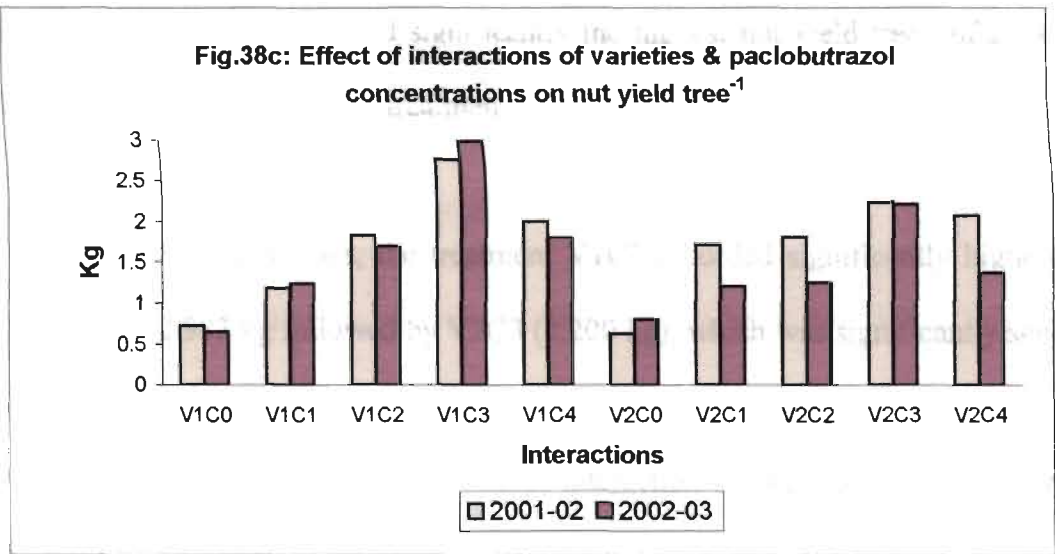
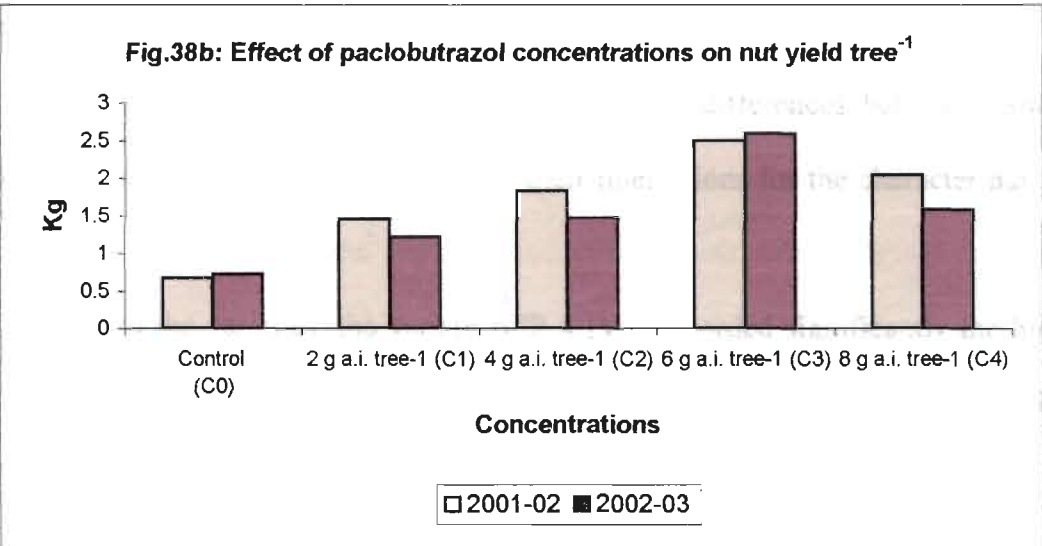
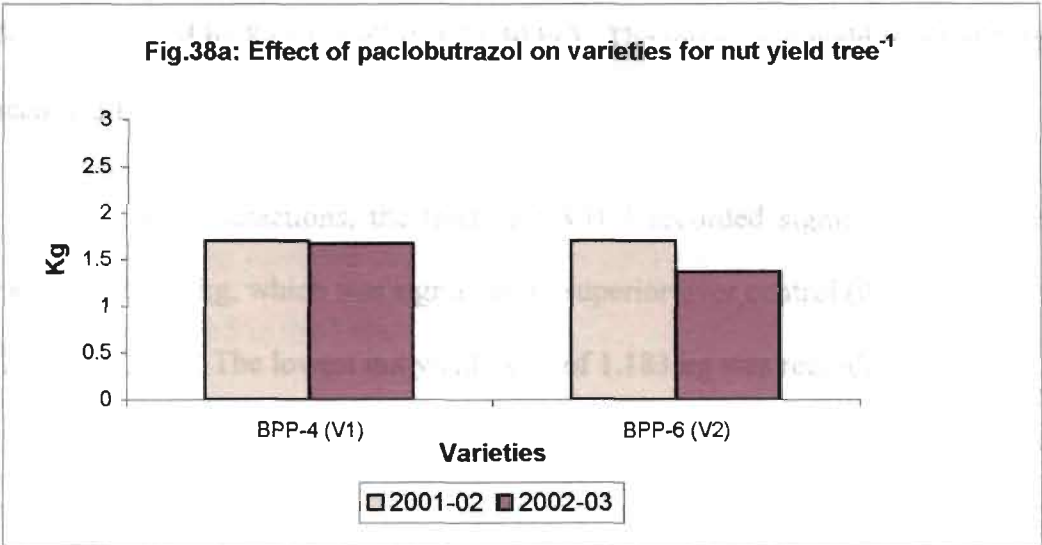
The data on nut yield tree⁻¹ as influenced by varieties, paclobutrazol concentration and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.10.

4.2.20.1 During 2001-02:

The data on the table showed significant differences between varieties, among the paclobutrazol concentrations and their interactions for the character nut yield tree⁻¹.

Between the varieties, the variety BPP-4 (V1) recorded significantly the highest nut yield tree⁻¹ of 1.701 kg while the other variety BPP-6 (V2) recorded nut yield of 1.696 kg tree⁻¹.

Among the concentrations of paclobutrazol in comparison with the control (0.698 kg), 6 g a.i.tree⁻¹ (C3) was recorded significantly the highest nut yield tree⁻¹ of 2.500 kg,



which was followed by 8g a.i.tree⁻¹ (C4 2.040 kg). The lowest nut yield tree⁻¹ of 1.450 kg was recorded by 2 g a.i.tree⁻¹ (C1).

Among the interactions, the treatment V1C3 recorded significantly highest nut yield tree⁻¹ of 2.767 kg, which was significantly superior over control (0.723 kg) followed by V2C3 (2.233 kg). The lowest nut yield tree⁻¹ of 1.183 kg was recorded by V1C1. The other treatments of interaction showed nut yield tree⁻¹ in the range from 1.717 kg to 1.833 kg.

4.2.20.2 During 2002-03:

The data on the Table 4.10 showed significant differences between varieties, among the paclobutrazol concentrations and their interactions for the character nut yield tree⁻¹.

Between the varieties, the variety BPP-4 (V1) recorded significantly the highest nut yield per tree of 1.669 while the other variety V2 (BPP-6) recorded nut yield of 1.363 per tree.

Among the concentrations of paclobutrazol in comparison with the control (0.725 kg) 6g a.i.tree⁻¹ (C3) was recorded significantly the highest nut yield tree⁻¹ of 2.591 kg which was superior over all other treatments. The lowest nut yield tree⁻¹ of 1.216 kg was recorded by 2 g a.i.tree⁻¹ (C1).

Among the interactions, the treatment V1C3 recorded significantly highest nut yield per tree of 2.983 kg followed by V2C3 (2.200 kg), which was significantly superior over all other treatments of interactions. The lowest nut yield per tree of 1.200 kg was recorded by V2C1. The other treatments of interaction showed nut yield tree⁻¹ in the range from 1.233 kg to 1.800 kg.

4.3 EFFECT OF ALAR:

4.3.1. Incremental growth in plant height (cm):

The data on increment in height as influenced by varieties, alar concentration and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.11.

4.3.1.1 During 2001-02:

The data of the table showed significant differences among the concentrations of alar, their interactions and non-significant differences between varieties for the character incremental growth in plant height.

Between the varieties non-significant differences were recorded. However, the variety BPP-6 (V2) recorded the lowest incremental growth in plant height of 79.57cm while the other variety BPP-4 (V1) recorded 79.93 cm of incremental growth in plant height.

Among the alar concentrations in comparison with control (105.0cm) 500 ppm double spray (C2) recorded lowest incremental growth in plant height of 66.25 cm which was statistically on par with 500 ppm single spray (C1 71.0 cm) and 500 ppm triple spray (C3 70.0 cm). The concentration of 1000 ppm single spray (C5 86.25 cm) recorded highest incremental growth in plant height.

Among the interactions, the treatment V2C3 recorded the lowest incremental growth in plant height of 52.50 cm followed by V1C1 (60.00 cm). The highest incremental growth in plant height of 115.00 cm was recorded by control (V2C0). The

Table 4.11: Plant height increment, stem girth, mean canopy spread and number of shoots m² in cashew as influenced by variety, alar and their interactions.

	Plant height increment (cm)		Stem girth increment (cm)		Mean canopy spread (cm)		Number of shoots m ²	
	2001-02		2002-03		2001-02		2002-03	
	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03
Varieties:								
BPP-4 (V1)	79.93	49.40	5.50	5.50	55.90	41.87	40.60	28.1
BPP-6 (V2)	79.57	43.60	5.50	6.20	60.95	55.50	38.85	27.7
Concentrations of alar:								
Control (Water spray) (C0)	105.00	52.80	5.75	8.25	62.57	51.12	27.75	21.50
500 ppm single spray (C1)	71.00	60.00	6.00	5.50	61.25	60.63	40.50	26.00
500 ppm double spray (C2)	66.25	52.50	5.25	4.25	60.95	60.63	49.00	26.30
500 ppm triple spray (C3)	70.00	38.80	5.50	5.75	58.15	47.80	49.00	35.50
1000 ppm single spray (C4)	75.00	40.00	5.25	6.00	54.70	45.00	35.00	24.80
1000 ppm double spray (C5)	86.25	35.00	5.25	5.25	55.38	43.13	40.25	32.30
1000 ppm triple spray (C6)	84.75	46.50	5.50	6.00	56.00	32.50	36.75	29.50
Interactions:								
V1C0	95.00	52.50	6.00	8.50	56.25	45.00	31.00	22.50
V1C1	60.00	62.50	5.50	6.50	55.00	55.00	41.00	25.00
V1C2	75.00	57.50	4.50	2.50	58.15	41.25	57.00	20.50
V1C3	87.50	40.00	6.00	6.00	55.65	43.10	41.00	33.50
V1C4	82.50	37.50	5.50	6.00	55.00	41.25	33.00	28.00
V1C5	80.00	42.50	6.00	5.00	56.75	35.00	38.50	36.00
V1C6	79.50	53.00	5.00	4.00	54.50	32.50	43.00	31.50
V2C0	115.00	53.00	5.50	8.00	68.90	57.25	24.50	20.50
V2C1	82.00	57.50	6.50	4.50	67.50	66.25	40.00	27.00
V2C2	57.50	47.50	6.00	6.00	63.75	80.00	41.00	32.00
V2C3	52.50	37.50	5.00	5.50	60.65	52.50	57.00	37.50
V2C4	67.50	42.50	5.00	6.00	54.40	48.75	37.00	21.50
V2C5	92.50	27.50	4.50	5.50	54.01	51.25	42.00	28.50
V2C6	90.00	40.00	6.00	8.00	57.50	32.50	30.50	27.50
2001-2002								
	S Em	CD	S Em	CD	S Em	CD	S Em	CD
Varieties	2.15	NS	0.23	NS	0.83	1.80	0.43	0.94
Concentrations of alar	4.02	8.69	0.43	NS	1.55	3.37	0.81	1.77
Interaction	5.69	12.29	0.61	1.32	1.55	3.37	1.16	2.50
2002-2003:								
	S Em	CD	S Em	CD	S Em	CD	S Em	CD
Varieties	2.27	4.90	0.30	0.66	0.85	1.84	0.56	NS
Concentrations of alar	4.25	9.17	0.57	1.23	1.59	3.44	1.05	2.27
Interaction	7.25	9.17	0.81	1.74	2.26	4.87	1.49	3.21

Fig.39a: Effect of alar on varieties for plant height increment

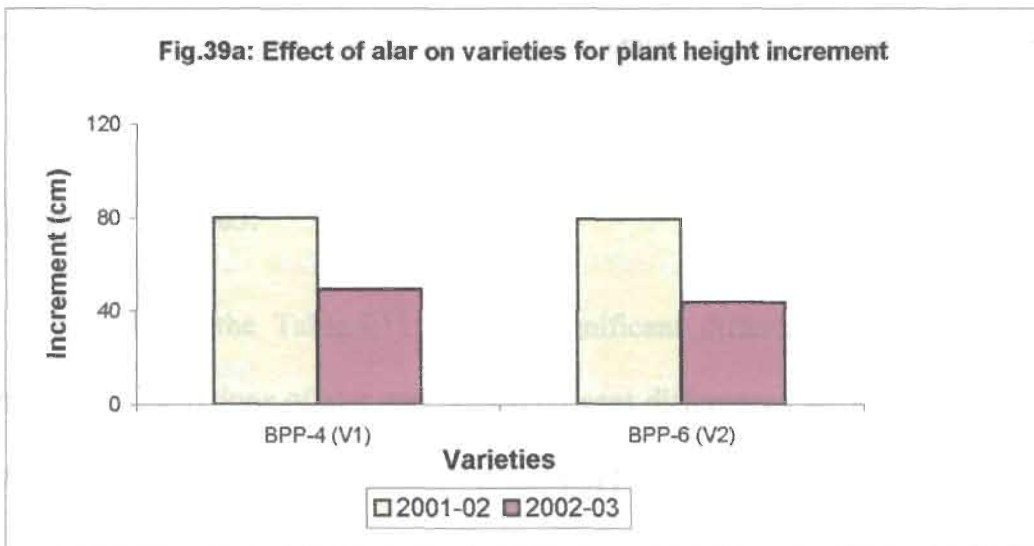


Fig.39b: Effect of alar concentration on plant height increment

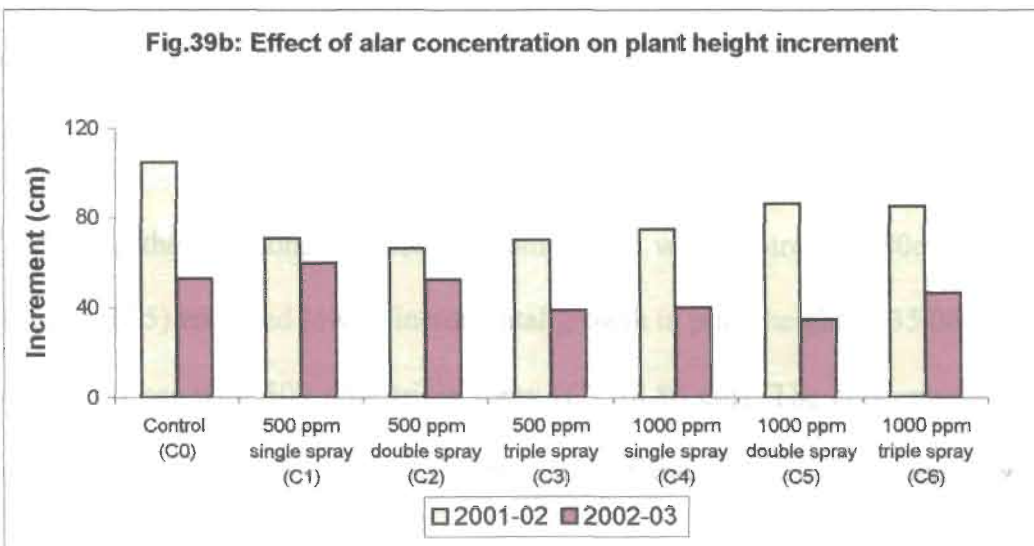
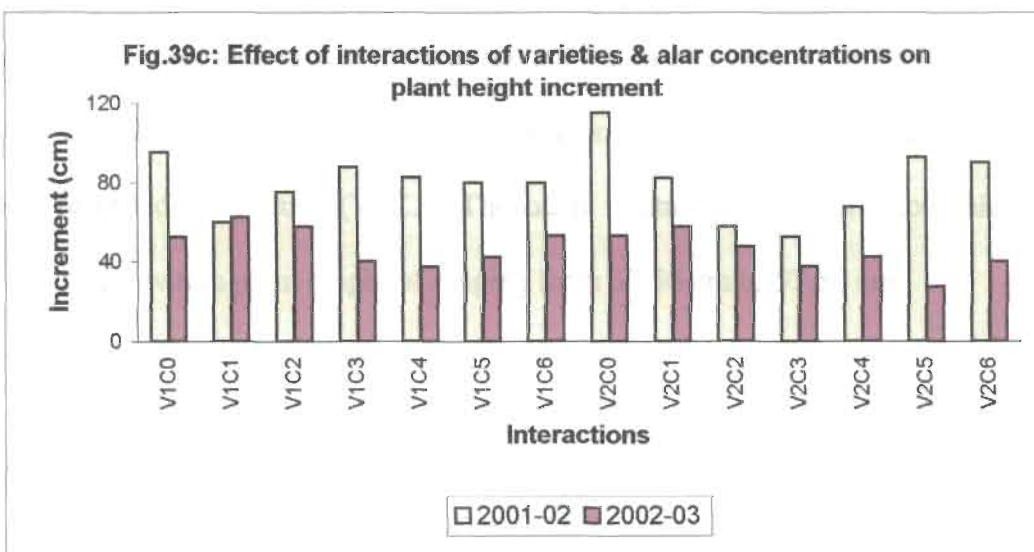


Fig.39c: Effect of interactions of varieties & alar concentrations on plant height increment



other treatments of interactions showed an incremental growth in plant height ranging from 57.50 cm to 95.00 cm.

4.3.1.2 During 2002-03:

The data of the Table.4.11 showed significant differences between varieties, among the concentrations of alar and non-significant differences were recorded for their interactions for the character incremental growth in plant height.

Between the varieties, the variety BPP-6 (V2) recorded the significant lowest incremental growth in plant height of 43.60 cm while the other variety BPP-4 (V1) recorded 49.40 cm of incremental growth in plant height.

Among the alar concentrations in comparison with control (52.80cm) 1000 ppm double spray (C5) recorded lowest incremental growth in plant height of 35.00 which was statistically on par with 500 ppm triple spray (C3 38.80 cm). The concentration of 500 ppm single spray (C1 60.00 cm) recorded highest incremental growth in plant height.

Among the interactions non-significant differences were recorded. However, the treatment V2C5 recorded lowest incremental growth in plant height of 27.50 cm as in the followed by V1C4 (37.50 cm). The highest incremental growth in plant height of 62.50 cm was recorded by control (V1C1). The other treatments of interactions showed an incremental growth in plant height of ranging from 37.50 cm to 57.50 cm.

4.3.2. Incremental growth in stem girth (cm):

The data on incremental growth in stem girth as influenced by varieties, among concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.11.

4.3.2.1 During 2001-02:

The data of the table showed significant differences among their interactions and non-significant differences between varieties and concentrations of alar for the character incremental growth in stem girth.

Between the varieties the non-significant differences were recorded. However, the variety BPP-4 (V1) recorded the incremental growth in stem girth of 5.5cm while the other variety BPP-6 (V2) recorded 5.5 cm incremental growth in stem girth.

Among the concentrations of alar non-significant differences were recorded. However, highest incremental growth stem girth of 6.00 cm was recorded by 500 ppm single spray (C1) followed by 500 ppm alar triple spray (C3 5.50cm). The lowest incremental growth in stem girth of 5.25 cm was recorded by 1000 ppm single and double spray of alar.

Among the interactions, the treatment V2C1 recorded significant highest incremental growth in stem girth of 6.50 followed by V1C3 (6.00 cm), VIC5 and V2C6. The lowest incremental growth in stem girth of 4.50 cm was recorded by control (V1C2) and V2C5. The other treatments of interactions showed an incremental growth in stem girth ranging from 5.0 cm to 5.5 cm.

Fig.40a: Effect of alar on varieties for stem girth increment

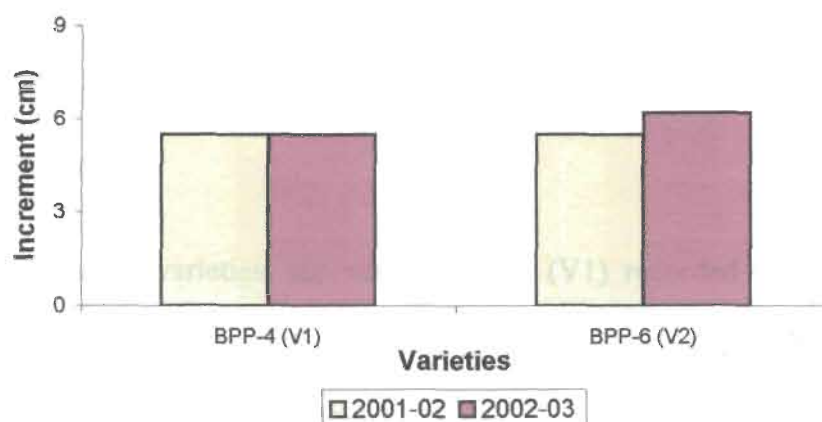


Fig.40b: Effect of alar concentration on stem girth increment

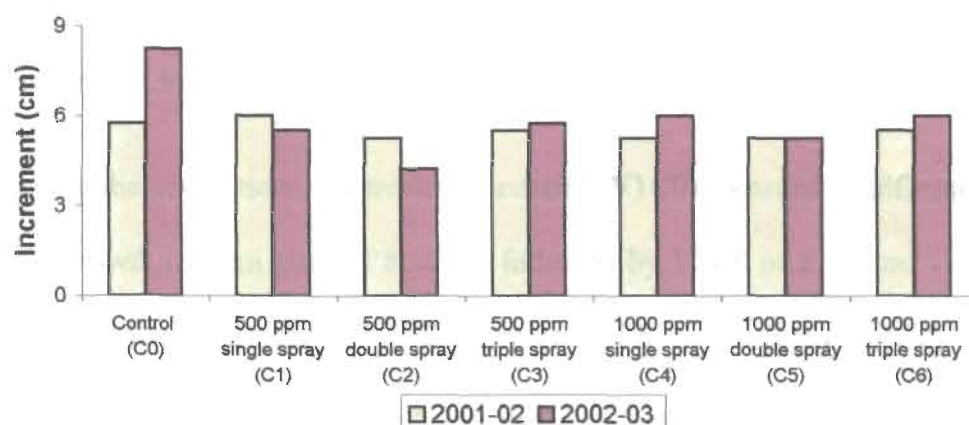
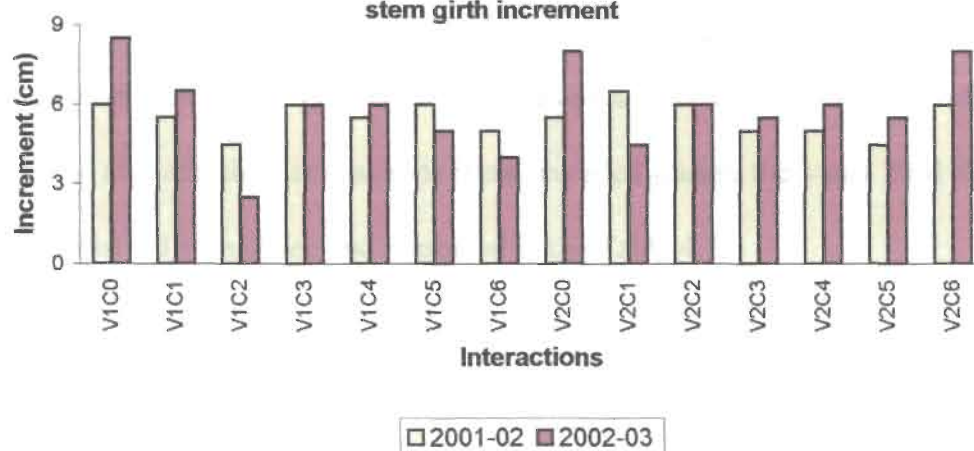


Fig.40c: Effect of interactions of varieties & alar concentrations on stem girth increment



4.3.2.2 During 2002-03:

The data of the Table.4.11 showed significant differences between varieties, among concentrations of alar and among their interactions for the character incremental growth in stem girth.

Between the varieties, the variety BPP-4 (V1) recorded the significant lowest incremental growth in stem girth of 5.5 cm while the other variety BPP-6 (V2) recorded 6.2 cm incremental growth in stem girth.

Among the alar concentrations significant differences were recorded. The highest incremental growth in stem girth of 8.25 cm was recorded control (C0). The lowest incremental growth in stem girth of 4.25 cm was recorded by 500 ppm double spray (C2).

Among the interactions, the treatment control (V1C0) recorded significant highest incremental growth in stem girth of 8.50 cm followed by V2C0 of 8.00 cm. The lowest incremental growth in stem girth of 2.50 was recorded by water spray (V1C2) followed by V1C6 (4.00 cm). The other treatments of interactions showed an incremental growth in stem girth ranging from 4.5 cm to 6.5 cm.

4.3.3. Incremental growth in mean canopy spread (cm):

The data on incremental growth in mean canopy spread as influenced by varieties, concentration of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.11.

Fig.41a: Effect of alar on varieties for mean canopy spread increment

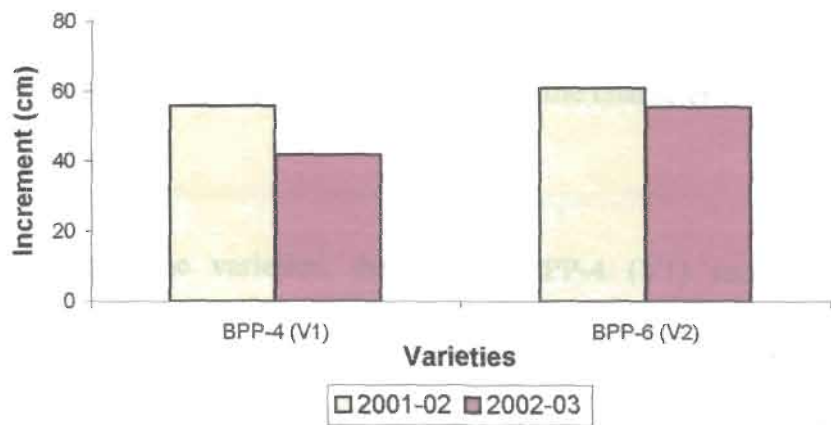


Fig.41b: Effect of alar concentration on mean canopy spread increment

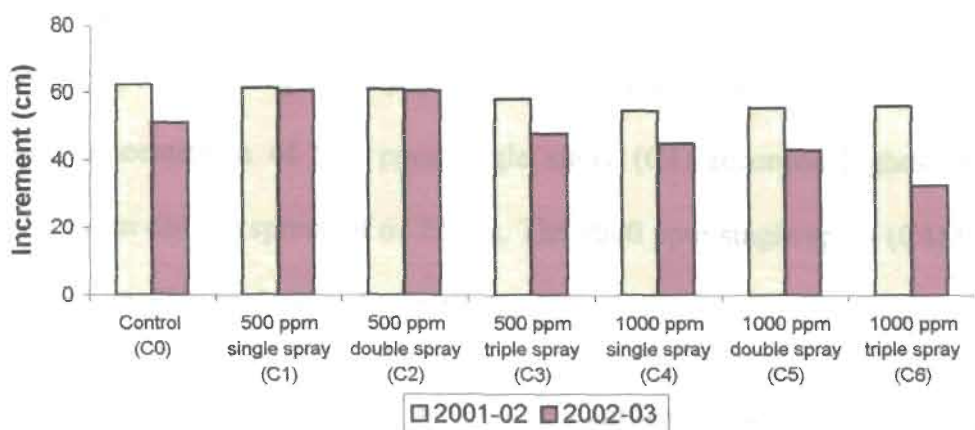
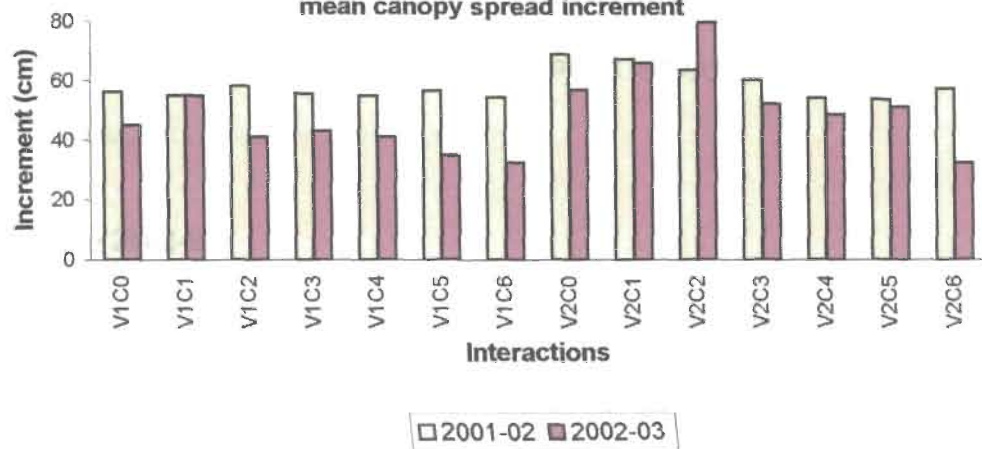


Fig.41c: Effect of interactions of varieties & alar concentrations on mean canopy spread increment



4.3.3.1 During 2001-02:

The data of the table showed significant differences between varieties, among the concentrations of alar and their interactions for the character incremental growth in mean canopy spread.

Between the varieties, the variety BPP-4 (V1) recorded significant lowest incremental growth in mean canopy spread of 55.90 cm while the other variety BPP-6 (V2) recorded an incremental growth in mean canopy spread of 60.95 cm.

Among the alar concentrations in comparison with the control (water spray C0 62.57 cm) significant lowest incremental growth in mean canopy spread of 54.70 cm was recorded by 1000 ppm single spray (C4) followed by 1000 ppm double spray (C5 55.38 cm). The concentration of 500 ppm single spray (C1) recorded highest incremental growth in mean canopy spread of 61.25 cm. The 1000 ppm single spray (C4) found to be superior among all other levels of treatments.

Among the interactions V2C5 recorded significant lowest incremental growth in mean canopy spread of 54.01 cm followed by V2C4 (54.40 cm). The highest incremental growth in mean canopy spread of 67.50 cm was recorded by V2C1. The other treatments of interactions showed an incremental growth in mean canopy spread ranging from 55.00 cm to 63.75 cm.

4.3.3.2 During 2002-03:

The data of the Table.4.11 showed significant differences between varieties, among the concentrations of alar and their interactions for the character incremental growth in mean canopy spread.

Between the varieties the variety BPP-4 (V1) recorded significant lowest incremental growth in mean canopy spread of 41.87 cm while the other variety BPP-6 (V2) recorded an incremental growth in mean canopy spread of 55.50 cm.

Among the concentrations of alar in comparison with the control (water spray C0 51.52 cm) significant lowest incremental growth in mean canopy spread of 32.50 cm was recorded by 1000 ppm triple spray of alar (C6). The concentration of 500 ppm single spray of alar (C1) recorded highest incremental growth in mean canopy spread of 60.63 cm. The 1000 ppm triple spray (C6) found to be superior among all other levels concentrations.

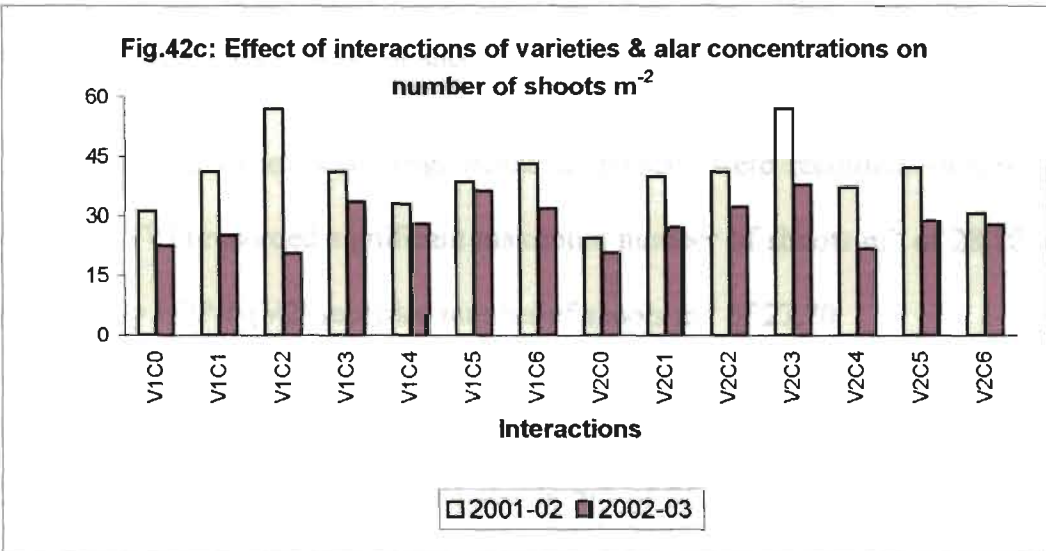
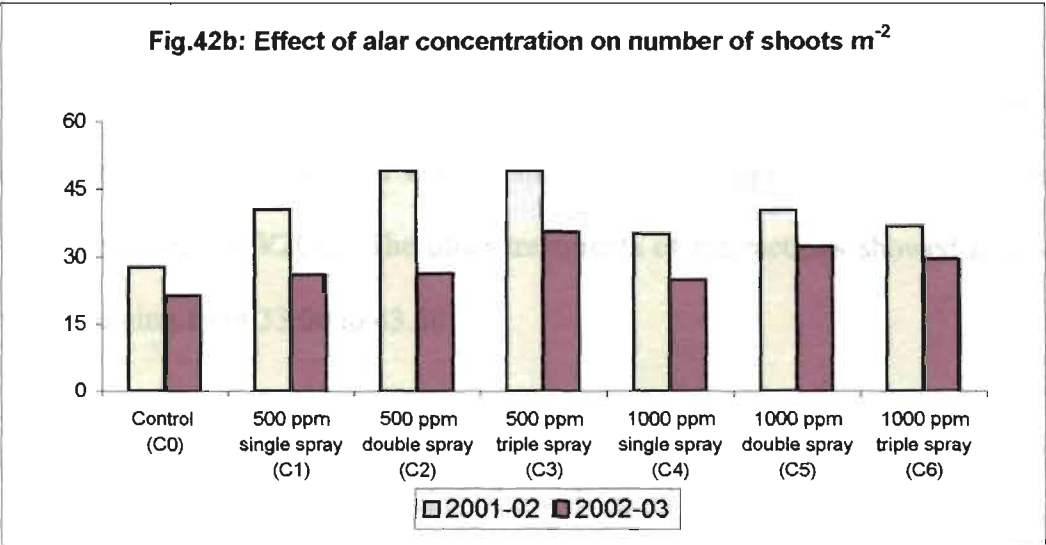
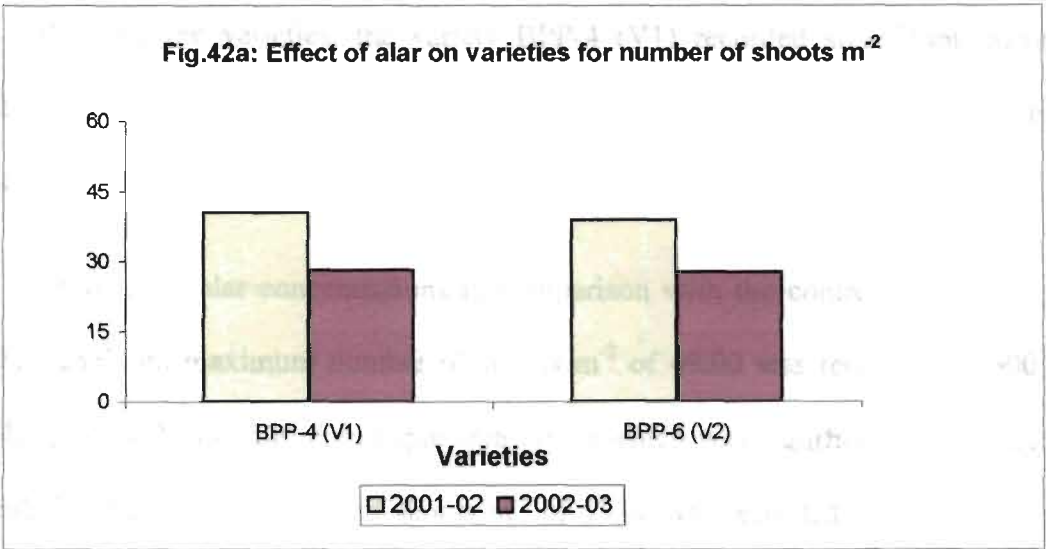
Among the interactions, the treatment V1C6 recorded significant lowest incremental growth in mean canopy spread of 32.50 cm followed by V2C6 (32.50). The highest incremental growth in mean canopy spread of 80.00 cm was recorded by V2C2. The other treatments of interactions showed an incremental growth in mean canopy spread ranging from 41.25 cm to 66.25 cm.

4.3.4. Number of shoots per square meter:

The data on number of shoots m^{-2} as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.11.

4.3.4.1 during 2001-02:

The data of the table showed significant differences between varieties, among the concentrations of alar and their interactions for the character number of shoots m^{-2} .



Between the varieties, the variety BPP-4 (V1) recorded significant maximum number of shoots m^{-2} of 40.60 while the other variety BPP-6 (V2) recorded number of shoots m^{-2} of 38.85.

Among the alar concentrations in comparison with the control (water spray C0 27.75) significant maximum number of shoots m^{-2} of 49.00 was recorded by 500 ppm double spray (C2) and 500 ppm triple spray (C3) which was significantly superior over control. The minimum number of shoots m^{-2} of 35.00 was recorded by concentration of 1000 ppm single spray of alar (C4).

Among the interactions, the treatment V1C2 recorded significant maximum number of shoots m^{-2} of 57.00 and V2C3 (57.00). The minimum number of shoots m^{-2} of 30.50 was recorded by V2C6. The other treatments of interactions showed number of shoots m^{-2} ranging from 33.00 to 43.00.

4.3.4.2 During 2002-03:

The data of the Table.4.11 showed significant differences among the concentrations of alar and their interactions and non-significant differences between varieties for the character number of shoots m^{-2} .

Between the varieties non-significant differences were recorded. However, the variety BPP-4 (V1) recorded significant maximum number of shoots m^{-2} of 28.10 while the other variety BPP-6 (V2) recorded number of shoots m^{-2} of 27.70.

Among the alar concentrations in comparison with the control (water spray C0 21.50) significant maximum number of shoots m^{-2} of 35.50 was recorded by 500 ppm

triple spray (C3) which was significantly superior over all other treatments but on par with 1000ppm double spray (C5 32.30). The minimum number of shoots m^{-2} of 26.30 was recorded by concentration of 500 ppm double spray (C2).

Among the interactions, the treatment V2C3 recorded significant maximum number of shoots m^{-2} of 37.50 followed by V1C5 (36.00). The minimum number of shoots m^{-2} of 20.50 was recorded by V1C2 and V2C0. The other treatments of interactions showed number of shoots m^{-2} ranging from 25.00 to 33.50.

4.3.5. Shoot length (cm):

The data on shoot length as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the table 4.12.

4.3.5.1 During 2001-02:

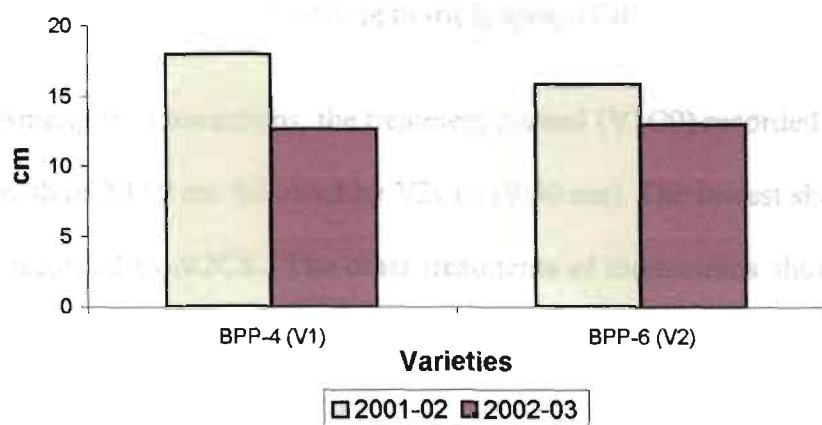
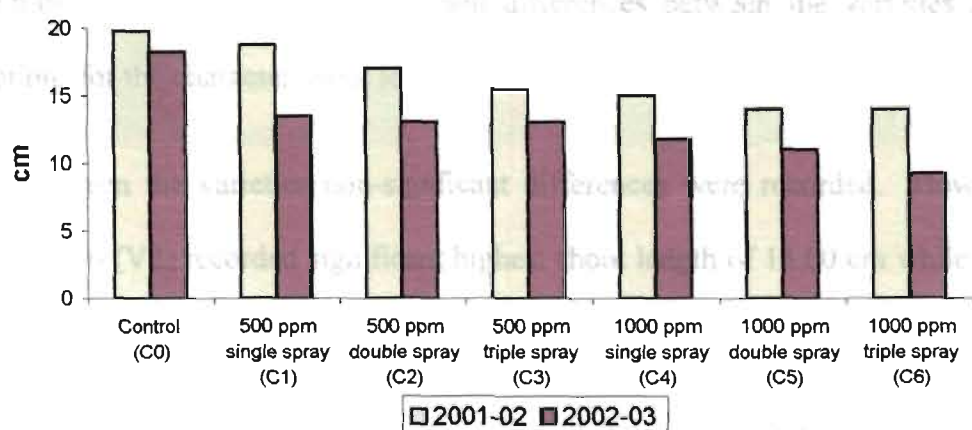
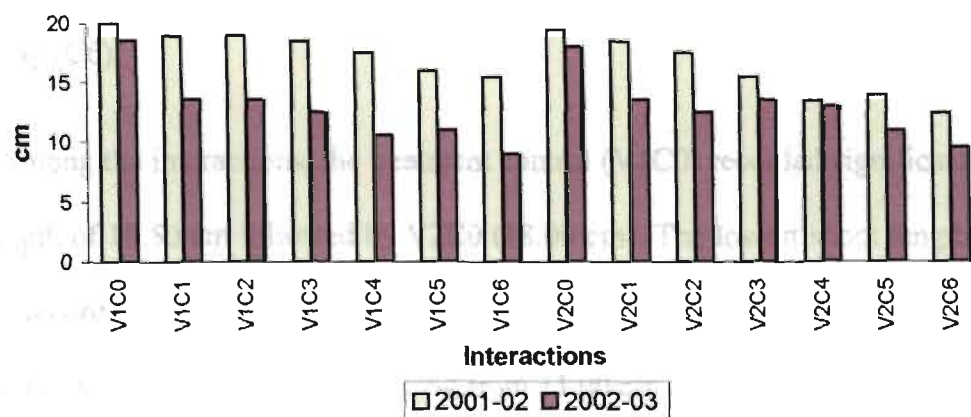
The data of the table showed significant differences between the varieties, among the concentrations of alar and non-significant differences for their interactions for the character shoot length.

Between the varieties, the variety BPP-4 (V1) recorded significant lowest shoot length of 17.93 cm while the other variety BPP-6 (V2) recorded shoot length of 15.85 cm.

Among the alar concentrations, the control (water spray C0) recorded significant highest shoot length of 19.75 cm followed by 500 ppm single spray of alar (C1 18.75

Table 4.12: Shoot length, number of leaves m⁻², leaf area per shoot, chlorophyll-a content in cashew as influenced by variety, alar and their interactions.

	Shoot length (cm)		Number of leaves m ⁻²		Leaf area per shoot (cm ²)		Chlorophyll-a content (mg/g)	
	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03
Varieties:								
BPP-4 (V1)	17.93	12.64	348.8	348.0	625.4	620.4	1.387	1.349
BPP-6 (V2)	15.85	13.00	354.3	369.0	669.7	691.3	1.432	1.415
Concentrations of alar :								
Control (Water spray) (C0)	19.75	18.25	399.2	400.0	778.3	783.9	1.171	1.185
500 ppm single spray (C1)	18.75	13.50	394.8	399.0	680.7	679.0	1.151	1.191
500 ppm double spray (C2)	17.00	13.00	376.5	379.2	664.4	678.2	1.365	1.362
500 ppm triple spray (C3)	15.50	13.00	353.2	362.3	630.6	625.8	1.403	1.426
1000 ppm single spray (C4)	15.00	11.75	330.0	337.5	618.1	617.5	1.508	1.487
1000 ppm double spray (C5)	14.00	11.00	311.0	332.0	589.4	604.1	1.535	1.483
1000 ppm triple spray (C6)	14.00	9.25	295.0	300.0	571.4	602.4	1.599	1.539
Interactions:								
V1C0	20.00	18.50	404.0	395.0	724.3	742.2	1.192	1.192
V1C1	19.00	13.50	400.5	404.0	641.7	611.7	1.212	1.300
V1C2	19.00	13.50	376.0	374.5	619.4	634.4	1.312	1.305
V1C3	18.50	12.50	357.0	347.5	617.9	597.5	1.349	1.333
V1C4	17.50	10.50	330.0	317.5	600.7	543.4	1.547	1.409
V1C5	16.00	11.00	319.0	312.5	594.7	632.8	1.511	1.411
V1C6	15.50	9.00	297.5	285.0	579.3	581.1	1.618	1.495
V2C0	19.50	18.00	394.5	405.0	832.3	825.6	1.251	1.179
V2C1	18.50	13.50	389.0	394.0	719.8	746.3	1.290	1.082
V2C2	17.50	12.50	377.0	384.0	709.4	722.0	1.418	1.418
V2C3	15.50	13.50	349.0	377.0	643.3	654.0	1.457	1.520
V2C4	13.50	13.00	330.0	357.5	635.5	691.7	1.469	1.565
V2C5	14.00	11.00	303.0	351.5	584.2	575.5	1.560	1.555
V2C6	12.50	9.50	292.5	315.0	563.4	623.7	1.581	1.585
2001-2002								
	S Em	CD	S Em	CD	S Em	CD	S Em	CD
Varieties	0.34	0.73	1.96	4.23	1.99	4.29	0.003	0.006
Concentrations of alar	0.63	1.37	3.67	7.93	3.72	8.04	0.005	0.012
Interaction	0.89	NS	5.19	NS	5.26	11.36	0.008	0.017
2002-2003								
Varieties	0.54	NS	2.54	5.49	1.54	3.33	0.004	0.009
Concentrations of alar	1.00	2.17	4.75	10.27	2.88	6.23	0.008	0.017
Interaction	1.42	NS	6.72	14.52	4.08	8.81	0.012	0.025

Fig.43a: Effect of alar on varieties for shoot length**Fig.43b: Effect of alar concentrations on shoot length****Fig.43c: Effect of interactions of varieties & alar concentrations on shoot length**

cm). The lowest shoot length of 14.00 cm was recorded by concentration of 1000 ppm double spray of alar (C5) and 1000 ppm triple spray (C6).

Among the interactions, the treatment control (V1C0) recorded significant highest shoot length of 20.00 cm followed by V2C0 (19.50 cm). The lowest shoot length of 12.50 cm was recorded by V2C6. The other treatments of interactions showed a shoot length ranging from 13.50 cm to 19.00 cm.

4.3.5.2 During 2002-03:

The data of the Table.4.12 showed significant differences among the concentrations of alar and non-significant differences between the varieties and their interactions for the character shoot length.

Between the varieties non-significant differences were recorded. However, the variety BPP-6 (V2) recorded significant highest shoot length of 13.00 cm while the other variety BPP-4 (V1) recorded shoot length of 12.64 cm.

Among the alar concentrations, the control (water spray C0) recorded significant highest shoot length of 18.25 cm followed by 500 ppm single spray of alar (C1) of 13.5 cm. The lowest shoot length of 9.25 cm was recorded by concentration of 1000 ppm triple spray (C6).

Among the interactions, the treatment control (V1C0) recorded significant highest shoot length of 18.50 cm followed by V2C0 (18.00 cm). The lowest shoot length of 9.00 cm was recorded by V1C6 followed by V2C6 (9.50 cm). The other treatments of interactions showed a shoot length ranging from 11.00 cm to 13.50 cm.

Plate 7: Effect of alar on shoot length of BPP-4

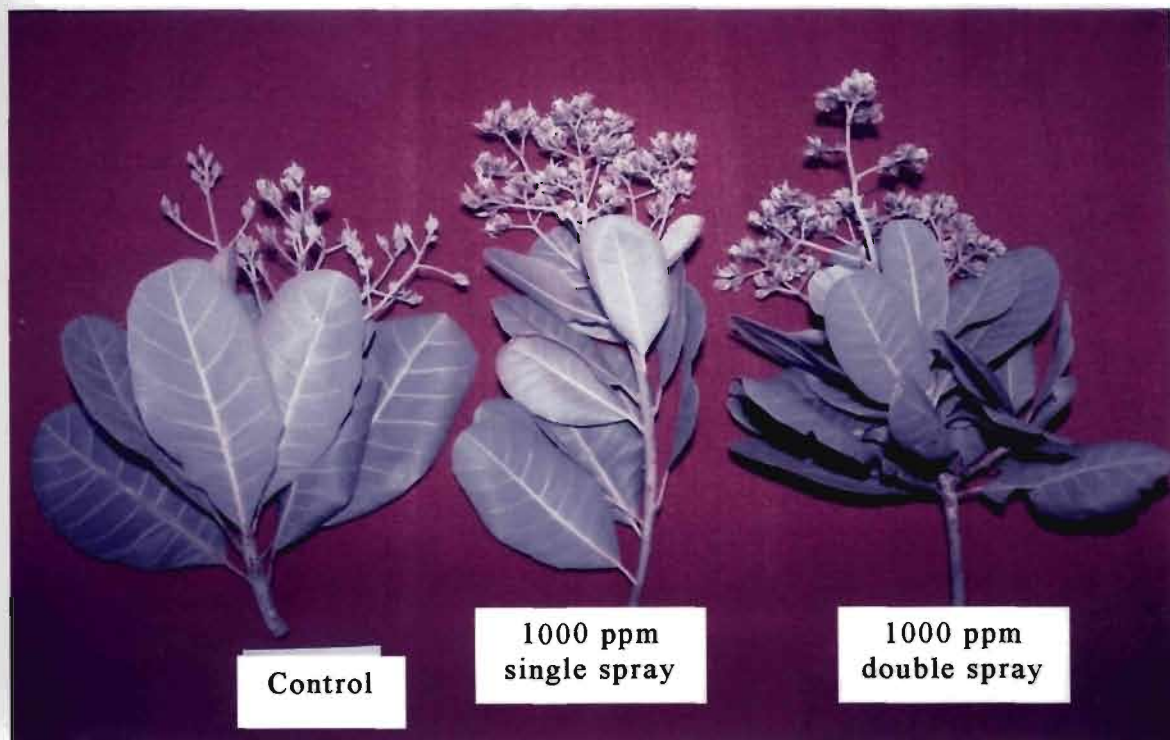
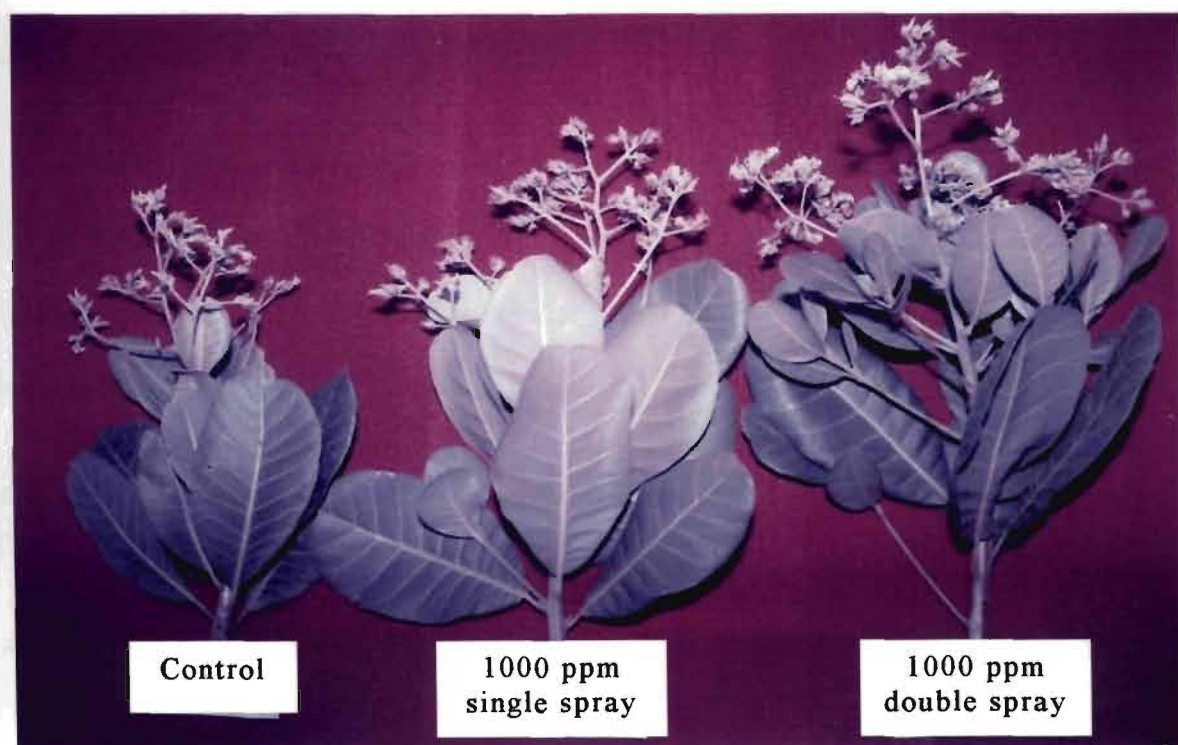


Plate 7a: Effect of alar on shoot length of BPP-6



4.3.6. Number of leaves m^{-2} :

The data on number of leaves m^{-2} as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.12

4.3.6.1 During 2001-02:

The data of the table showed significant differences between the varieties, among concentrations of alar and their interactions for the character number of leaves m^{-2} .

Between the varieties, the variety BPP-4 (V1) recorded significant minimum number of leaves m^{-2} of 348.8 while the other variety BPP-6 (V2) recorded number of leaves m^{-2} of 354.3.

Among the concentrations of alar, in comparison with the control (water spray C0 399.2) significant minimum number of leaves m^{-2} of 295.00 was recorded by 1000 ppm triple spray (C6). The maximum number of leaves m^{-2} of 394.80 was recorded by concentration of 500 ppm single spray (C1).

Among the interactions, V2C6 recorded significant minimum number of leaves m^{-2} of 292.50 followed by V1C6 (297.5). The highest number of leaves m^{-2} of 400.5 was recorded by V1C1. The other treatments of interaction showed number of leaves m^{-2} ranging from 303.0 to 404.0.

4.3.6.2 During 2002-03:

The data of the Table.4.12 showed significant differences between the varieties, among concentrations of alar and their interactions for the character number of leaves m^{-2} .

Fig.44a: Effect of alar on varieties for number of leaves m^{-2}

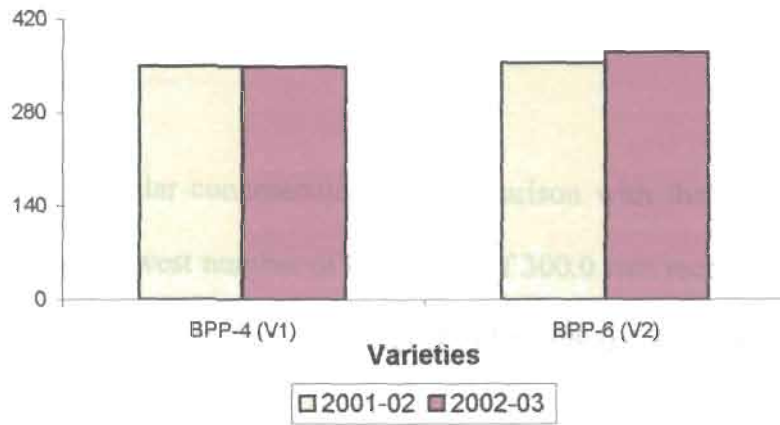


Fig.44b: Effect of alar concentrations on number of leaves m^{-2}

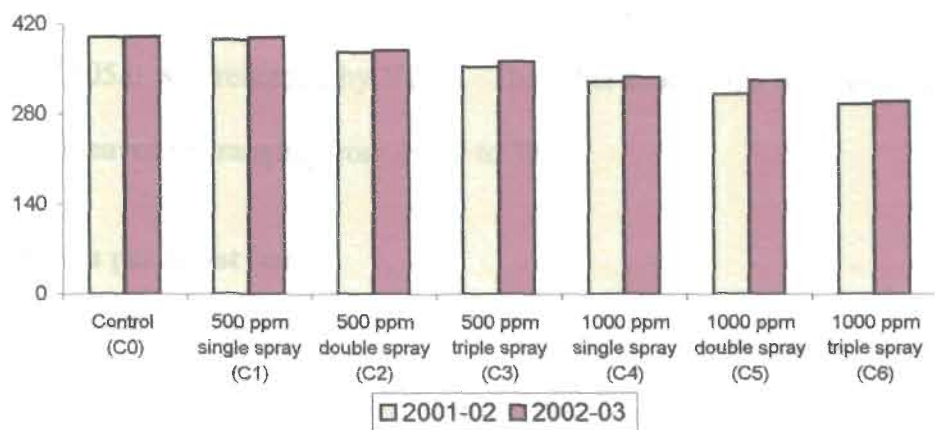
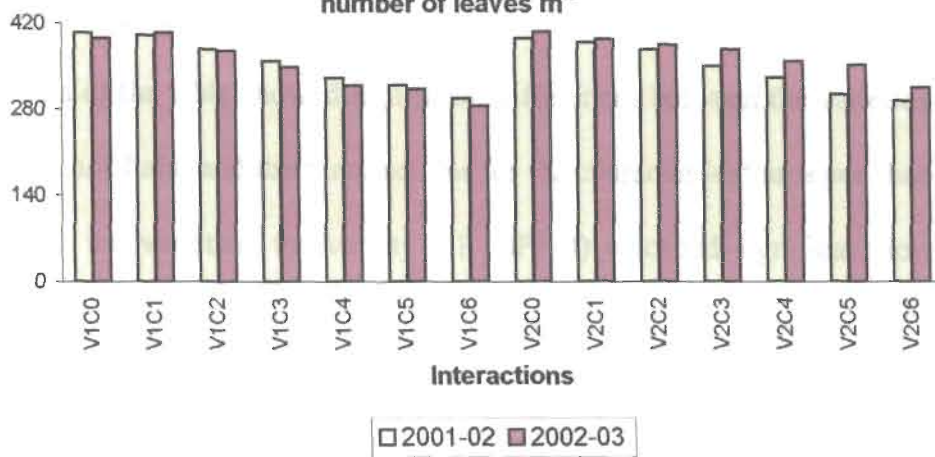


Fig.44c: Effect of interactions of varieties & alar concentrations on number of leaves m^{-2}



Between the varieties, the variety BPP-4 (V1) recorded significant minimum number of leaves m^{-2} of 348.0 while the other variety BPP-6 (V2) recorded number of leaves m^{-2} of 369.0.

Among the alar concentrations in comparison with the control (water spray C0 400.0) significant lowest number of leaves m^{-2} of 300.0 was recorded by 1000 ppm triple spray (C6). The maximum number of leaves m^{-2} of 399.0 was recorded by concentrations of 500 ppm single spray (C1).

Among the interactions, the treatment V1C6 recorded significantly minimum number of leaves m^{-2} of 285.0 followed by V1C5 (312.5). The maximum number of leaves m^{-2} of 405.0 was recorded by V2C0. The other treatments of interaction showed the number of leaves m^{-2} ranging from 317.5 to 394.0.

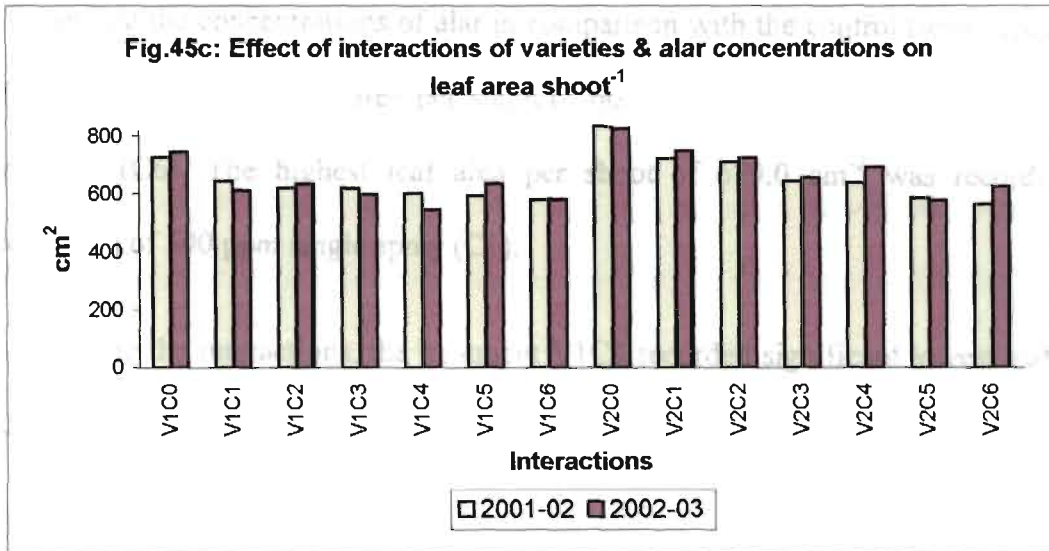
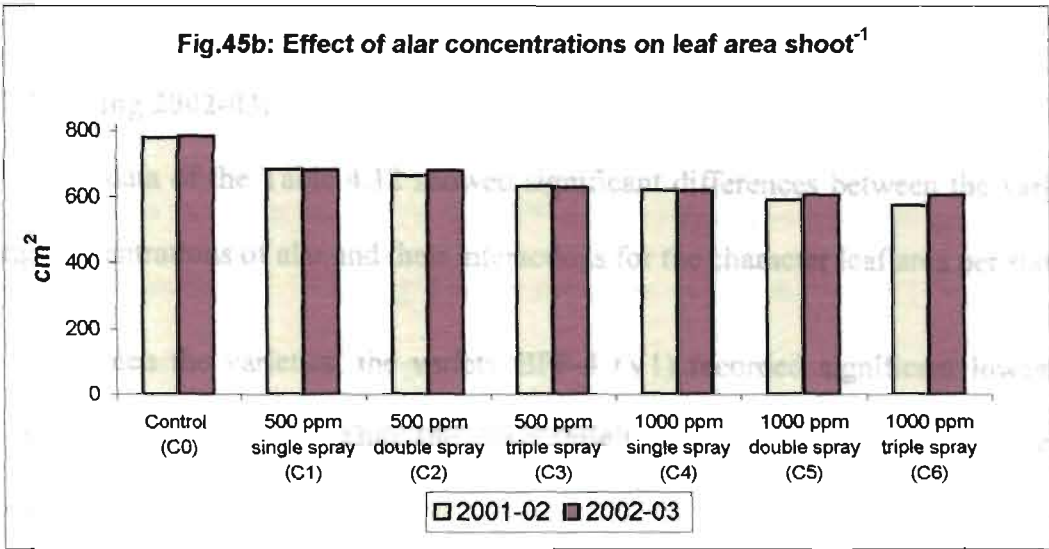
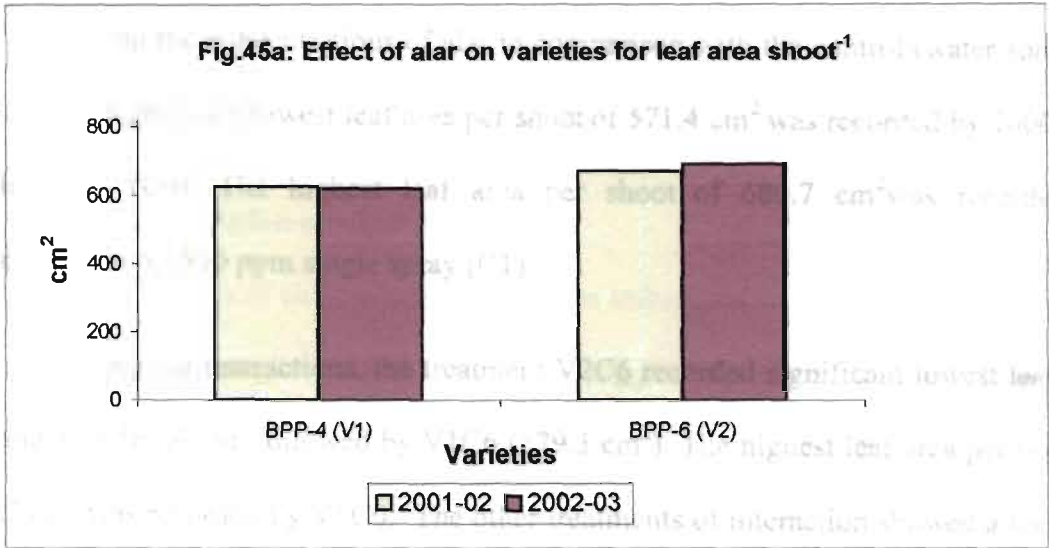
4.3.7. Leaf area per shoot (cm^2):

The data on leaf area per shoot as influenced by varieties, concentration of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.12.

4.3.7.1 During 2001-02:

The data of the table showed significant differences between the varieties, among the concentrations of alar and their interactions for the character leaf area per shoot.

Between the varieties, the variety V1 (BPP-4) recorded significant lowest leaf area per shoot of 625.4 cm^2 while the other variety V2 (BPP-6) recorded leaf area per shoot of 669.7 cm^2 .



Among the concentrations of alar in comparison with the control (water spray C0 778.3 cm²) significant lowest leaf area per shoot of 571.4 cm² was recorded by 1000 ppm triple spray (C6). The highest leaf area per shoot of 680.7 cm² was recorded by concentration of 500 ppm single spray (C1).

Among the interactions, the treatment V2C6 recorded significant lowest leaf area per shoot of 563.4 cm² followed by V1C6 (579.3 cm²). The highest leaf area per shoot of 724.3 cm² was recorded by V1C0. The other treatments of interaction showed a leaf area per shoot ranging from 584.2 cm² to 719.8 cm².

4.3.7.2 During 2002-03:

The data of the Table 4.12 showed significant differences between the varieties, among concentrations of alar and their interactions for the character leaf area per shoot.

Between the varieties, the variety BPP-4 (V1) recorded significant lowest leaf area per shoot of 620.4 cm² while the other variety BPP-6 (V2) recorded leaf area per shoot of 691.3 cm².

Among the concentrations of alar in comparison with the control (water spray C0 783.9) significant lowest leaf area per shoot of 602.4 cm⁻² was recorded by 1000 ppm triple spray (C6). The highest leaf area per shoot of 679.0 cm⁻² was recorded by concentration of 500 ppm single spray (C1).

Among the interactions, the treatment V1C4 recorded significant lowest leaf area per shoot of 543.4 cm⁻² followed by V2C5 (575.5 cm⁻²). The highest leaf area per shoot of

825.6cm⁻² was recorded by V2C0. The other treatments of interaction showed leaf area per shoot ranging from 581.1 cm⁻² to 746.3 cm⁻².

4.3.8. Leaf chlorophyll-a content (mg/g):

The data on leaf chlorophyll-a content as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.12.

4.3.8.1 During 2001-02:

The data of the table showed significant differences between the varieties, among concentrations of alar and their interactions for the character leaf chlorophyll-a content.

Between the varieties, the variety BPP-6 (V2) recorded significant maximum leaf chlorophyll-a content of 1.432 mg/g while the other variety BPP-4 (V1) recorded leaf chlorophyll-a content of 1.387 mg/g.

Among the concentrations of alar in comparison with the control (water spray C0 1.171 mg/g) significant maximum leaf chlorophyll-a content of 1.599 mg/g was recorded by 1000 ppm triple spray (C6). The lowest leaf chlorophyll-a content of 1.151 mg/g was recorded by concentration of 500 ppm single spray (C1).

Among the interactions, the treatment V1C6 recorded significant highest leaf chlorophyll-a content of 1.618 mg/g followed by V2C6 (1.581 mg/g). The lowest leaf chlorophyll-a content of 1.212 mg/g was recorded by V1C1. The other treatments of interaction showed the leaf chlorophyll-a content ranging from 1.251 mg/g to 1.560 mg/g.

Fig.46a: Effect of alar on varieties for chlorophyll-a content

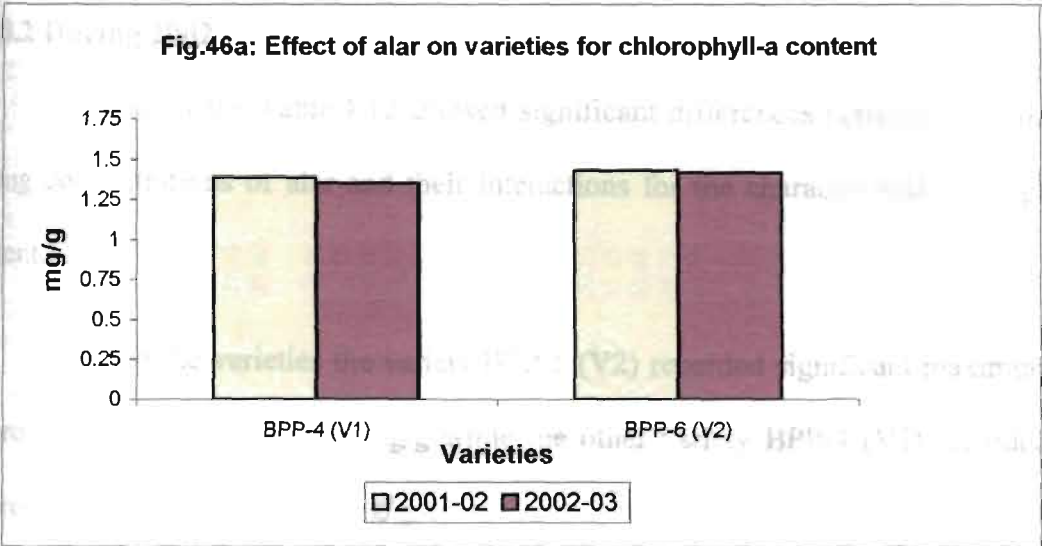


Fig.46b: Effect of alar concentration on chlorophyll-a content

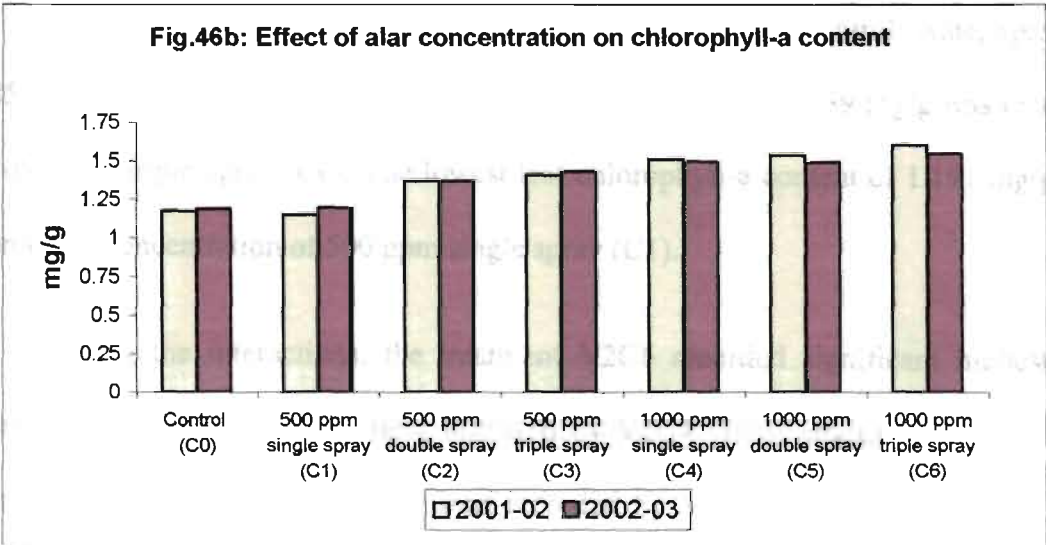
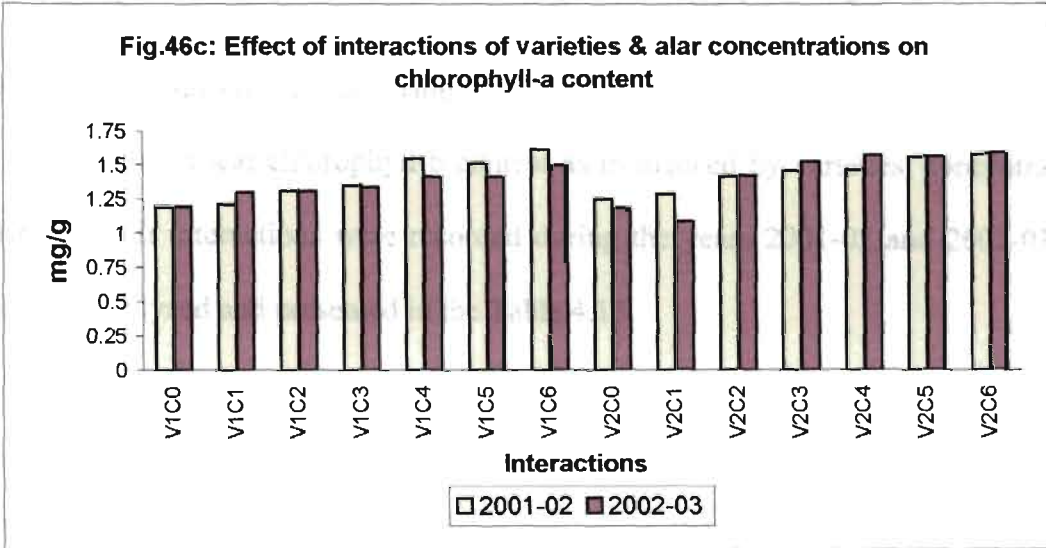


Fig.46c: Effect of interactions of varieties & alar concentrations on chlorophyll-a content



4.3.8.2 During 2002-03:

The data of the Table.4.12 showed significant differences between the varieties, among concentrations of alar and their interactions for the character leaf chlorophyll-a content.

Between the varieties the variety BPP-6 (V2) recorded significant maximum leaf chlorophyll-a content of 1.415 mg/g while the other variety BPP-4 (V1) recorded leaf chlorophyll-a content of 1.349 mg/g.

Among the concentrations of alar in comparison with the control (water spray C0 1.185 mg/g) significant maximum leaf chlorophyll-a content of 1.539 mg/g was recorded by 1000 ppm triple spray (C6). The lowest leaf chlorophyll-a content of 1.191 mg/g was recorded by concentration of 500 ppm single spray (C1).

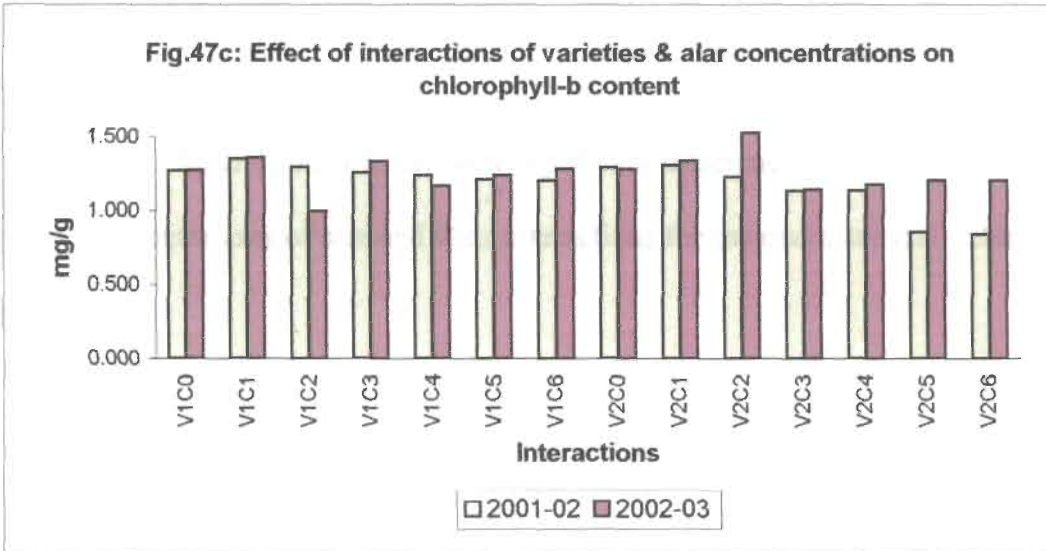
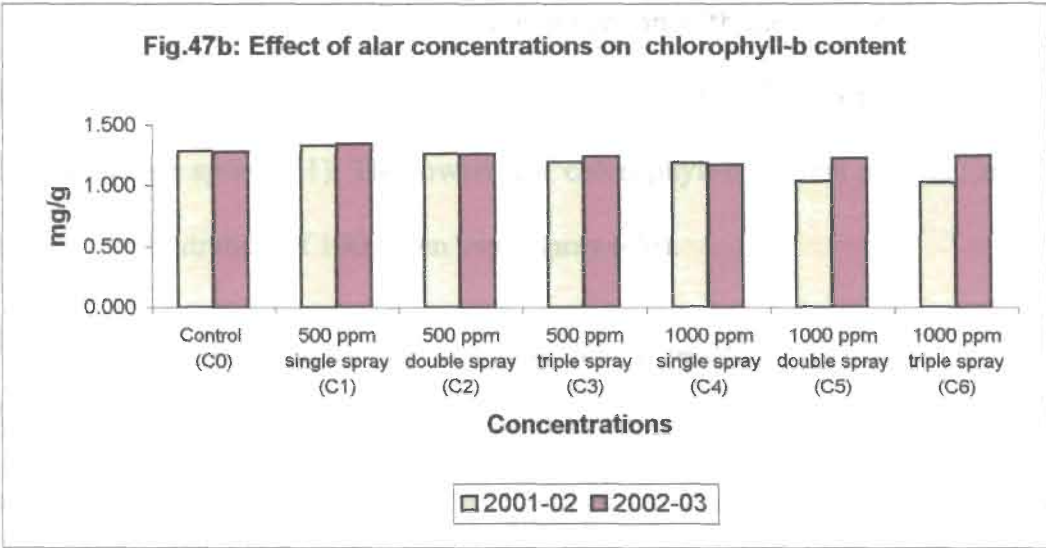
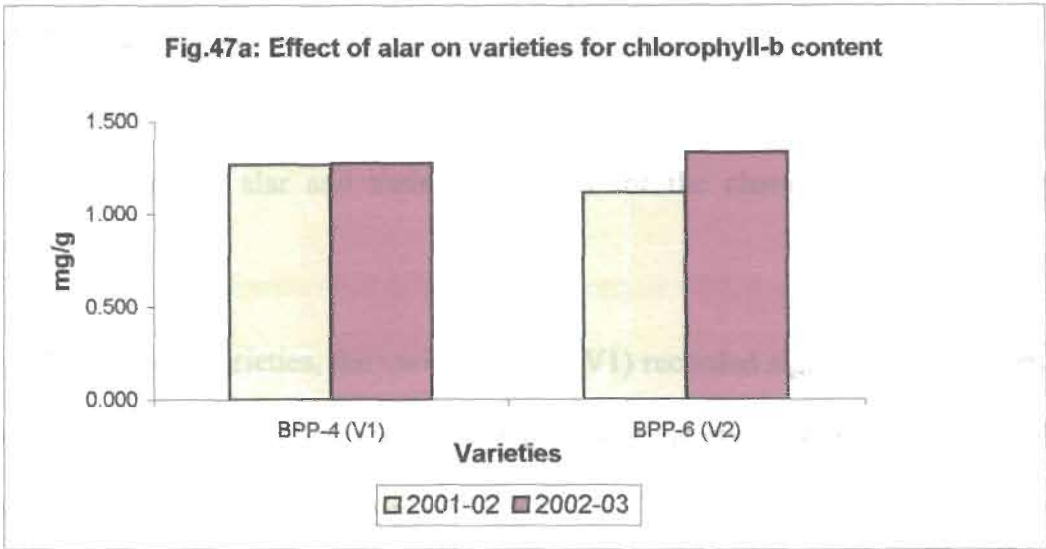
Among the interactions, the treatment V2C6 recorded significant highest leaf chlorophyll-a content of 1.585 mg/g followed by V2C4 (1.565 mg/g). The lowest leaf chlorophyll-a content of 1.082 mg/g was recorded by V2C1. The other treatments of interaction showed a leaf chlorophyll-a content ranging from 1.179 mg/g to 1.555 mg/g.

4.3.9. Leaf chlorophyll-b content (mg/g):

The data on leaf chlorophyll-b content as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.13.

Table 4.13: Chlorophyll-b content, number of flowering shoots m⁻², number of non-flowering shoots m⁻² and number of panicles m⁻² in cashew as influenced by variety, alar and their interactions.

	Chlorophyll-b content (mg/g)			Number of flowering shoots m ⁻²			Number of non-flowering shoots m ⁻²			Number of panicles m ⁻²	
	2001-02	2002-03		2001-02	2002-03		2001-02	2002-03		2001-02	2002-03
Varieties:											
BPP-4 (V1)	1.261	1.271		33.70	24.80		18.70	4.39		28.48	25.34
BPP-6 (V2)	1.115	1.329		30.80	33.50		14.70	4.71		26.80	26.75
Concentrations of alar:											
Control (water spray) (C0)	1.281	1.278		17.50	17.80		19.75	6.81		20.56	17.25
500 ppm single spray (C1)	1.328	1.345		32.00	28.00		17.50	5.31		26.88	23.94
500 ppm double spray (C2)	1.259	1.262		32.30	29.80		14.50	5.75		28.44	28.00
500 ppm triple spray (C3)	1.194	1.239		34.25	33.50		13.75	5.00		31.06	29.87
1000 ppm single spray (C4)	1.187	1.172		36.50	31.30		14.30	3.19		29.31	28.75
1000 ppm double spray (C5)	1.034	1.223		36.75	31.30		17.80	2.94		28.88	28.65
1000 ppm triple spray (C6)	1.022	1.243		36.50	32.00		19.50	2.88		28.38	25.88
Interactions:											
V1C0	1.271	1.276		18.50	17.12		21.00	9.00		20.25	17.88
V1C1	1.352	1.356		35.55	25.70		18.50	5.38		27.88	23.38
V1C2	1.294	0.997		34.00	27.00		16.50	3.63		29.25	27.25
V1C3	1.255	1.335		35.50	29.10		15.50	2.88		33.13	29.00
V1C4	1.239	1.164		37.50	24.30		17.50	3.75		30.88	27.38
V1C5	1.214	1.240		38.00	23.80		20.50	3.25		29.25	27.75
V1C6	1.206	1.281		37.00	26.30		21.50	2.88		28.15	24.75
V2C0	1.291	1.282		16.50	18.60		18.50	4.63		20.88	16.63
V2C1	1.304	1.335		28.50	30.30		16.50	5.25		25.88	24.50
V2C2	1.225	1.528		30.00	32.80		12.50	7.88		27.63	28.75
V2C3	1.134	1.144		33.00	37.90		12.00	7.13		29.00	30.75
V2C4	1.136	1.179		35.50	38.30		11.00	2.63		27.75	30.13
V2C5	0.854	1.205		35.50	38.90		15.00	2.63		28.50	29.50
V2C6	0.838	1.205		36.00	37.80		17.50	2.88		28.00	27.00
				2001-2002							
	S Em	CD		S Em	CD		S Em	CD		S Em	CD
Varieties	0.002	0.004		0.42	0.92		0.41	0.90		0.32	0.69
Concentrations of alar	0.003	0.007		0.79	1.72		0.78	1.69		0.59	1.29
Interaction	0.005	0.010		1.12	2.43		1.10	NS		0.59	1.29
				2002-2003							
Varieties	0.004	0.009		0.29	0.62		0.15	0.33		0.52	1.12
Concentrations of alar	0.008	0.018		0.54	1.17		0.28	0.61		0.97	2.08
Interaction	0.012	0.026		0.77	1.66		0.40	0.86		1.37	2.95



4.3.9.1 During 2001-02:

The data of the table showed significant differences between the varieties, among the concentrations of alar and their interactions for the character leaf chlorophyll-b content.

Between the varieties, the variety BPP-4 (V1) recorded significant maximum leaf chlorophyll-b content of 1.261 mg/g while the other variety BPP-6 (V2) recorded leaf chlorophyll-b content of 1.115 mg/g.

Among the concentrations of alar in comparison with the control (water spray C0 1.281 mg/g) significant maximum leaf chlorophyll-b content of 1.328 mg/g was recorded by 500 ppm single spray (C1). The lowest leaf chlorophyll-b content of 1.022 mg/g was recorded by concentration of 1000 ppm triple spray (C6).

Among the interactions, the treatment V1C1 recorded significant highest leaf chlorophyll-b content of 1.352 mg/g followed by V2C1 (1.304 mg/g). The lowest leaf chlorophyll-b content of 0.838 mg/g was recorded by V2C6. The other treatments of interaction showed a leaf chlorophyll-b content ranging from 0.854 mg/g to 1.294 mg/g.

4.3.9.2 During 2002-03:

The data of the Table.4.13 showed significant differences between the varieties, among the concentrations of alar and their interactions for the character leaf chlorophyll-b content.

Between the varieties, the variety BPP-6 (V2) recorded significant maximum leaf chlorophyll-b content of 1.329 mg/g while the other variety BPP-4 (V1) recorded leaf chlorophyll-b content of 1.271 mg/g.

Among the concentrations of alar in comparison with the control (water spray C0 1.278 mg/g) significant maximum leaf chlorophyll-b content of 1.345 mg/g was recorded by 500 ppm single spray (C1). The lowest leaf chlorophyll-b content of 1.172 mg/g was recorded by concentration of 1000 ppm single spray (C4).

Among the interactions, the treatment V2C2 recorded significant highest leaf chlorophyll-b content of 1.528 mg/g followed by V1C1 (1.356 mg/g). The lowest leaf chlorophyll-b content of 0.997 mg/g was recorded by V1C2. The other treatments of interactions showed leaf chlorophyll-b content ranging from 1.144 mg/g to 1.335 mg/g.

4.3.10. Number of flowering shoots m⁻²:

The data on number of flowering shoots m⁻² as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.13.

4.3.10.1 During 2001-02:

The data of the table showed significant differences between the varieties, among the concentrations of alar and their interactions for the character number of flowering shoots m⁻².

Fig.48a: Effect of alar on varieties for number of flowering shoots m^{-2}

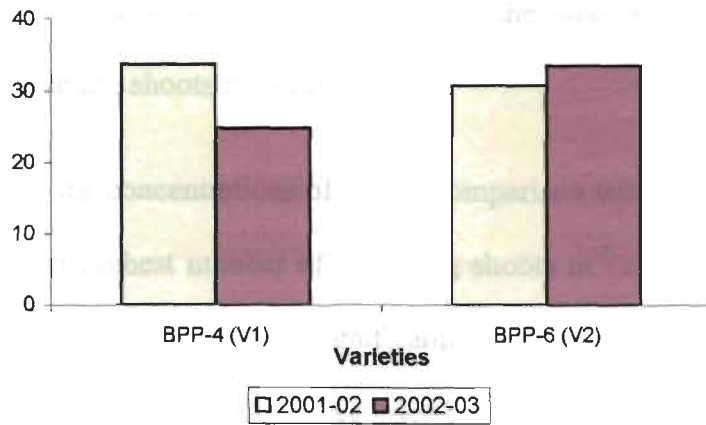


Fig.48b: Effect of alar concentrations on number of flowering shoots m^{-2}

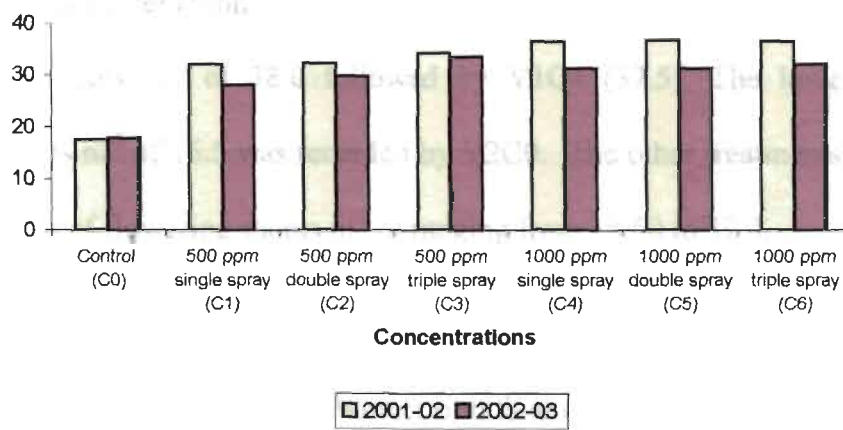
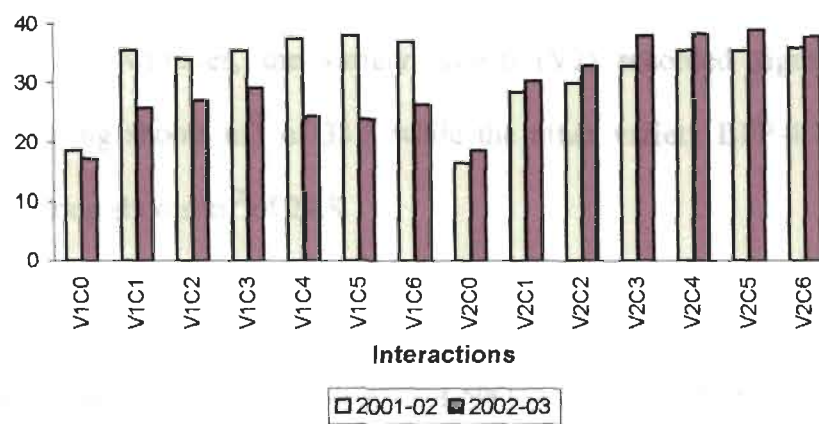


Fig.48c: Effect of interactions of varieties & alar concentrations on number of flowering shoots m^{-2}



Between the varieties, the variety BPP-4 (V1) recorded significant highest number of flowering shoots m^{-2} of 33.7 while the other variety BPP-6 (V2) recorded number of flowering shoots m^{-2} of 30.8.

Among the concentrations of alar in comparison with the control (water spray C0 17.5) significant highest number of flowering shoots m^{-2} of 36.8 was recorded by 1000 ppm double spray (C5) which was significantly superior over control. The lowest number of flowering shoots m^{-2} of 32.0 was recorded by concentration of 500 ppm single spray of alar (C1).

Among the interactions, the treatment V1C5 recorded significant highest number of flowering shoots m^{-2} of 38.0 followed by V1C4 (37.5). The lowest number of flowering shoots m^{-2} of 16.5 was recorded by V2C0. The other treatments of interaction showed number of flowering shoots m^{-2} of ranging from 18.50 to 37.0.

4.3.10.2 During 2002-03:

The data of the Table 4.13 showed significant differences between the varieties, among the concentrations of alar and their interactions for the character number of flowering shoots m^{-2} .

Between the varieties, the variety BPP-6 (V2) recorded significant highest number of flowering shoots m^{-2} of 33.5 while the other variety BPP-4 (V1) recorded number of flowering shoots m^{-2} of 24.8.

Among the concentrations of alar in comparison with the control (water spray C0 17.8) significant highest number of flowering shoots m^{-2} of 33.5 was recorded by 500

ppm triple spray (C3) which was significantly superior over control. The lowest number of flowering shoots m^{-2} of 28.0 was recorded by concentration of 500 ppm single spray (C1).

Among the interactions, the treatment V2C5 recorded significant highest number of flowering shoots m^{-2} of 38.9 followed by V2C4 (38.3). The lowest number of flowering shoots m^{-2} of 17.1 was recorded by V1C0. The other treatments of interaction showed a number of flowering shoots m^{-2} ranging from 18.6 to 37.9.

4.3.11. Number of non-flowering shoots m^{-2} :

The data on number of non-flowering shoots m^{-2} as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.13.

4.3.11.1 During 2001-02:

The data of the table showed significant differences between the varieties, among the concentrations of alar and non-significant differences for their interactions for the character number of non-flowering shoots m^{-2} .

Between the varieties, the variety BPP-6 (V2) recorded significant lowest number of non-flowering shoots m^{-2} of 14.7 while the other variety BPP-4 (V1) recorded number of non-flowering shoots m^{-2} of 18.7.

Among the concentrations of alar in comparison with the control (water spray C0 19.75) significant lowest number of non-flowering shoots m^{-2} of 13.80 was recorded by 500 ppm triple spray (C3) which was significantly superior over control but on par with

Fig.49a: Effect of alar on varieties for number of non-flowering shoots m⁻²



Fig.49b: Effect of alar concentrations on number of non-flowering shoots m⁻²

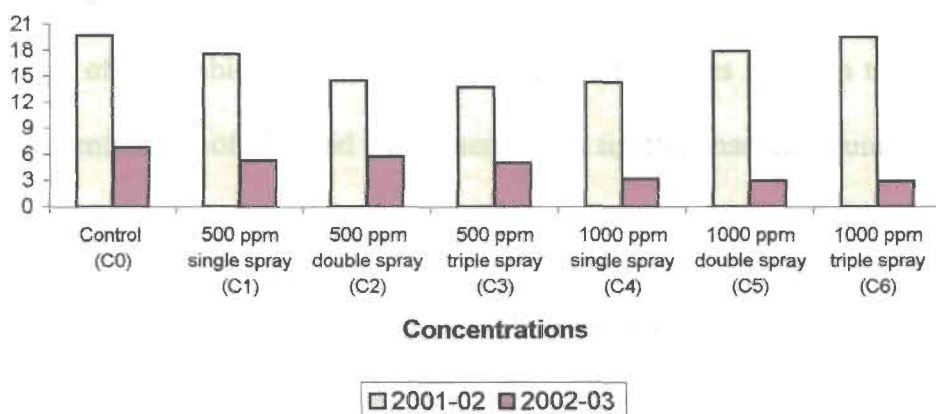
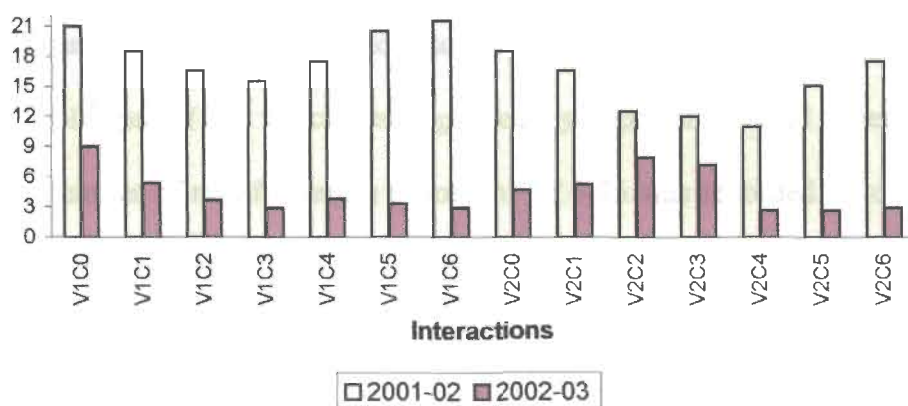


Fig.49c: Effect of interactions of varieties & alar concentrations on number of non-flowering shoots m⁻²



500 ppm double spray (14.50) and 1000 ppm single spray (14.3). The highest number of non-flowering shoots m^{-2} of 19.5 was recorded by concentration of 1000 ppm triple spray (C6).

Among the interactions, non-significant differences were recorded. However, the treatment V2C4 recorded significant lowest number of non-flowering shoots m^{-2} of 11.0 followed by V2C3 (12.0). The highest number of non-flowering shoots m^{-2} of 21.5 was recorded by V1C6. The other treatments of interaction showed number of non-flowering shoots m^{-2} ranging from 12.5 to 21.0.

4.3.11.2 During 2002-03:

The data of the Table 4.13 showed significant differences between the varieties, among the concentrations of alar and their interactions for the character number of non-flowering shoots m^{-2} .

Between the varieties, the variety BPP-4 (V1) recorded significant lowest number of non-flowering shoots m^{-2} of 4.39 while the other variety BPP-6 (V2) recorded number of non-flowering shoots m^{-2} of 4.71.

Among the concentrations of alar in comparison with the control (water spray C0 6.81) significant lowest number of non-flowering shoots m^{-2} of 2.88 was recorded by 1000 ppm triple spray (C6) which was significantly superior over all other treatments. The highest number of non-flowering shoots m^{-2} of 5.75 was recorded by concentration of 500 ppm double spray (C2).

Among the interactions, the treatment V2C5 and V2C4 recorded significant lowest number of non-flowering shoots m^{-2} of 2.63, which were significantly superior over control. The highest number of non-flowering shoots m^{-2} of 9.00 was recorded by V1C0. The other treatments of interaction showed a number of non-flowering shoots m^{-2} ranging from 2.88 to 7.88.

4.3.12. Number of panicles m^{-2} :

The data on number of panicles m^{-2} as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 were statistically analyzed and presented in the Table.4.13.

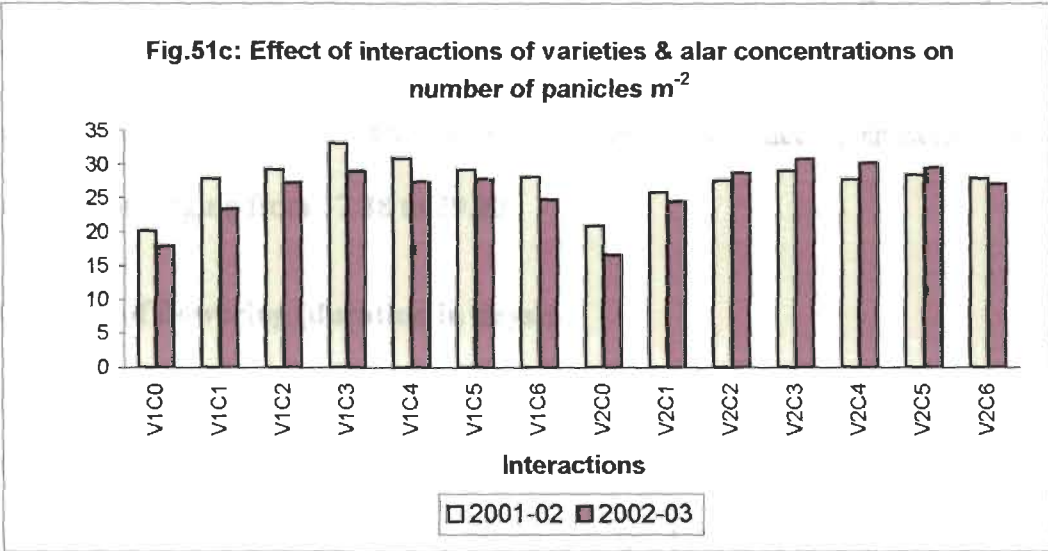
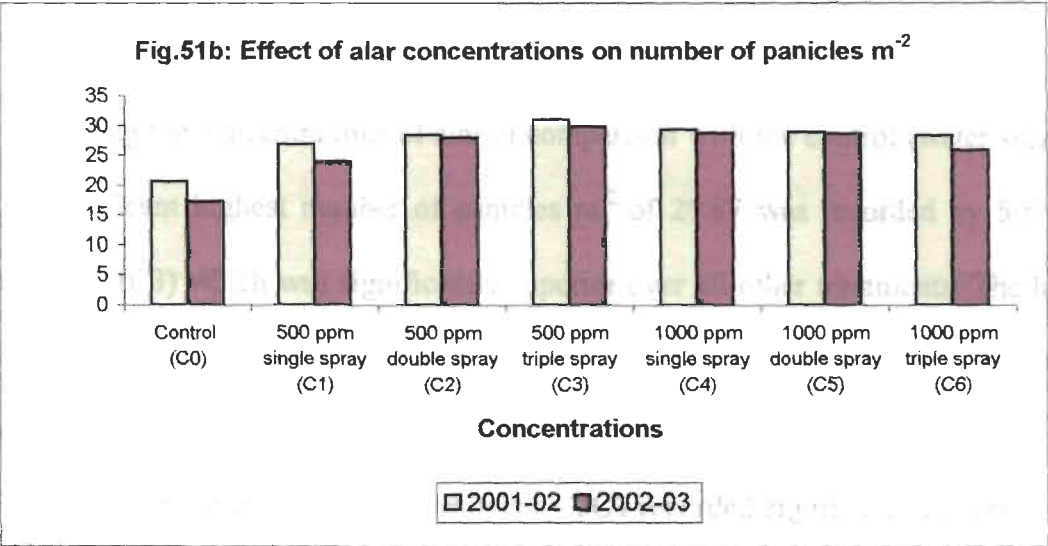
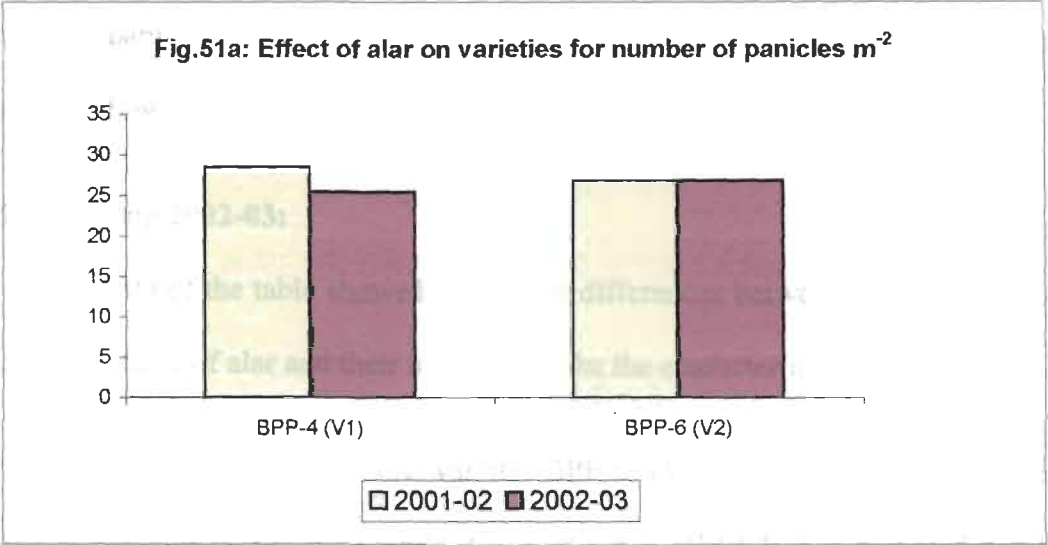
4.3.12.1 During 2001-02:

The data of the table showed significant differences between the varieties, among the concentrations of alar and their interactions for the character number of panicles m^{-2} .

Between the varieties, the variety BPP-4 (V1) recorded significant highest number of panicles m^{-2} of 28.48 while the other variety BPP-6 (V2) recorded number of panicles m^{-2} of 26.80.

Among the concentrations of alar in comparison with the control (water spray C0 20.56) significant highest number of panicles m^{-2} of 31.06 was recorded by 500 ppm tripele spray (C3) which was significantly superior over all other treatments. The lowest number of panicles m^{-2} of 26.88 was recorded by concentration of 500 ppm single spray (C1).

Among the interactions, the treatment V1C3 recorded significant highest number of panicles m^{-2} of 33.13 followed by V1C2 (29.25) and V1C5 (29.25). The lowest



number of panicles m^{-2} of 25.88 was recorded by V2C1. The other treatments of interaction showed a number of panicles m^{-2} ranging from 27.63 to 29.00.

4.3.12.2 During 2002-03:

The data of the table showed significant differences between the varieties, among the concentrations of alar and their interactions for the character number of panicles m^{-2} .

Between the varieties, the variety BPP-6 (V2) recorded significant highest number of panicles m^{-2} of 26.75 while the other variety BPP-4 (V1) recorded number of panicles m^{-2} of 25.34.

Among the concentrations of alar in comparison with the control (water spray C0 17.25) significant highest number of panicles m^{-2} of 29.87 was recorded by 500 ppm tripele spray (C3) which was significantly superior over all other treatments. The lowest number of panicles m^{-2} of 23.94 was recorded by concentration of 500 ppm single spray (C1).

Among the interactions, the treatment V2C3 recorded significant highest number of panicles m^{-2} of 30.75 and on par with V2C5 (30.13) which was significantly superior over all other treatments of interaction. The lowest number of panicles m^{-2} of 16.63 was recorded by control (V2C0). The other treatments of interaction showed number of panicles m^{-2} of ranging from 17.88 to 29.00.

4.3.13. Time of flowering (duration in days):

The data on time of flowering (duration in days) as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.14

Table 4.14: Time of flowering, number of hermaphrodite flowers per panicle, sex ratio and percentage fruit set in cashew as influenced by variety, alar and their interactions.

Interaction	Time of flowering (duration in days)		Number of hermaphrodite flowers panicle ⁻¹		Sex ratio (male to hermaphrodite flowers)		Percentage fruit set	
	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03
Varieties:								
BPP-4 (V1)	80.00	79.60	189.90	153.70	2.99	5.35	3.20	6.25
BPP-6 (V2)	83.10	81.60	101.50	102.10	6.71	7.63	5.24	7.90
Concentrations of alar:								
Control (water spray) (C0)	89.00	91.00	136.30	46.80	6.35	10.99	3.48	4.16
500 ppm single spray (C1)	78.70	75.80	109.50	89.80	5.76	6.43	3.87	4.44
500 ppm double spray (C2)	77.30	75.80	124.30	106.40	5.80	6.73	4.05	5.00
500 ppm triple spray (C3)	79.80	82.80	256.60	161.00	3.98	4.00	4.47	7.56
1000 ppm single spray (C4)	83.80	80.00	210.70	176.10	3.93	5.37	4.85	9.24
1000 ppm double spray (C5)	81.00	80.50	263.40	181.90	3.79	5.38	4.92	9.91
1000 ppm triple spray (C6)	81.50	79.50	228.70	133.30	4.36	6.54	3.92	9.25
Interactions:								
V1C0	89.50	93.50	136.30	42.90	4.76	14.84	2.57	2.63
V1C1	73.00	69.00	109.50	104.70	3.62	3.94	3.08	3.68
V1C2	72.00	72.00	124.30	137.20	3.98	3.73	2.99	3.40
V1C3	79.50	82.50	256.60	247.70	2.02	1.01	3.11	3.14
V1C4	83.00	80.50	210.70	275.10	2.27	1.56	3.79	11.52
V1C5	82.50	80.50	263.40	181.60	2.00	3.68	3.88	10.36
V1C6	80.50	79.50	228.70	86.70	2.27	8.68	3.03	9.09
V2C0	88.50	88.50	77.10	50.60	7.94	7.16	4.38	5.70
V2C1	84.50	82.50	85.60	74.90	7.90	8.91	4.67	5.21
V2C2	82.50	79.50	90.30	75.70	7.61	9.73	5.11	6.60
V2C3	80.00	83.00	103.10	74.40	5.94	6.99	5.83	11.98
V2C4	84.50	79.50	119.10	77.10	5.60	9.18	5.92	6.96
V2C5	79.50	79.00	123.60	182.40	5.58	7.07	5.96	9.47
V2C6	82.50	79.00	111.70	180.00	6.46	4.39	4.81	9.41
2001-2002								
	S Em	CD	S Em	CD	S Em	CD	S Em	CD
Varieties	0.48	1.04	1.03	2.23	0.05	0.09	0.67	0.15
Concentrations of alar	0.89	1.94	1.93	4.17	0.09	0.18	0.13	0.28
Interaction	1.27	2.74	2.73	5.89	0.12	0.26	0.19	0.40
2002-2003								
	S Em	CD	S Em	CD	S Em	CD	S Em	CD
Varieties	0.58	1.25	1.21	2.63	0.09	0.21	0.12	0.26
Concentrations of alar	1.08	2.34	2.28	4.92	0.18	0.38	0.23	0.49
Interaction	1.53	3.31	3.22	6.95	0.25	0.54	0.32	0.69

4.3.13.1 During 2001-02:

The data of the table showed significant differences between the varieties, among concentrations of alar and their interactions for the character time of flowering.

Between the varieties, the variety BPP-4 (V1) recorded significant lowest duration flowering of 80.0 days while the other variety BPP-6 (V2) recorded duration of flowering of 83.1 days.

Among the concentrations of alar in comparison with the control (water spray C0 89.0 days) significant lowest duration of flowering of 77.3 days was recorded by 500 ppm double spray (C2) which was significantly superior over control but on par with 500 ppm single spray (C1 78.7 days). The highest duration flowering of 83.8 days was recorded by concentration of 1000 ppm single spray (C4).

Among the interactions, the treatment V1C2 recorded significant lowest duration of flowering of 72.0 days followed by V1C1 (73.0 days) which, was significantly superior over control. The highest duration of flowering of 89.5 days was recorded by V1C0. The other treatments of interaction showed duration of flowering ranging from 73.0 days to 88.5 days.

4.3.13.2 During 2002-03:

The data of the Table 4.14 showed significant differences between the varieties, among the concentrations of alar and their interactions for the character time of flowering.

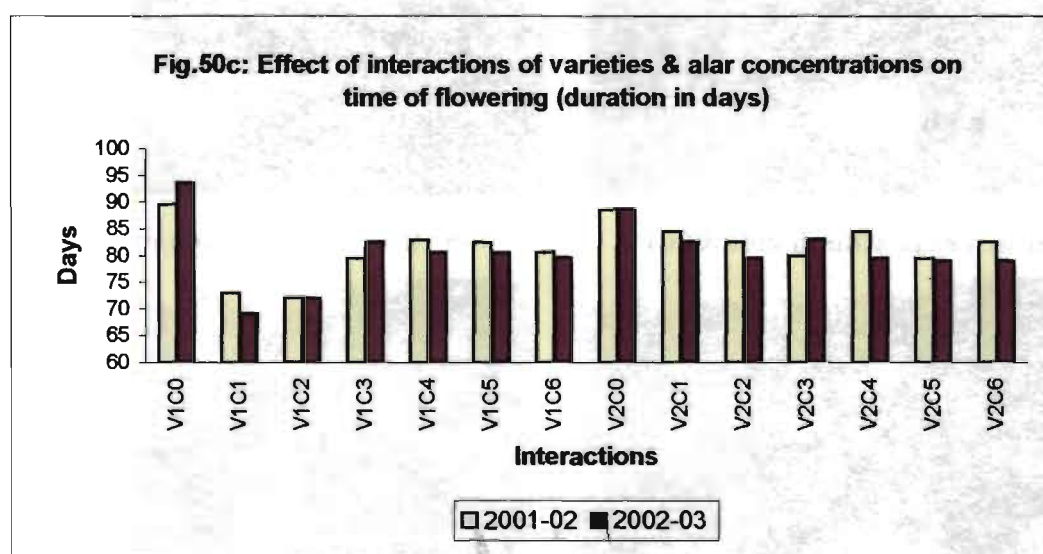
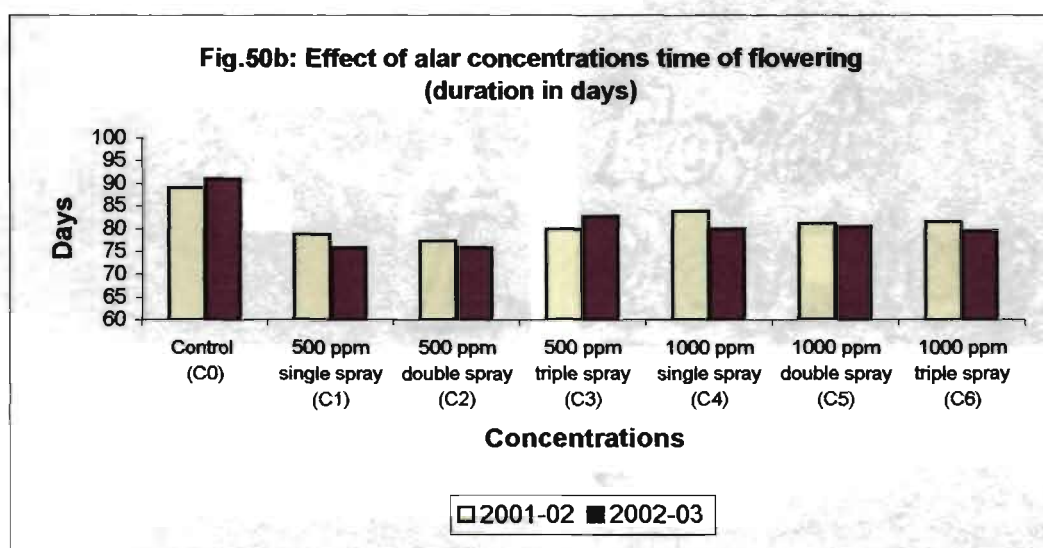
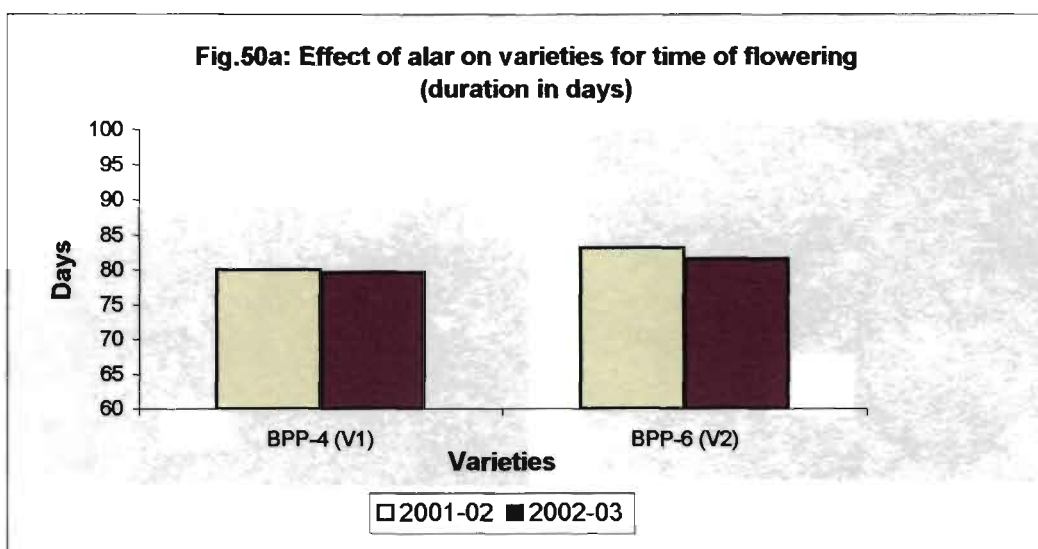


Plate 8: Effect of alar on flowering in BPP-4 and BPP-6



Control (BPP-4)



Control (BPP-6)



1000 ppm single spray in BPP-4



1000 ppm single spray in BPP-6



1000 ppm double spray in BPP-4



1000 ppm double spray in BPP-6



1000 ppm triple spray in BPP-4



1000 ppm triple spray in BPP-6

Between the varieties, the variety BPP-4 (V1) recorded significant lowest duration flowering of 79.6 days while the other variety BPP-6 (V2) recorded duration of flowering of 81.6 days.

Among the concentrations of alar in comparison with the control (water spray C0 91.0 days) significant lowest duration of flowering of 75.8 days was recorded by 500 ppm single (C1) and 500 ppm double spray (C2) which was significantly superior over control. The highest duration flowering of 82.8 days was recorded by concentration of 1000 ppm single spray (C4).

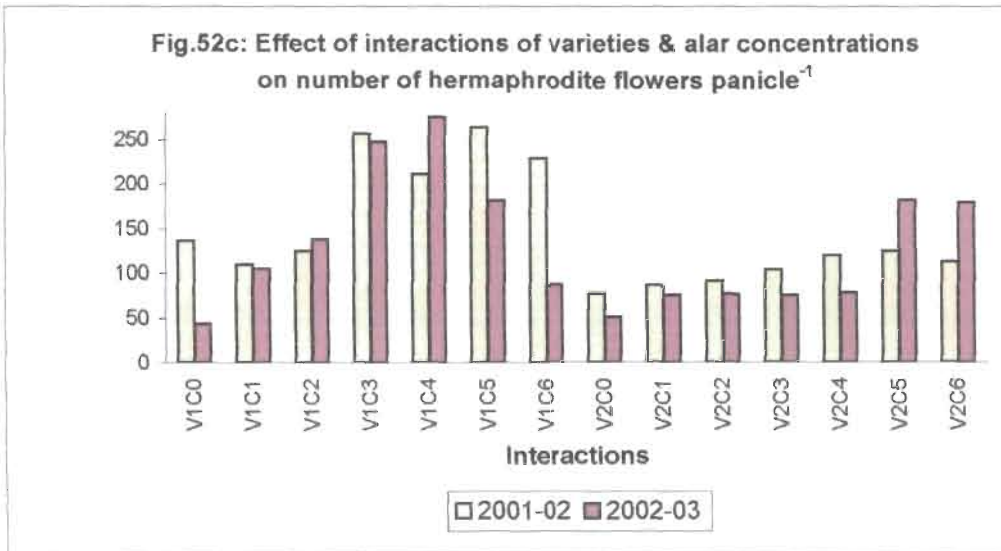
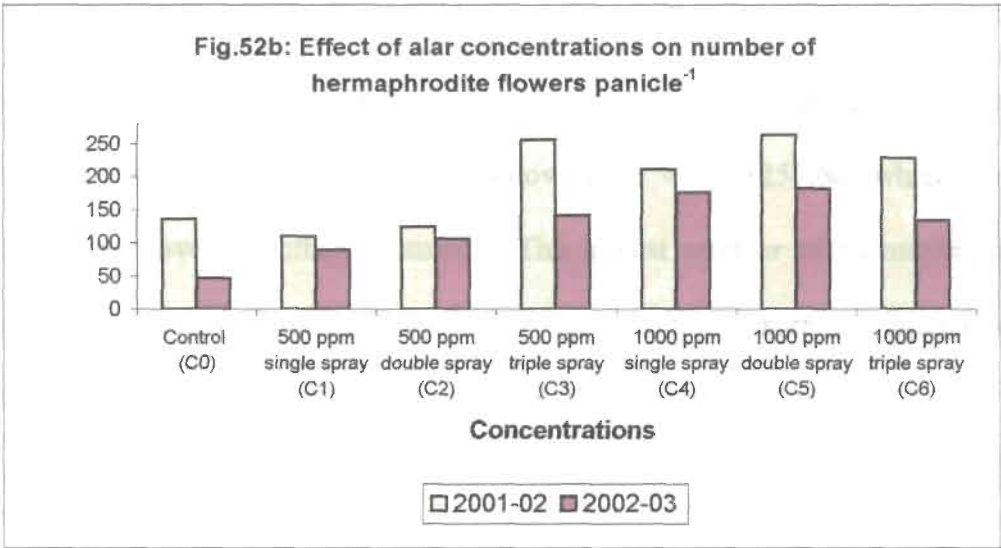
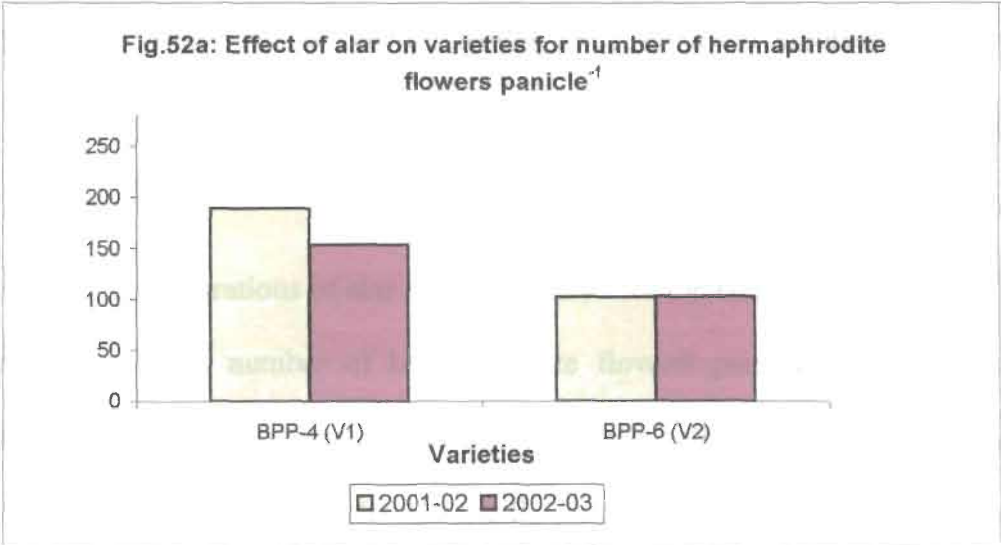
Among the interactions, the treatment V1C2 recorded significant lowest duration of flowering of 72.0 days followed by V2C5 (79.0 days) and V2C6 (79.0 days) which were significantly superior over control. The highest duration of flowering of 93.5 days was recorded by V1C0. The other treatments of interaction showed duration of flowering ranging from 79.5 days to 88.5 days.

4.3.14. Number of hermaphrodite flowers panicle⁻¹:

The data on number of hermaphrodite flowers panicle⁻¹ as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.14

4.3.14.1 During 2001-02:

The data of the table showed significant differences between the varieties, among the concentrations of alar and their interactions for the character number of hermaphrodite flowers panicle⁻¹.



Between the varieties, the variety BPP-4 (V1) recorded significant highest number of hermaphrodite flowers panicle⁻¹ of 189.9 while the other variety BPP-6 (V2) recorded number of hermaphrodite flowers panicle⁻¹ of 101.50.

Among the concentrations of alar in comparison with the control (water spray C0 136.3) significant highest number of hermaphrodite flowers panicle⁻¹ of 263.4 was recorded by 1000 ppm double spray (C5) which was significantly superior over all other treatments. The lowest number of hermaphrodite flowers panicle⁻¹ of 109.5 was recorded by concentration of 500 ppm single spray (C1).

Among the interactions, the treatment V1C5 recorded significant highest number of hermaphrodite flowers panicle⁻¹ of 263.40 followed by V1C3 (256.60) which were significantly superior over all other treatments. The lowest number of hermaphrodite flowers panicle⁻¹ of 77.10 was recorded by V2C0. The other treatments of interaction showed number of hermaphrodite flowers panicle⁻¹ ranging from 85.60 to 2228.7.

4.3.14.2 During 2002-03:

The data of the Table 4.14 showed significant differences between the varieties, among the concentrations of alar and their interactions for the character number of hermaphrodite flowers panicle⁻¹.

Between the varieties, the variety BPP-4 (V1) recorded significant highest number of hermaphrodite flowers panicle⁻¹ of 153.7 while the other variety BPP-6 (V2) recorded number of hermaphrodite flowers panicle⁻¹ of 102.1.

Among the concentrations of alar in comparison with the control (water spray C0 46.8) significant highest number of hermaphrodite flowers panicle⁻¹ of 181.9 was recorded by 1000 ppm double spray (C5). The lowest number of hermaphrodite flowers panicle⁻¹ of 89.8 was recorded by concentration of 500 ppm single spray (C1).

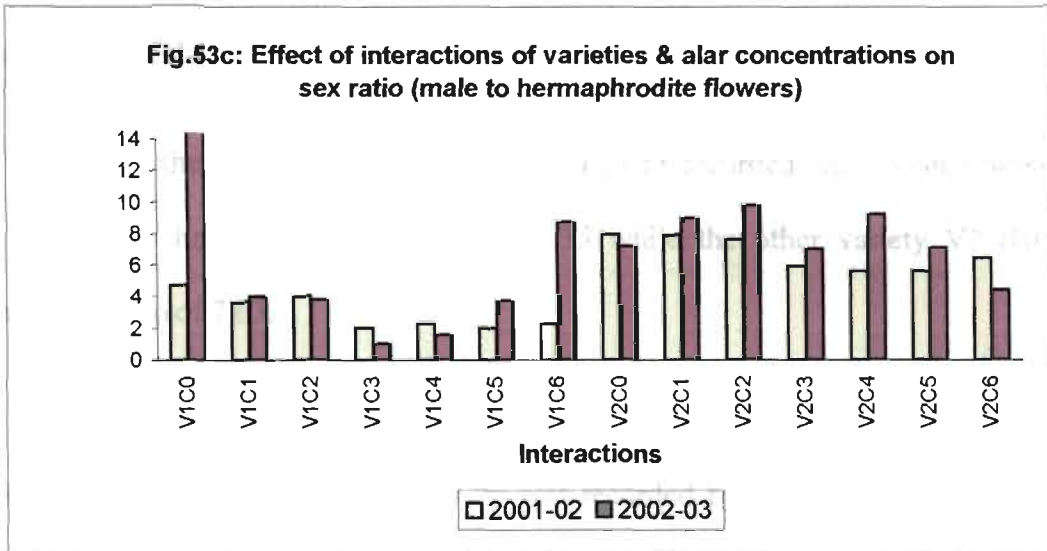
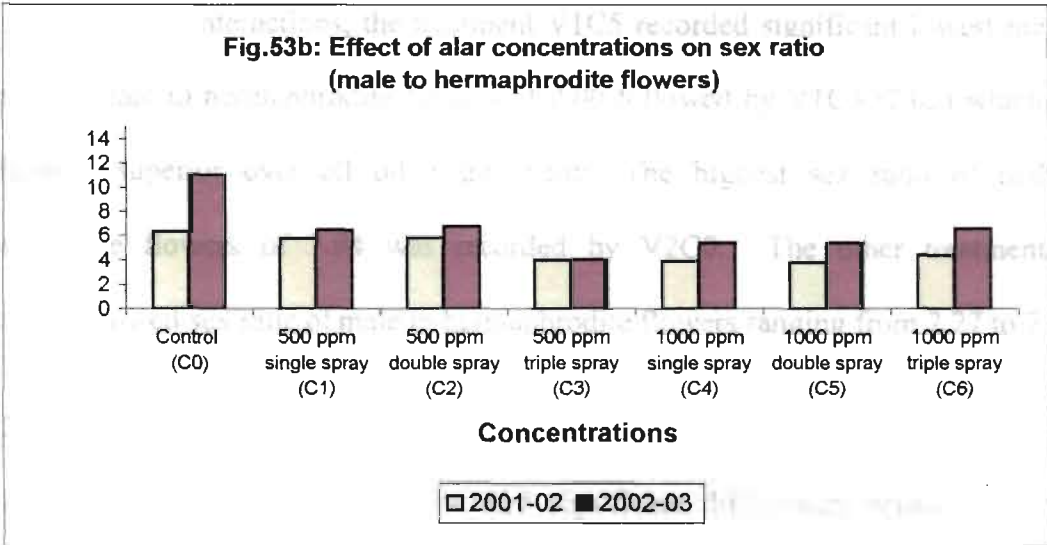
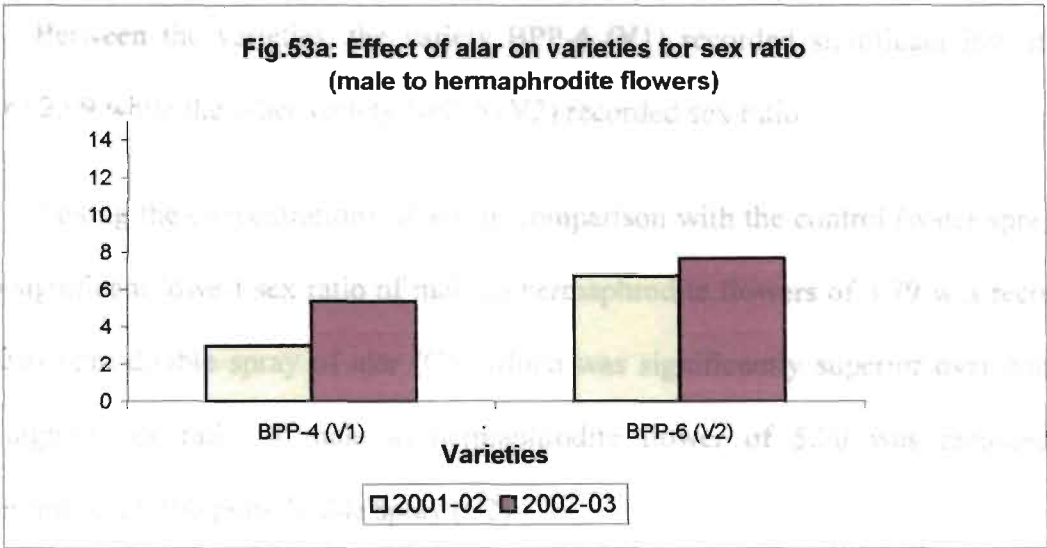
Among the interactions, the treatment V1C4 recorded significant highest number of hermaphrodite flowers panicle⁻¹ of 275.1 followed by V1C3 (247.7) which, was significantly superior over all other treatments of interaction. The lowest number of hermaphrodite flowers panicle⁻¹ of 42.90 was recorded by V1C0. The other treatments of interaction showed number of hermaphrodite flowers panicle⁻¹ ranging from 50.60 to 182.40.

4.3.15. Sex ratio (male to hermaphrodite flowers):

The data on sex ratio as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-2002 and 2002-2003 and statistically analyzed and presented in the Table.4.14.

4.3.15.1 During 2001-02:

The data of the table showed significant differences between varieties, among the concentrations of alar and their interactions for the character sex ratio of male to hermaphrodite flowers.



Between the varieties, the variety BPP-4 (V1) recorded significant lowest sex ratio of 2.99 while the other variety BPP-6 (V2) recorded sex ratio of 6.71.

Among the concentrations of alar in comparison with the control (water spray C0 6.35) significant lowest sex ratio of male to hermaphrodite flowers of 3.79 was recorded by 1000 ppm double spray of alar (C5) which was significantly superior over control. The highest sex ratio of male to hermaphrodite flower of 5.80 was recorded by concentration of 500 ppm double spray (C2).

Among the interactions, the treatment V1C5 recorded significant lowest number sex ratio of male to hermaphrodite flowers of 2.00 followed by V1C3 (2.02) which was significantly superior over all other treatments. The highest sex ratio of male to hermaphrodite flowers of 7.94 was recorded by V2C0. The other treatments of interaction showed sex ratio of male to hermaphrodite flowers ranging from 2.27 to 7.90.

4.3.15.2 During 2002-03:

The data of the Table 4.14 showed significant differences between varieties, among the concentrations of alar and their interactions for the character sex ratio of male to hermaphrodite flowers.

Between the varieties, the variety BPP-4 (V1) recorded significant lowest sex ratio of male to hermaphrodite flowers of 5.35 while the other variety V2 (BPP-6) recorded sex ratio of 7.63.

Among the concentrations of alar in comparison with the control (water spray C0 10.99) significant lowest sex ratio of 4.00 was recorded by 500 ppm triple spray (C3)

which was significantly superior over control. The highest sex ratio of 6.73 was recorded by concentration of 500 ppm double spray of alar (C2).

Among the interactions, the treatment V1C3 recorded significant lowest number sex ratio of 1.01 followed by V1C4 (1.56) which was significantly superior over other treatments of interaction. The highest sex ratio of 9.73 was recorded by V2C2. The other treatments of interaction showed sex ratio of male to hermaphrodite flowers ranging from 1.56 to 9.18.

4.3.16. Percentage of fruit set:

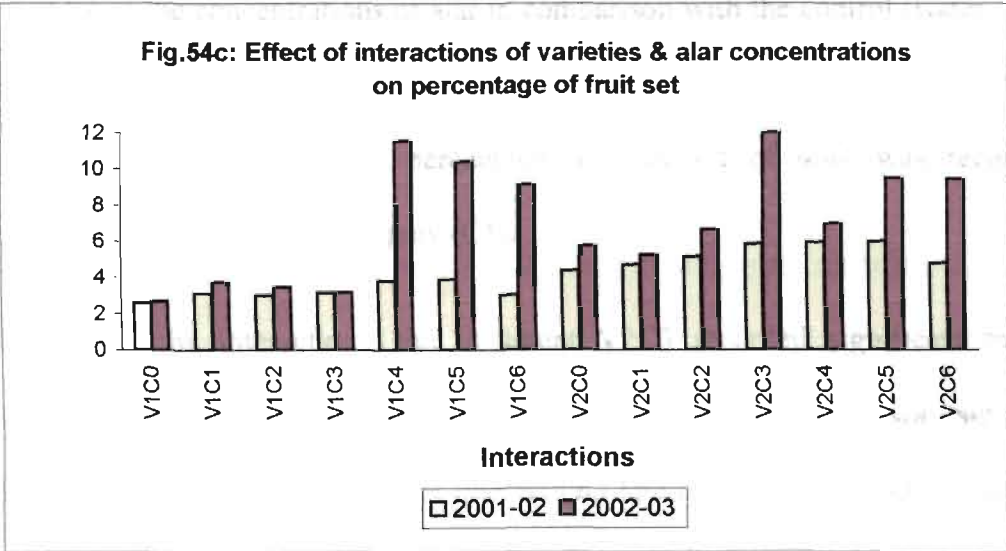
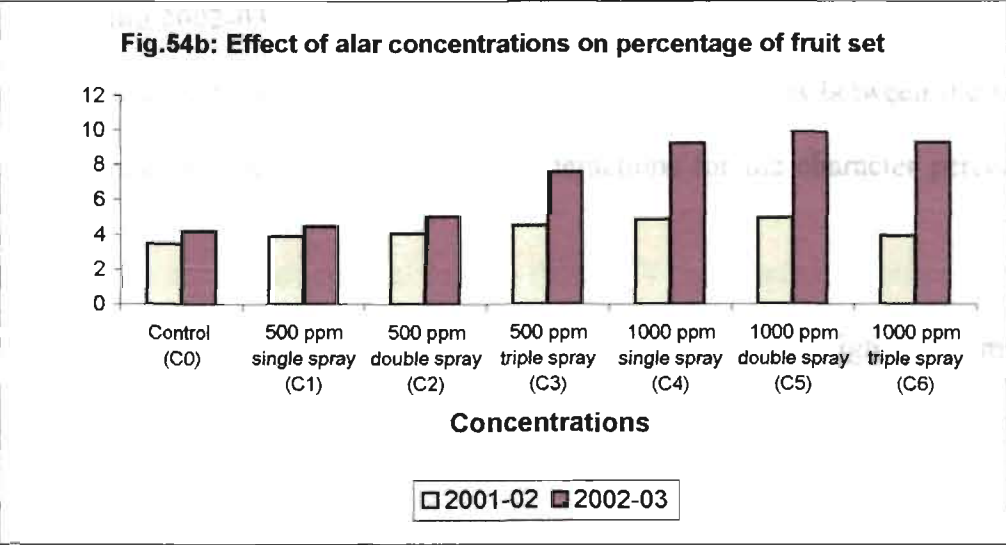
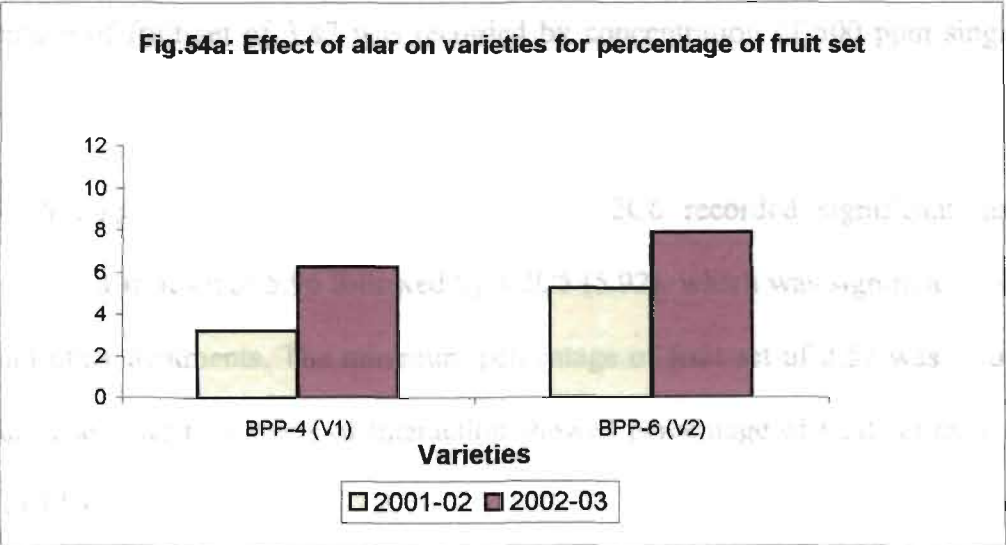
The data on percentage of fruit set as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.14.

4.3.16.1 During 2001-02:

The data of the table showed significant differences between the varieties, among the concentrations of alar and their interactions for the character percentage of fruit set.

Between the varieties, the variety BPP-6 (V2) recorded significant maximum percentage of fruit set of 5.24 while the other variety BPP-4 (V1) recorded percentage of fruit set of 3.20.

Among the concentrations of alar in comparison with the control (water spray C0 3.48) significant maximum percentage of fruit set of 4.92 was recorded by 1000 ppm double spray (C5) but on par with 1000 ppm single spray (C4 4.85). The lowest



percentage of fruit set of 3.87 was recorded by concentration of 500 ppm single spray (C1).

Among the interactions, the treatment V2C6 recorded significant maximum percentage of fruit set of 5.96 followed by V2C5 (5.92) which was significantly superior over all other treatments. The minimum percentage of fruit set of 2.57 was recorded by V1C0. The other treatments of interaction showed percentage of fruit set ranging from 2.99 to 5.83.

4.3.16.2 During 2002-03:

The data of the Table 4.14 showed significant differences between the varieties, among the concentrations of alar and their interactions for the character percentage of fruit set.

Between the varieties, the variety BPP-6 (V2) recorded significant maximum percentage of fruit set of 7.90 while the other variety BPP-4 (V1) recorded percentage of fruit set of 6.25.

Among the concentrations of alar in comparison with the control (water spray C0 4.16) significant maximum percentage of fruit set of 9.91 was recorded by 1000 ppm double spray (C5). The lowest percentage of fruit set of 4.44 was recorded by concentration of 500 ppm single spray (C1).

Among the interactions, the treatment V2C3 recorded significant maximum percentage of fruit set of 11.98 followed by V1C4 (11.52), which was significantly superior over all other treatments of interaction. The minimum percentage fruit set of

2.63 was recorded by V1C0. The other treatments of interaction showed percentage of fruit set ranging from 3.14 to 10.36.

4.3.17. Number of nuts reached maturity m⁻²:

The data on number of nuts reached maturity m⁻² as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.15.

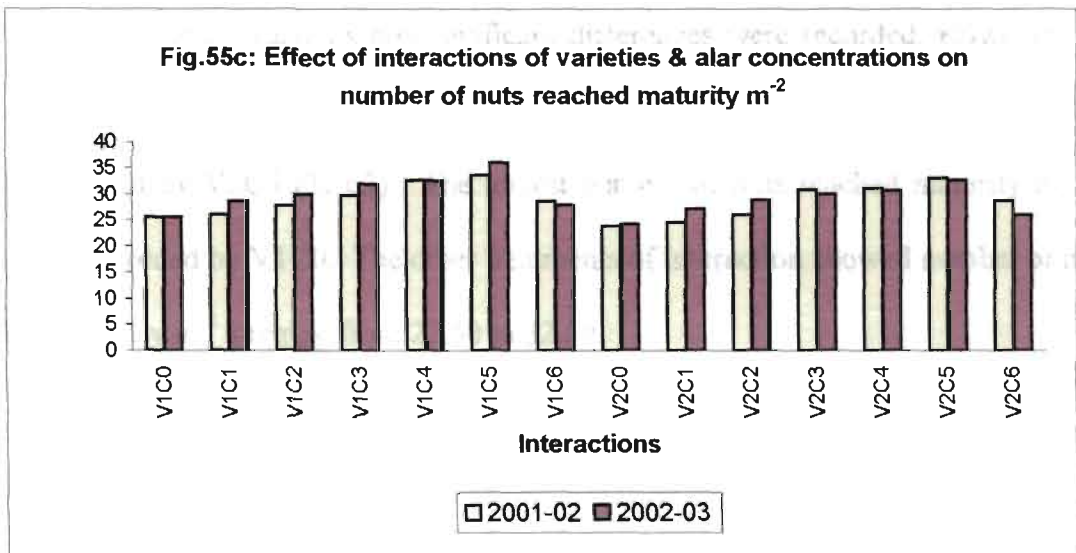
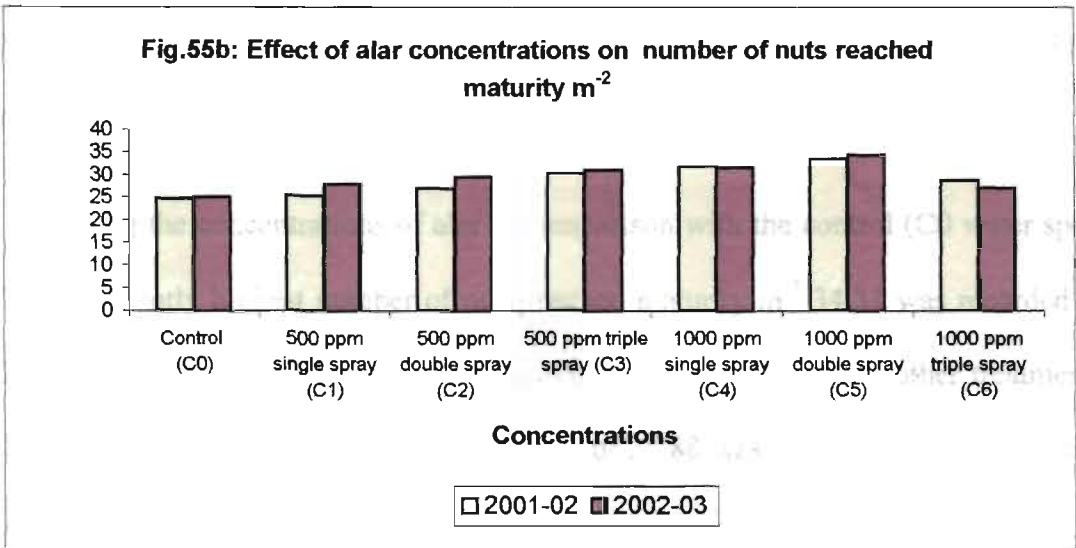
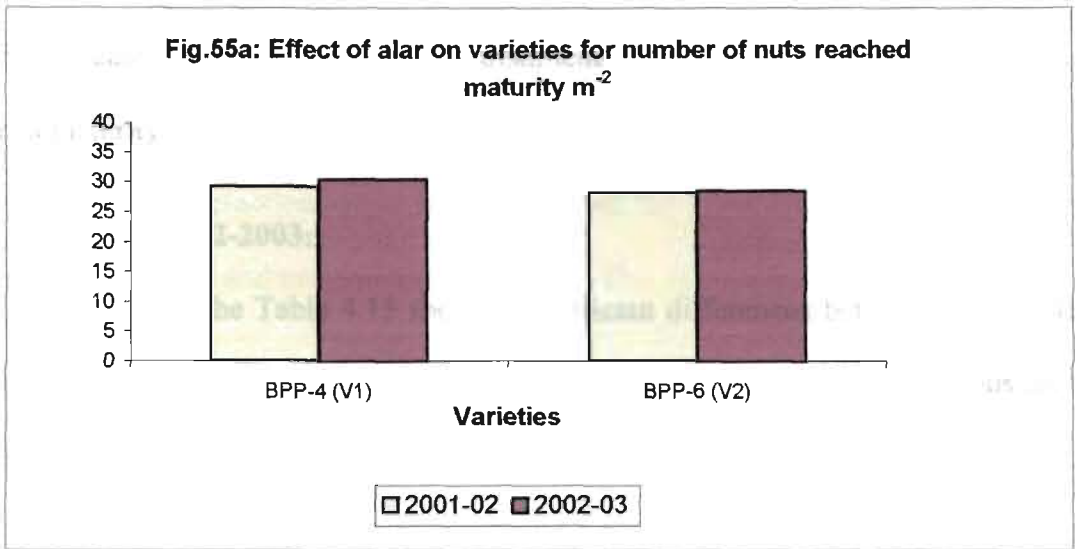
4.3.17.1 During 2001-02:

The data of the table showed significant differences between the varieties, among the concentrations of alar and non-significant differences for their interactions for the character number of nuts reached maturity m⁻².

Between the varieties, the variety BPP-4 (V1) recorded significantly highest number of number of nuts reached maturity m⁻² of 29.12 while the other variety BPP-6 (V2) recorded number of nuts reached maturity m⁻² of 28.25.

Among the concentrations of alar in comparison with the control (C0 water spray 24.62) significantly highest number of nuts reached maturity m⁻² 33.31 was recorded by 1000 ppm double spray (C5). The lowest number of nuts reached maturity m⁻² of 25.25 was recorded by concentration of 500 ppm single spray (C1).

Among the interactions non-significant differences were recorded however, the treatment V1C5 recorded significant highest number of nuts reached maturity m⁻² of 33.63 followed by V2C5 (33.00). The lowest number of nuts reached maturity m⁻² of



23.75 was recorded by V2C0. The other treatments of interaction showed number of nuts reached maturity m^{-2} of ranging from 24.50 to 32.63.

4.3.17.2 During 2002-2003:

The data of the Table 4.15 showed significant differences between the varieties, among concentrations of alar and non-significant differences for their interactions for the character number of nuts reached maturity m^{-2} .

Between the varieties, the variety BPP-4 (V1) recorded significantly highest number of number of nuts reached maturity m^{-2} of 30.34 while the other variety BPP-6 (V2) recorded number of nuts reached maturity m^{-2} of 28.48.

Among the concentrations of alar in comparison with the control (C0 water spray 24.81) significantly highest number of nuts reached maturity m^{-2} 34.31 was recorded by 1000 ppm double spray (C5) which was significantly superior over all other treatments. The lowest number of nuts reached maturity m^{-2} of 27.88 was recorded by concentration of 500 ppm single spray (C1).

Among the interactions non-significant differences were recorded. However, the treatment V1C5 recorded significant highest number of nuts reached maturity m^{-2} of 36.00 followed by V2C5 (32.63). The lowest number of nuts reached maturity m^{-2} of 24.13 was recorded by V1C0. The other treatments of interaction showed number of nuts reached maturity m^{-2} ranging from 25.50 to 32.50.

4.3.18. Number of fruits per panicle:

The data on number of fruits per panicle as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.15.

4.3.18.1 During 2001-02:

The data of the table showed significant differences between the varieties, among the concentrations of alar and their interactions for the character number of fruits per panicle.

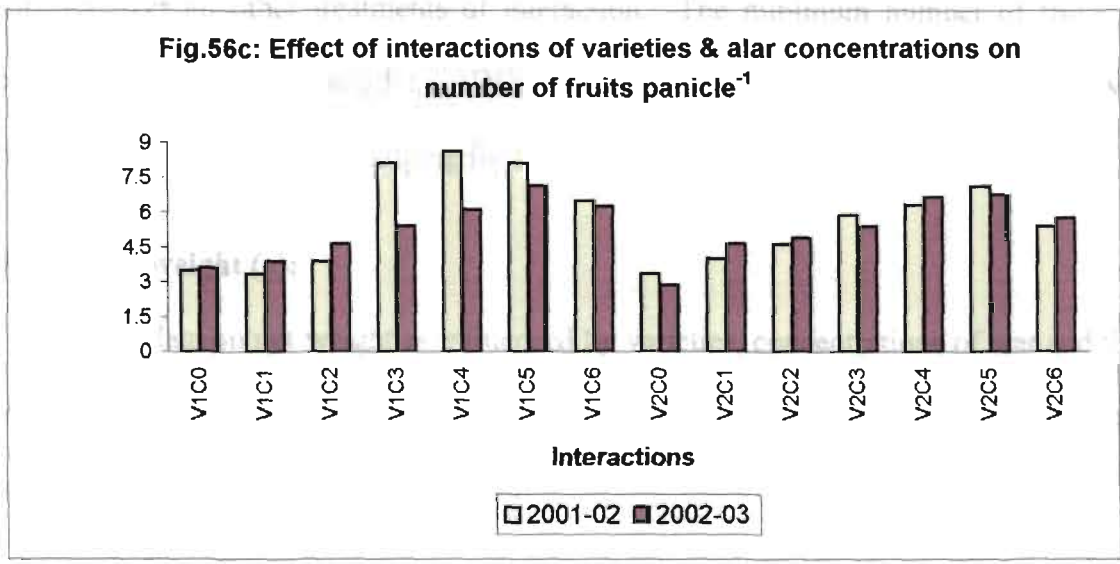
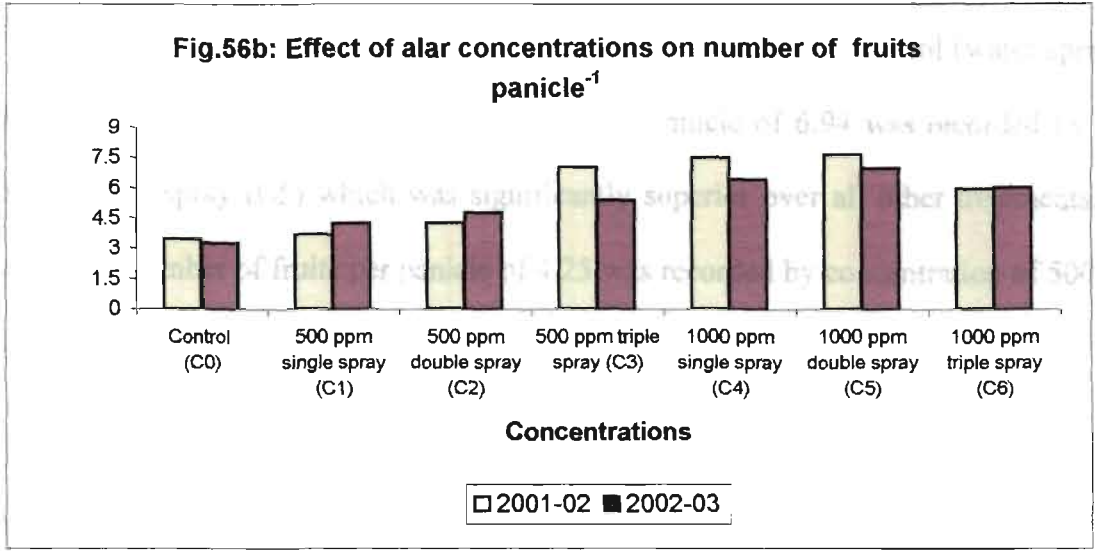
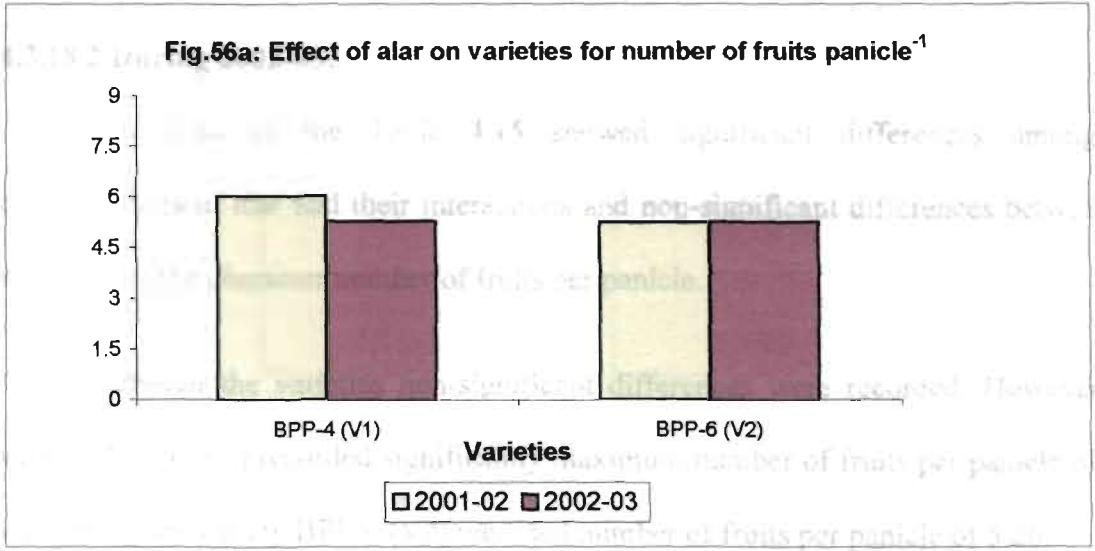
Between the varieties, the variety BPP-4 (V1) recorded significant maximum number of fruits per panicle of 6.01 while the other variety BPP-6 (V2) recorded number of fruits per panicle of 5.25.

Among the concentrations of alar in comparison with the control (water spray C0 3.44) significant maximum number of fruits per panicle of 7.63 was recorded by 1000 ppm double spray (C5) but on par with 1000 ppm single spray (C4 7.49). The lowest number of fruits per panicle of 3.69 was recorded by concentration of 500 ppm single spray (C1).

Among the interactions, the treatment V1C4 recorded significant maximum number of fruits per panicle of 8.60 V1C5 (8.13) which was significantly superior over all other treatments of interaction. The minimum number of fruits per panicle of 3.38 was recorded by V1C1 and V2C0. The other treatments of interaction showed number of fruits per panicle of ranging from 3.50 to 8.12.

Table 4.15: Number of nuts reached maturity m⁻², number of fruits per panicle, nut weight and nut yield tree⁻¹ in cashew as influenced by variety, alar and their interactions.

	Number of fruits panicle ⁻¹			Number of nuts reached maturity m ⁻²			Nut weight (g)			Nut yield tree ⁻¹ (kg)	
	2001-02	2002-03		2001-02	2002-03		2001-02	2002-03		2001-02	2002-03
Varieties:											
BPP-4 (V1)	6.01	5.28		29.12	30.34		5.37	4.84		1.889	1.629
BPP-6 (V2)	5.25	5.26		28.25	28.48		5.77	5.10		1.657	1.684
Concentrations of alar:											
Control (Water spray) (C0)	3.44	3.25		24.62	24.81		4.92	4.33		1.300	1.420
500 ppm single spray (C1)	3.69	4.25		25.25	27.88		5.18	4.98		1.550	1.483
500 ppm double spray (C2)	4.25	4.75		26.87	29.44		5.42	5.15		1.688	1.638
500 ppm triple spray (C3)	7.00	5.37		30.25	30.94		6.00	5.28		1.813	1.750
1000 ppm single spray (C4)	7.49	6.36		31.81	31.56		5.90	5.37		2.000	1.813
1000 ppm double spray (C5)	7.63	6.94		33.31	34.31		5.91	4.84		2.113	1.863
1000 ppm triple spray (C6)	5.94	6.00		28.69	26.94		5.66	4.86		1.950	1.638
Interactions:											
V1C0	3.50	3.63		25.50	25.50		4.28	4.06		1.350	1.375
V1C1	3.38	3.88		26.00	28.63		4.98	5.08		1.650	1.490
V1C2	3.88	4.63		27.75	30.00		5.48	5.58		1.725	1.570
V1C3	8.12	5.38		29.75	31.88		5.98	5.66		1.875	1.625
V1C4	8.60	6.10		32.63	32.50		5.95	4.94		2.150	1.775
V1C5	8.13	7.12		33.63	36.00		5.62	4.15		2.325	1.900
V1C6	6.50	6.25		28.63	27.88		5.34	4.43		2.150	1.650
V2C0	3.38	2.88		23.75	24.13		5.56	4.61		1.250	1.465
V2C1	4.00	4.63		24.50	27.13		5.38	4.88		1.450	1.475
V2C2	4.63	4.88		26.00	28.88		5.38	4.72		1.650	1.675
V2C3	5.88	5.38		30.75	30.00		6.02	4.92		1.750	1.875
V2C4	6.31	6.63		31.00	30.63		5.85	5.80		1.850	1.850
V2C5	7.13	6.75		33.00	32.63		6.20	5.52		1.900	1.825
V2C6	5.37	5.75		28.75	26.00		5.99	5.30		1.750	1.625
2001-2002											
	S Em	CD		S Em	CD		S Em	CD		S Em	CD
Varieties	0.09	0.19		0.25	0.54		0.05	0.10		0.030	0.060
Concentrations of alar	0.16	0.35		0.47	1.01		0.09	0.19		0.060	0.120
Interaction	0.22	0.49		0.66	NS		0.12	0.27		0.080	0.170
2002-2003											
	S Em	CD		S Em	CD		S Em	CD		S Em	CD
Varieties	0.13	NS		0.17	0.36		0.07	0.17		0.020	0.050
Concentrations of alar	0.24	0.51		0.31	0.68		0.14	0.31		0.040	0.090
Interaction	0.33	0.72		0.44	NS		0.20	0.44		0.060	0.120



4.3.18.2 During 2002-03:

The data of the Table 4.15 showed significant differences among the concentrations of alar and their interactions and non-significant differences between the varieties for the character number of fruits per panicle.

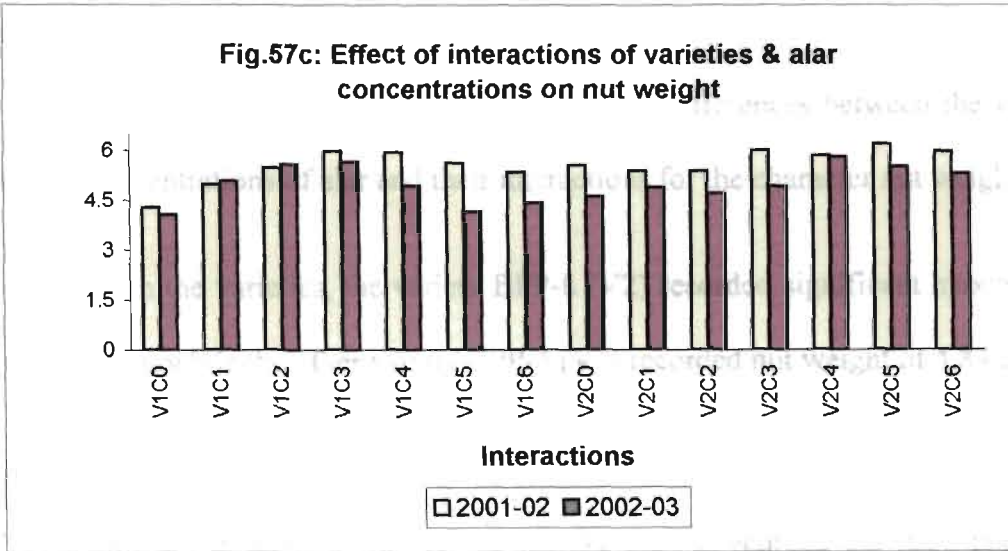
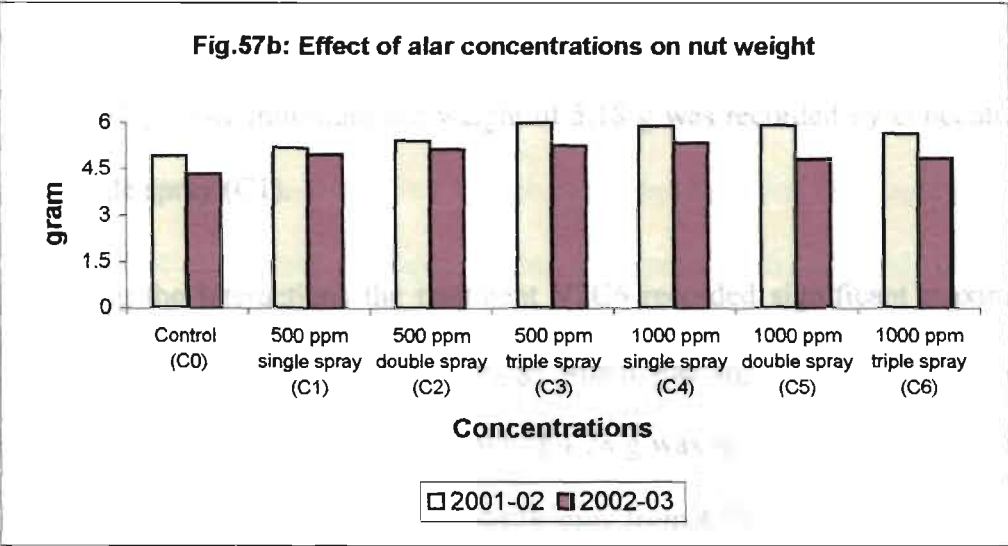
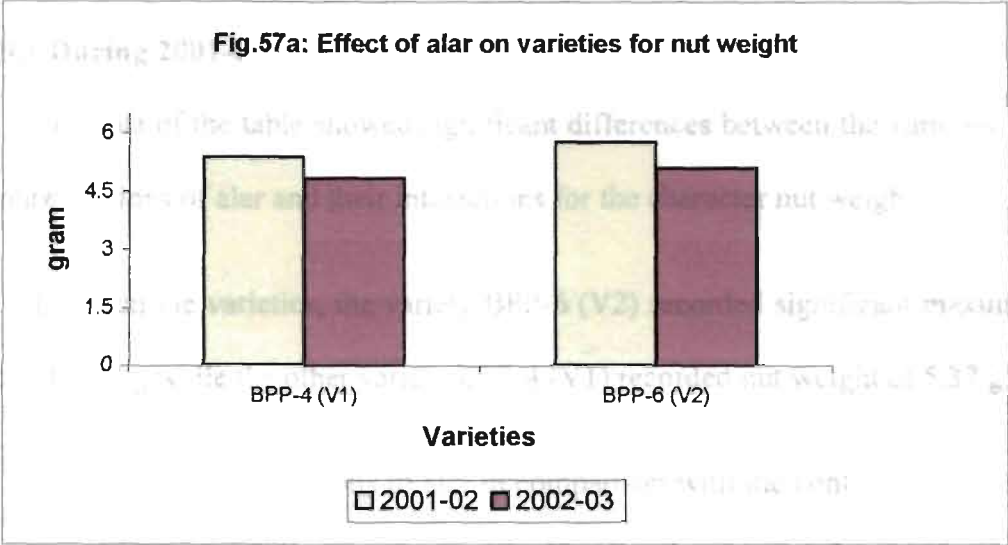
Between the varieties non-significant differences were recorded. However, the variety BPP-4 (V1) recorded significantly maximum number of fruits per panicle of 5.28 while the other variety BPP-6 (V2) recorded number of fruits per panicle of 5.26.

Among the concentrations of alar in comparison with the control (water spray C0 3.25) significant maximum number of fruits per panicle of 6.94 was recorded by 1000 ppm double spray (C5) which was significantly superior over all other treatments. The minimum number of fruits per panicle of 4.25 was recorded by concentration of 500 ppm single spray (C1).

Among the interactions, the treatment V1C5 recorded significant maximum number of fruits per panicle of 7.12 followed by V2C5 (6.75) which was significantly superior over all other treatments of interaction. The minimum number of fruits per panicle of 2.88 was recorded by V2C0. The other treatments of interaction showed number of fruits per panicle ranging from 3.63 to 6.63.

4.3.19. Nut weight (g):

The data on nut weight as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.15



4.3.19.1 During 2001-02:

The data of the table showed significant differences between the varieties, among the concentrations of alar and their interactions for the character nut weight.

Between the varieties, the variety BPP-6 (V2) recorded significant maximum nut weight of 5.77 g while the other variety BPP-4 (V1) recorded nut weight of 5.37 g.

Among the concentrations of alar in comparison with the control (C0 water spray 4.92 g) significantly maximum nut weight of 6.00 g was recorded by 500 ppm triple spray (C3) but on par with 1000 ppm single spray (C4 5.90 g) and 1000 ppm double spray (C5 5.91 g). The minimum nut weight of 5.18 g was recorded by concentration of 500 ppm single spray (C1).

Among the interactions the treatment V2C6 recorded significant maximum nut weight of 6.20 g followed by V2C3 (6.02 g) which was significantly superior over all other treatments. The minimum nut weight of 4.28 g was recorded by V1C0. The other treatments of interaction showed nut weight ranging from 4.98 g to 5.99 g.

4.3.19.2 During 2002-03:

The data of the Table 4.15 showed significant differences between the varieties, among the concentrations of alar and their interactions for the character nut weight.

Between the varieties, the variety BPP-6 (V2) recorded significant maximum nut weight of 5.10 g while the other variety BPP-4 (V1) recorded nut weight of 4.84 g.

Among the concentrations of alar in comparison with the control (C0 water spray 4.33 g) significant maximum nut weight of 5.37 g was recorded by 1000 ppm single

spray (C4) but on par with 500 ppm triple spray (C3 5.28 g) and 500 ppm double spray (C2 5.15 g). The minimum nut weight of 4.84 g was recorded by concentration of 1000 ppm double spray (C5).

Among the interactions, the treatment V2C4 recorded significant maximum nut weight of 5.80 g followed by V1C3 (5.66 g) which was significantly superior over all other treatments of interactions. The minimum nut weight of 4.06 g was recorded by V1C0. The other treatments of interaction showed a nut weight ranging from 4.15 g to 5.58 g.

4.3.20. Nut yield tree⁻¹ (kg):

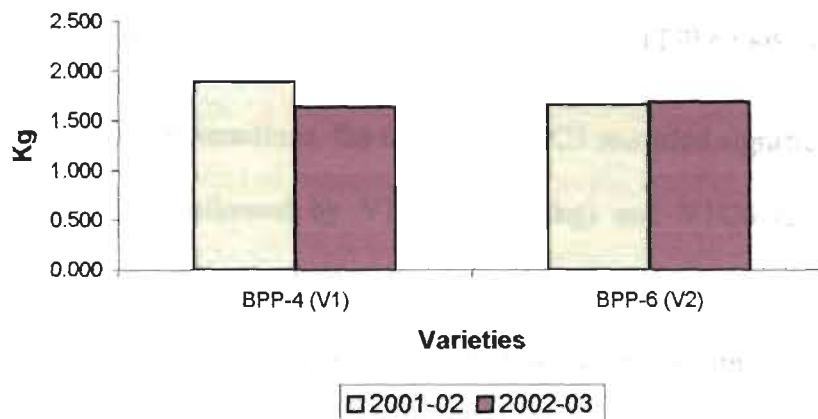
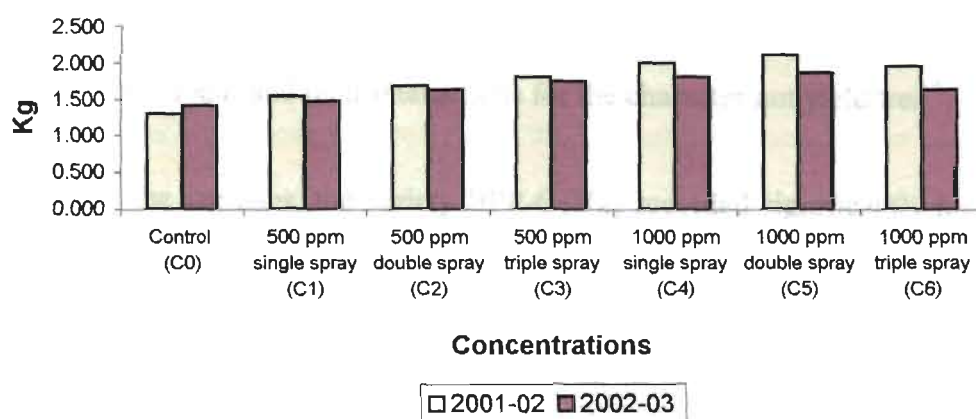
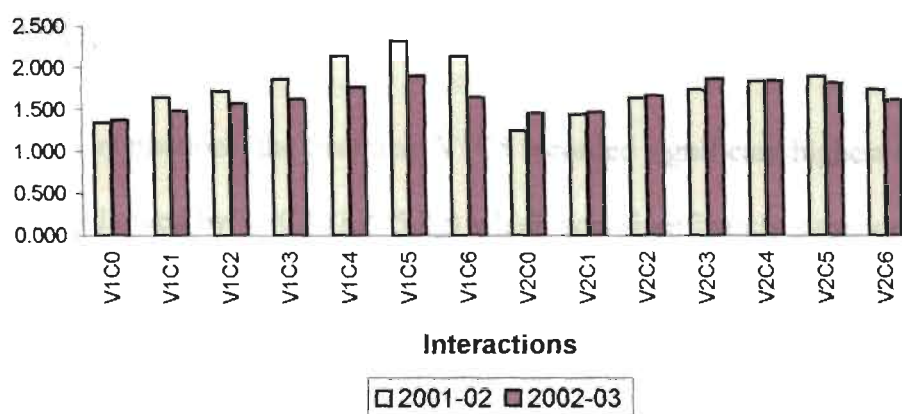
The data on nut yield per tree as influenced by varieties, concentrations of alar and their interactions were recorded during the years 2001-02 and 2002-03 and statistically analyzed and presented in the Table.4.15.

4.3.20.1 During 2001-02:

The data of the table showed significant differences between the varieties, among the concentrations of alar and their interactions for the character nut yield tree⁻¹.

Between the varieties, the variety BPP-4 (V1) recorded significantly highest nut yield per tree of 1.889 kg while the other variety BPP-6 (V2) recorded nut yield tree⁻¹ of 1.657 kg.

Among the concentrations of alar in comparison with the control (C0 water spray 1.300 kg) significant highest nut yield tree⁻¹ of 2.113 kg was recorded by 1000 ppm

Fig.58a: Effect of alar on varieties for nut yield tree⁻¹Fig.58b: Effect of alar concentrations on nut yield tree⁻¹Fig.58c: Effect of interactions of varieties & alar concentrations on nut yield tree⁻¹

double spray (C5) on par with 1000 ppm single spray (C4 2.000 kg). The lowest nut yield tree⁻¹ of 1.550 kg was recorded by concentration of 500 ppm single spray (C1).

Among the interactions, the treatment V1C5 recorded significant highest nut yield tree⁻¹ of 2.325 kg followed by V1C4 (2.150 kg) and V1C6 (2.150 kg) which was significantly superior over all other treatments of interaction. The lowest nut yield tree⁻¹ of 1.250 kg was recorded by V2C0. The other treatments of interaction showed nut yield tree⁻¹ ranging from 1.350 kg to 1.900 kg.

4.3.20.2 During 2002-03:

The data of the table showed significant differences between the varieties, among the concentrations of alar and their interactions for the character nut yield tree⁻¹.

Between the varieties, the variety BPP-6 (V2) recorded significantly highest nut yield per tree of 1.684 kg while the other variety BPP-4 (V1) recorded nut yield per tree of 1.629 kg.

Among the concentrations of alar in comparison with the control (C0 water spray 1.420 kg) significant highest nut yield tree⁻¹ of 1.863 kg was recorded by 1000 ppm double spray (C5) on par with 1000 ppm single spray (C4 1.813 kg). The lowest nut yield tree⁻¹ of 1.483 kg was recorded by 500 ppm single spray of alar (C1).

Among the interactions, the treatment V1C5 recorded significant highest nut yield tree⁻¹ of 1.900 kg followed by V2C3 (1.875 kg) which was significantly superior over all other treatments of interaction. The lowest nut yield tree⁻¹ of 1.375 kg was recorded by V1C0. The other treatments of interaction showed nut yield tree⁻¹ ranging from 1.465 kg to 1.850 kg.

4.4 CORRELATION COEFFICIENTS:

Correlation studies ~~was~~ undertaken between nut yield (dependent variable) and eight independent variables viz., plant height increment, canopy spread, number of shoots per square meter, number of panicles per square meter, number of hermaphrodite flowers, number of fruits per panicle, number of nuts reached maturity per square meter and nut weight. The results are presented in the Table 16.

The correlation coefficients presented in the table showed significant positive correlation of plant height increment with number of shoots per square meter (+ 0.4497), number of hermaphrodite flowers per panicle (+ 0.4786), number of fruits per panicle (+0. 4247), nut weight (+ 0.4937) and nut yield per tree (+ 0.5623) and non-significant positive correlation with canopy spread (+ 0.1963), number of panicles per square meter (+ 0.3412) and number of nuts reached maturity per square meter (+ 0.3655).

The correlation coefficients presented in the table showed significant negative correlation of canopy spread increment with number of panicles per square meter (-0.4375) and non-significant negative correlation with number of hermaphrodite flowers per panicle (- 0.3368), number of fruits per panicle (-0. 3681), number of nuts reached maturity per square meter (- 0.1811), nut weight (- 0.2691) and nut yield per tree (-0.1705). It has recorded non-significant positive correlation with number of shoots per square meter (+ 0.2029).

The character number of shoots per square meter recorded non-significant positive correlation with number of panicles per square meter (+ 0.2762), number of hermaphrodite flowers per panicle (+ 0.1045), number of fruits per panicle (+0.1550),

Table 4.16: Correlation coefficients of growth and yield attributing characters of cashew:

Character	Plant height increment	Canopy spread increment	Number of shoots m ⁻²	Number of panicles m ⁻²	Number of hermaphrodite flowers panicle ⁻¹	Number of fruits panicle ⁻¹	Number of nuts reached maturity m ⁻²	Nut weight	Nut yield tree ⁻¹
Plant height increment	1.000								
Canopy spread increment	0.1963	1.000							
Number of shoots m ⁻²	0.4497*	0.2029	1.000						
Number of panicles m ⁻²	0.3412	-0.4375*	0.2762	1.000					
Number of hermaphrodite flowers panicle ⁻¹	0.4786*	-0.3368	0.1045	0.5836*	1.000				
Number of fruits panicle ⁻¹	0.4247*	-0.3681	0.1550	0.7868v	0.5543*	1.000			
Number of nuts reached maturity m ⁻²	0.3655	-0.1811	0.1325	0.6964*	0.6997*	0.6968*	1.000		
Nut weight	0.4937*	-0.2691	-0.3750	0.0859	0.3057	0.2650	0.2106	1.000	
Nut yield tree ⁻¹	0.5623*	-0.1705	0.3802	0.7217*	0.4044*	0.6570*	0.6027*	0.3148	1.000

* Significant at 5 %

number of nuts reached maturity per square meter (+ 0.1325), nut yield per tree (+ 0.3802) and negative correlation with nut weight (- 0.1705).

The character number of panicles per square meter recorded significant positive correlation with number of hermaphrodite flowers per panicle (+ 0.5836), number of fruits per panicle (+0.7868), number of nuts reached maturity per square meter (+ 0.6964) and nut yield per tree (+ 0.7217) but non-significant with nut weight (0.0859).

The character number of hermaphrodite flowers per panicle recorded significant positive correlation with number of fruits per panicle (+0.5543), number of nuts reached maturity per square meter (+ 0.6997) and nut yield per tree (+ 0.4044) but non-significant correlation with nut weight (0.3057).

The character number of fruits per panicle recorded significant positive correlation with number of nuts reached maturity per square meter (+ 0.6968) and nut yield per tree (+ 0.6570) but non-significant correlation with nut weight (0.2650).

The character number of nuts reached maturity per square meter recorded significant positive correlation with nut yield per tree (+ 0.6027) but non-significant correlation with nut weight (0.2106).

Discussion

CHAPTER V

DISCUSSION

Cashew trees (*Anacardium occidentale* L.) are normally grown without even removing the dead wood, criss-cross branches and water shoots which may reduce the yield potential of the trees. Further to control the size of the tree and increase the productivity, removal of these dead wood, criss-cross branches and water shoots is an important aspect. The practice helps in keeping good sanitary conditions of the plant. In several crops the pruning was found to be beneficial.

New strategies to control size and increase precocity coupled with productivity have to be developed in cashew. Tubbs (1955) in a review on control of vegetative growth and reproduction of fruit trees pointed out that response to pruning in matured trees is related both to the vigour and the relevance between vegetative and reproductive phases.

Normally, a seedling of cashew develops a canopy of umbrella shaped crown that extending to a diameter of 5-7 m. The large umbrella shaped canopy structure has many disadvantages in management of the crop. There has been a wide spread effort to reduce tree size, increase tree density, accelerate canopy and yield development (Nalini,2002). The total yield of a crop was shown to be related to total light interception (Jackson 1980). It has been observed the real productive branches in 6th order of branches in cashew. Often, the 6th order branches that develop in the lower strata of the canopy become unproductive due to poor light penetration. Two approaches are possible to improve light penetration and distribution in cashew. One is breeding relatively natural tree form that allows light penetration through the canopy and secondly by providing a small opening in the tree canopy by artificial means of

manipulating the canopy (Nalini,2002). Therefore, pruning and or using of growth retardants may be helpful in changing the pattern of branching and flushing in cashew like any other perennial crop.

Pruning is little known in cashew. However, Khan *et al.*, (1987) reported that the pruning dead wood alone in older trees helped in increasing the nut yield by 32-40 per cent. Similarly, yields can also be increased per unit area of the land by developing dwarf plants, which can easily be accommodated in high density planting. This can be achieved by using growth retardants that reduce shoot growth by causing a reduction in internodal growth (Cathey,1964). Paclobutrazol and alar (daminozide) are two such growth retardants reported to be modifying or altering the growth behaviour and increasing the yield per unit area. To study the influence of pruning and growth retardants, on the response of cashew (two cultivars viz., BPP-4 and BPP-6) three different experiments were conducted during 2001-02 and 2002-03 and their results are discussed separately in the foregoing paragraphs.

5.1 INFLUENCE OF TIME AND LEVEL OF PRUNING ON CASHEW:

5.1.1 Vegetative growth:

The growth of cashew plant is described in terms of increment in plant height, stem girth, mean canopy spread, number of shoots per square meter of the canopy, shoot length, number of leaves per square meter of surface canopy and leaf area per shoot.

In cashew the excessive vegetative growth is to be controlled by any means in order to improve the productivity of the plant. In other words, the minimal increment in growth towards plant height is a desirable feature. This minimal incremental growth between the two varieties was not significant during the year 2001-02 but

significant during the year 2002-03. The variations between the varieties from the year to year could be attributed to difference in the rainfall received during 2001-02 and 2002-03. In the year 2001-02, there was relatively more rainfall and consequently both the varieties showed similar incremental growth. But during the 2002-03, there was a prolonged moisture stress due to low rainfall (30% deficit) received and as such there was actual response of the variety in the absorption and transport of water and minerals. The results of Table 4.1a and the Fig.1a clearly revealed the genetic potentiality of the variety BPP-4 which happened to be vigorous one in the absorption of water and plant nutrients from the soil and resulted in increased incremental growth.

Pertaining to time of pruning, non-significant differences were observed in both the years of 2001-02 and 2002-03. However, it is interesting to note wide differences in the mean values of incremental growth during both these years (Table 4.1a and Fig.1b). During 2001-02 both the varieties irrespective of time of pruning recorded an increase in incremental growth which could be due to receipt of more rain fall and the lower values during ~~the~~ 2002-03 could be due to the prolonged moisture stress in the soil.

Among the levels of pruning, pruning of both leader and lateral shoots during 2001-02 and pruning of only leader shoots showed minimum increment of growth in plant height. The reduction of plant height was by 3.3% during 2001-02 and 28% during 2002-03 over control. These differences from year to year to level of pruning could be attributed to the physiological condition of the plant at the time of rainfall. In other words in rainy year, pruning of both leader and lateral was found to be necessary in order to curtail the excessive vegetative growth (Table 4.1a and Fig.1c).

Growth of a plant is also expressed in terms of stem girth. Particularly in perennial crop like cashew, the increased stem girth of a perennial tree reflects the sturdiness of the plant and its ability to withstand adverse climatic conditions by virtue of its stored reserved food material. Further, the increased stem girth supports the crop load and gives a firm anchoring. Therefore, in a perennial tree while suppressing the annual incremental growth by plant height, it is desirable to promote the increased girth annually.

The results presented in the Table 4.1a and Fig.2a showed that both the varieties recorded similar response to the level and time of pruning in the year 2001-02. But the variety BPP-4 recorded an increased incremental growth in stem girth due to time of pruning and level of pruning during 2002-03 (Table 4.1a and Fig.2b and 2c). Considering the interaction effects of variety, level of pruning and time of pruning in the present study, it is noted that the variety BPP-4 was found to be more responsive to pruning of both the leader and lateral shoots in mid-August in normal rainy year and in mid-July in low rainfall year. Although there were significant differences pertaining to time of pruning between the two years of study, but there were no such differences in connection with level of pruning. Therefore, in cashew in order to increase the stem girth, pruning of both leader and lateral shoots is a desirable aspect to be considered. The mechanism of response to pruning may be hormonal in nature. Perhaps this could be the reason for significantly increasing the girth of the stem. It can also be attributed to accumulation of reserved food material in the stem consequent to pruning of leader and lateral shoots. Similarly, Walt-M-Van-der *et al.*, (1996) in mango reported a positive correlation between stem circumference and total mass after pruning by increased production of carbohydrates.

The entire vegetative growth of a tree is a total reflection in the form of the canopy spread. In the present experiment, it showed that there was a significant difference between the two varieties under study. During the year 2001-02, BPP-6 significantly recorded lower mean canopy spread increment of 52.3 cm on an average while BPP-4 recorded 53.72 cm (Table 4.1a and Fig.3a). It is indicated that BPP-6 responded with reduced incremental spread due to pruning which could be probably due to less vigorous nature of the variety BPP-6. However, such significant reduction in incremental canopy spread was not noticed during 2002-03.

With respect to time of pruning, mid-August pruning recorded the lowest mean canopy spread increment significantly during 2001-02 and non-significantly during 2002-03. The difference in these two years may be due to more rainfall received during the year 2001-02 and prolonged moisture stress during 2002-03. The significant influence of mid-August pruning over other mid-July and mid-September may be due to the fact that under local agro-climatic conditions, prolonged moisture stress with relatively higher temperatures occurred in the month of August reflecting the true autumn condition (Table 4.1a and Fig.3b).

Considering the influence of level of pruning on mean canopy spread increment as seen in the Table 4.1a and Fig.3c it is noted that pruning of leader shoot during both the years of study was found to be beneficial in reducing the vegetative canopy spread. Such results were also reported by Anon. (2001). The beneficial influence of leader shoot pruning in cashew could be attributed to removal of apical dominance and reduction in the spread by 21% during 2001-02 and 20% during 2002-03 over control. It could further be explained that the mechanism of response after pruning is hormonal in nature. The downward flow of auxins from growing tip or

shoot controlled the bud development. When the leader shoot tip was pruned by heading back, the downward flow of auxins was arrested, which enabled the increased lateral shoots to sprout. Perhaps this could be the reason that higher number of laterals was produced on the pruned cashew shoots. Such observations were made by earlier workers in cashew by Mohan (1983), Mohan and Room Singh (1988) and in guava by Aravindakshan (1963) and in fig by Sundaraj *et al.*, (1969).

Among the interactions of the treatments in present study it is observed that pruning of leader shoot of variety BPP-4 during mid-September and the variety BPP-6 during mid-August were found to be superior in recording the lowest mean canopy spread increment. It could be explained that in case of a vigorous variety like BPP-4, the pruning of leader shoot can be delayed up to mid-September and the less vigorous variety like BPP-6 it may be advanced by a month in mid-August. This could be attributed to the varietal characteristic feature (genetic) of producing off-season flowering shoots and fruiting in BPP-6. In such type of varieties, under local agro-climatic conditions, it is always advisable to prune the leader shoot earlier by mid-August, which will sprout the dormant buds. These newly sprouted buds develop into shoots in more number and bear flowering and fruiting in normal main season and thus the off-season production of flowering shoots could be avoided in such kind of varieties like BPP-6.

Cashew trees may undergo rest period (quiescent stage) for a brief period after the harvest of the crop in the month of April-May under local agro-climatic conditions. It may continue to the next productive flushing season of September-October. The lateral shoots are usually formed at the terminal portion of a leader shoot, which would become fruitful. In aged trees, such self-pruning (drying) of

leader shoot may give rise to single new shoot from a single terminal bud and consequently may result in very low productivity. But if the terminal bud is pruned manually the dormant lateral buds sprout and large number of shoots per unit canopy surface area may be produced. Thus an increased number of flower panicles may develop and may result in increased productivity.

The vigorously growing variety BPP-4 was found to be superior over the other variety BPP-6 in the production of shoots per square meter area of surface canopy in cashew ((Table 4.1a and Fig.4a). This could possibly be due to genetic factor (varietal difference) for having many numbers of dormant buds on a leader shoot. Pertaining to time of pruning, mid-July was found to be superior during 2001-02 and mid-August during 2002-03 as it has recorded a maximum of 37.75 numbers of shoots m^{-2} of the surface canopy area (Table 4.1a and Fig.4b). It indicates that in crops like cashew it was found better to prune the shoots earlier after harvesting is over. Among the levels of pruning, pruning of leader shoot was found to be beneficial as it has recorded a maximum of 37.33 and 22.38 number of shoots m^{-2} of the surface canopy area registering 23.4 % and 10.7 % over control during 2001-02 and 2002-03 respectively over other levels of pruning viz., pruning of laterals, pruning of leaders as well as laterals and control (no pruning) (Table 4.1a and Fig.4c). The beneficial effect of pruning of leader shoot could be attributed to mechanism of response through hormones. Perhaps the downward flow of auxins from the tip of the leader shoot might have been arrested and thus enabled to increase the number of lateral buds to sprout below the cut as explained by Mohan and Room Singh (1988).

Among the interactions of varieties, time of pruning and level of pruning, pruning of laterals of BPP-4 in mid-August during 2001-02 (rainy year) and pruning

of leader shoots in mid-July during 2002-03 (dry year) were found to be superior in producing more number of shoots m^{-2} in the surface canopy area. It explains that the pruning technique should be adjusted to either leader or laterals based on the environmental situation during the period of mid-July to mid-August.

In cashew, shoots with greater photosynthetic efficiency are likely to be fruitful and productive. In other words such a fruitfulness of a shoot out of photosynthetic efficiency could be gauged either by having number of leaves or total leaf area. Pruning results in the production of shoots after the dormant buds gets activated in cashew. The length of such new shoots produced showed significant variations in the length due to level of pruning, time of pruning and their interaction in both the years of study. Between the two varieties employed in the study, BPP-6 recorded a mean length of 19.63 cm during 2001-02 and 18.95 cm during 2002-03 (Table 4.2a and Fig.5a). It indicated that there was a varietal difference in response to pruning for the character shoot length.

With respect to time of pruning mid-September was found to be appropriate statistically as it has resulted in the production of a mean maximum shoot length of 19.25 cm during 2001-02 and 19.64 cm during 2002-03. However, the mid-August pruning was found to be significantly superior over the mid-September pruning during 2001-02 but was on par during 2002-03 (Table 4.2a and Fig.5b). This explains that under local agro-climatic conditions when there was sufficient rain from South-West monsoon season the time of pruning must be carried out in time. If the pruning is delayed it may result in the production of shoots with considerable loss in the length of the shoot.

Pertaining to the level of pruning, there were significant differences among the levels of pruning for the character shoot length. Pruning of both leader and laterals resulted in the production of lowest shoot length. There was a reduction by 11.0 per cent over control (Table 4.2a and Fig.5c). There was a progressive reduction in shoot length after pruning of the leader alone, laterals alone and leader plus laterals together. Contrarily, during the year 2002-03 the response of cashew to level of pruning differed which could be probably attributed to the sudden rainfall received in the month of September, 2002.

5.1.2. Leaf:

The character number of leaves per square meter in cashew is an important aspect with respect to photosynthesis and flowering relationship. Considering this aspect, production of more number of leaves m^{-2} per canopy area is beneficial for the synthesis and accumulation of photosynthates which may in turn be helpful in the differentiation of buds into reproductive ones. In the present study the data presented in the Table 4.2a and Fig.6a it is observed that the vigorous variety BPP-4 produced maximum number of 331.29 leaves m^{-2} of canopy during 2001-02 and 349.77 during 2002-03 and found significantly superior over other variety BPP-6.

With respect to time of pruning it is interesting to note that a mean maximum of 339.0 leaves m^{-2} of canopy was recorded by mid-July pruning treatment during the year 2001-02 and a maximum of 329.0 number of leaves m^{-2} canopy by mid-September pruning in the year 2002-03 (Table 4.2a and Fig.6b). The change of production of more number of leaves m^{-2} area canopy in cashew under local agro-climatic conditions could be attributed to the rainfall received either before or at the time of pruning. During the year 2001-02 a rainfall of 1097.8 mm from SW monsoon

were received from July month and consequently it might have encouraged the tree to produce leaves in greater number. In contrast in the year 2002-03 the monsoon rains were received lately to an extent of 704.0 mm from September. Consequently, the mid-September pruning treatment has recorded more number of leaves m^{-2} . This relationship of moisture availability in the soil and production of more number of leaves after pruning could be possibly be due to the availability and absorption of the nitrogen and other nutrients by the tree. Similar observations were reported by Latha (1992).

It is not only the time of pruning but also the level of pruning that is an important aspect. In the present study it was found that the pruning of leader shoots at the time of pruning has recorded significantly maximum number of leaves of 330.4 per m^2 canopy area during 2001-02 and 346.4 number of leaves m^{-2} of canopy area during 2002-03 registering an increase of 3.9% and 6.9% over control (Table 4.2a and Fig.6c). However, it is interesting to note that in the present study, the pruning of both leader as well as lateral shoots in both the years of study recorded the lowest number of leaves per m^2 of canopy indicating that too much pruning may adversely affect the production of leaves through reduced length of the shoots. Therefore, in cashew it is observed that the pruning should be confined to leader shoot only.

The interaction effects of these three factors viz., variety, time of pruning and level of pruning and their possible combinations also revealed significant difference in both the years of study. The interaction treatment of pruning of leader shoot of BPP-4 variety in mid-July was found to be superior over all other interactions of combination of these three factors. Although this interaction effects were found to be

superior over all other treatments in the study, the time of pruning varied with the moisture availability in the soil and vigour of the variety.

The productivity of a plant largely relies on the source of carbohydrate synthesis in the leaf. If more leaf area is exposed to the radiant energy source, the greater will be the photosynthates prepared and thus there may be a possibility of greater accumulation of photosynthates in the shoots. The accumulation of photosynthates in turn may decide the differentiation of bud into a reproductive one. Therefore, an observation was attempted on the character, total leaf area of the shoot emerged after pruning in cashew. The data presented in the Table 4.2a and Fig. 7a, 7b and 7c revealed significant differences in both the years of study due to varieties, time of pruning and level of pruning and their combination of interactions.

Between the two varieties the vigorously growing BPP-4 variety recorded significantly lower total leaf area of the shoot while that of less vigorous and off-season variety BPP-6 recorded significantly higher leaf area of 553.26 cm² per shoot during the year 2001-02 which was considered as rainy year. The other variety BPP-4 recorded 476.35 cm². It is interesting to note that the vigorously growing variety of BPP-4 that has produced more number of leaves m⁻² area of the canopy and more number of shoots after pruning recorded significantly lower total leaf area indicating that the individual leaf was smaller in vigorously growing variety BPP-4. It is true that when the leaf number on a shoot increases, their size automatically get reduced. As such the less vigorous variety BPP-6 although recorded less number of shoots and less number of leaves per m² area of tree canopy, its total leaf area was found to be higher. It explains that the individual leaf area developed after pruning is larger in size. However, the results recorded due to varieties were found to be contrary in the

next succeeding year, which was experienced with prolonged moisture stress (2002-03, drought year). During this year, although, the vigorous variety BPP-4 recorded comparatively a maximum of 608.18 cm² total leaf area of the shoot, numerically the increase over the less vigorous variety BPP-6 was by 13.44 cm² only. Such difference in the total leaf area of the shoot between two varieties was found to be very wide by 76.91 cm² during the year 2001-02 (Table 4.2a and Fig.7a). This observation explains that the tree vigour in a plant like cashew mostly influenced during favourable agro-climatic condition i.e., when there was sufficient rainfall coupled with other favourable inputs. Such favourable situation was not existing during the year 2002-03 for a quiet a long period and as such both vigorous variety BPP-4 and less vigorous variety BPP-6 showed more or less same vigour and number of leaves per shoot. In other words, it also explains that the cashew trees, irrespective of the varieties, if there is any moisture stress for quite a long period, the leaf production will be affected.

With respect to the time of pruning in the present study, mid-September pruning recorded maximum total leaf area per shoot of 549.88 cm² during 2001-02 and 609.89 cm² during 2002-03 and found to be superior over other treatments of pruning time. This could be probably due to continued rainfall up to September during 2001-02 and delayed rainfall in the month of September during 2002-03. Total leaf area of the shoot was recorded in the month of January after effecting pruning in mid-July, mid-August and mid-September (Table 4.2a and Fig.7b). Consequently the duration from the time of pruning to the date of recording observation was decreasing with delayed in pruning time. Therefore, the leaves developed on a cashew tree after mid-July pruning might have reached aging stage and dropped due to senescence. Probably this drop may be getting reduced with the delayed pruning. Thus either no

drop or less drop after the delayed pruning in mid-September might have contributed to the increased total leaf area in the treatment of mid-September pruning.

Though pruning of both leader and lateral shoot recorded a maximum of 530.7 cm^2 ~~total leaf area~~ per shoot, it was on par statistically with control of without pruning (523.73 cm^2) during the year 2001-02. Interestingly during the year 2002-03 the control i.e., no pruning, the total leaf area produced was found to be 659.5 cm^2 followed by leader shoot pruning (650.2 cm^2) and leader and lateral shoot pruning (548.4 cm^2) which were statistically on par with each other (Table 4.2a and Fig.7c). This finding may be explaining that the cashew irrespective of pruning level, new shoots may develop and bear the leaves with larger total leaf area. On observing the overall results of this character due to variety, time of pruning and level of pruning it is understood that the cashew tree under coastal humid conditions, responds more to the time of rainfall rather than tree pruning time.

5.1.3. Flowering:

The inflorescence of cashew is an indeterminate panicle of polygamomonoecious type (Rao and Hassan, 1957 and Damodaran *et al.*, 1965). Copeland (1961) described the inflorescence of cashew as terminal panicle like cluster. Normally, the canopy of cashew gets closed when attains maturity. When canopy opened at various degrees the distribution of light availability within the canopy and surface were improved considerably. Then light infiltration to the inside of canopy encourage possibly an increase in the chlorophyll content and subsequent higher photosynthetic efficiency which might have triggered the production of optimum number of proleptic branches and also higher percentage of hermaphroditic flowers and thus higher number of nuts per panicle. In the present study the results

presented in Table 4.3a and Fig.8a both the varieties showed superior performance during the year 2001-02. However, during the year 2002-03 both the varieties were found to be statistically on par with each other. With respect to time of pruning during the year 2001-02 maximum number of 23.57 flowering shoots m^{-2} of surface canopy area was recorded by mid-August pruning and found to be statistically superior over other pruning time treatments. The least number of flowering shoots of 21.83 m^{-2} area of surface canopy was recorded by mid-September pruning indicating that the delay by a month may result in the reduction of number of flowering shoots m^{-2} area of tree surface canopy. However, during the year 2002-03 it is interesting to note that delayed pruning up to mid September reduced the number of flowering shoots m^{-2} area of canopy in cashew by 40-60 per cent but recorded maximum number of flowering shoots m^{-2} area of the surface canopy (Table 4.3a and Fig.8b). These observations could probably be attributed to prolonged drought conditions and delayed rain in September during the year 2002-03 of the study. This finding further confirms that the time of monsoon rain was much more influential in predicting optimum number of flowering shoots m^{-2} area of surface canopy of cashew.

Among the levels of pruning in cashew with respect to character number of flowering shoots m^{-2} area of surface canopy, pruning of leader shoot showed better results of producing a maximum of 27.59 during 2001-02 and 14.29 during 2002-03 registering 35.7 % during 2001-02 and 10.4% during 2002-03 increase over control (Table 4.3a and Fig.8c). These findings of the present study on the number of flowering shoots m^{-2} area of surface canopy confirm the observations made by Nalini (2002) in cashew and Srihari and Rao (1998), Suresh Kumar *et al.*, (2003) in mango.

The data presented after working out the number of non-flowering shoots m^{-2} area of surface canopy and ratio of flowering to non-flowering shoots m^{-2} area of surface canopy, it was noticed that pruning of leader shoot of the variety BPP-4 was the best as it not only recorded the minimum number of non-flowering shoots but also recorded maximum of 7.66 flowering to non-flowering shoots ratio in both the years of study. (Table 4.3a and Fig.9b and 9c). Regarding the other variety BPP-6, it also recorded considerably lower number of non-flowering shoots with a higher flowering to non-flowering shoot ratio (Table 4.3a and Fig.9a). It indicated that under local agro-climatic conditions, irrespective of the variety, pruning of leader shoot in mid-August is useful to increase the productivity through production of more number of flowering shoots. However, under west coast conditions of Karnataka, Mohan and Room Singh (1988) reported that the leader shoot pruning in July significantly produced more number of lateral shoots, which were productive. The difference in months of pruning normally varies from one region to other. Usually, the west coast region of our country receives the monsoon rains much earlier than the east coast region of Bapatla. Perhaps this may be the reason for the early differentiation and inflorescence formation in the west coast. Further, pruning of woody perennial like cashew that recorded increased number of flowering shoot production could be attributed to more availability of nutrients and water and a balanced vegetative and reproductive growth.

5.1.4 Inflorescence:

The two varieties BPP-4 and BPP-6 employed in the study are different in their response of producing flowering panicles since BPP-6 is variety that is associated with the off-season flowering under local agro-climatic conditions. Therefore, in the present study the data presented in the Table 4.3a and in the Fig.10a

showed a difference between the two varieties on pruning. It was mid-August pruning that recorded maximum number of panicles m^{-2} area while that of the BPP-6 produced more number of panicles after mid-July pruning. This could be probably due to availability of sufficient food material for early panicle formation in the off-season flowering type of BPP-6. Further, another point noticed in the present study was that of the time of pruning. Irrespective of variety, pruning is related to the onset of monsoon rains. It showed that during 2001-02 which was considered as normal rainy year, mid-July pruning of leader shoot resulted in the production of more flowering shoots but during the year 2002-03 (which was dry year) with delayed rains in the month of September, the treatment pruning in the mid-August has recorded more number of panicles (Table 4.3a and Fig.10b and 10c). Similar observation of change in the pruning time based on the onset of monsoon was reported by Mohan and Room Singh (1988).

Similar results of number of panicles m^{-2} area, number of hermaphrodite flowers panicle⁻¹ and sex ratio of male to hermaphrodite flowers were found to be maximum with the variety BPP-4 followed by BPP-6 where the leader shoots were pruned in mid-July followed by mid-August in both the years of study (Table 4.4a and Fig.12a and 12c). However, the time of pruning of mid-July was on par with the mid-August pruning. It confirms once again that the best time of pruning of a vigorously growing variety like BPP-4 of cashew under local agro-climatic condition is mid-July to mid-August (Table 4.4a and Fig.12b). It is probably due to early activation of buds and early production of large number of reproductive shoots and the opportunity of accumulating adequate photosynthates. Thus it might be responsible for higher production of panicles with maximum count of hermaphrodite flowers.

With regard to duration of flowering, non-significant differences among the treatments imposed were recorded in both the years of study (Table 4.3a and Fig.11a, 11b and 11c). It indicates that a woody perennial like cashew, productivity was mainly concerned only with the number of flowering shoots, number of panicle per square meter area of tree canopy and number of hermaphrodite flowers per panicle but not the duration of flowering phases. In crops like cashew, which are mainly season bound, the flowering duration is not much important as the flower bud differentiation and development normally takes place in a short spell of one month during October to November. The extension of flowering is not generally observed beyond mid-February as the temperatures will be raising under local coastal tropical condition. The rise in temperature may also affect the flower buds to drop, even if, developed. Therefore, irrespective of variety, the influence of level of pruning and time of pruning on the character duration of flowering will remain same and negligible.

In cashew, flowering appears in two or three distinguished phases and those appearing in intermediate stage are generally the most productive ones. Pavithran and Narendranathan (1974) reported three distinguished phases, first male phase, second mixed phase with nil to 60 per cent male flowers and 20 per cent hermaphrodite flowers and the third, a male phase with nil to 6.7 per cent. Other workers (Morada 1941, Aiyadurai and Koyamu, 1957, Rao and Hassan, 1957, Damodaran *et al.*, 1965, Northwood, 1966, Kumaran *et al.*, 1976b) also have reported that the flowers produced early in a panicle are mostly male.

Normally, the cashew tree produces innumerable flowers of which less than 10 per cent are perfect and under normal conditions nearly 85 per cent flowers are

fertilized of which only 4-6 percent reaches maturity. The remaining flowers being dropped at various stages of development (Nair *et al.*, 1979). With this in mind an attempt was made to record the influence of level of pruning and time of pruning on these two popular varieties of cashew BPP-4 and BPP-6 in the present study and the data developed were presented in the Table 4.4a and Fig.13a, 13b and 13c.

Pertaining to percentage of fruit set out of total number of hermaphrodite flowers per panicle, pruning of leader shoot of the variety BPP-4 in mid-August and the variety BPP-6 in mid-July recorded maximum percentage of fruit set of 7.50 and 9.21 respectively during the year 2001-02 and 3.17 and 8.17 during 2002-03 respectively (Table 4.4a and Fig.14a and 14b). These observations are further confirming that pruning of leader shoot in mid-August for BPP-4 and in mid-July for BPP-6 are better for incremental productivity in a flowering shoots of cashew (Table 4.4a and Fig.14c).

The data on the characters viz., number of fruits panicle⁻¹, number of fruits formed m⁻² tree canopy, number of nuts that reached maturity m⁻², the fruit drop m⁻² tree canopy and the percentage of drop showed significant influence of level of pruning and time of pruning on these two varieties of cashew (Table 4.5a and Fig.16a). The number of fruits panicle⁻¹ as well as per square meter area of tree canopy were found to be more in the treatment of pruning of leader shoot in the month of August in case of BPP-4 and in mid-July in case of BPP-6 varieties of cashew during the year 2001-02. However, in the next year of 2002-03, which was considered as a prolonged drought year with late rains, the mid-September pruning of same leader shoot of BPP-4 was found good (Table 4.5a and Fig.16b). The change could be probably be due to the late receipt of monsoon rains during the year 2002-03.

Contrarily an interesting observation was that in case of off-season bearing habit variety BPP-6, irrespective of receipt of rains, the mid-July pruning of leader shoot recorded maximum number of fruit panicle⁻¹ as well as square meter area of tree canopy (Table 4.4a and Fig.15a). This could probably be due to availability of sufficient photosynthates in the shoots developed after pruning of the plant. Similar trend was observed for the character, that the number of nuts that reached maturity m⁻² of the tree canopy. However, if the fruit drop per square meter of tree canopy and percentage of drop were observed, maximum drop was found to be recorded by the same treatments of pruning of leader shoot pruning in mid-August as in the case of BPP-4 and mid-July in the case of BPP-6 (Table 4.4a and Fig.15b and 15c). In other words, it indicates that the treatments, which recorded maximum number of fruits panicle⁻¹ as well as fruits per square meter area have also recorded maximum fruit drop m⁻² of tree canopy during both the years of study. This can be attributed to the competition developed among many fruits that were set on all fruiting shoots for water, minerals and photosynthates. As a result, many of the incompetent fruits, which failed to develop normally, might have dropped. Thus it explains that excessive fruiting on a productive shoot in perennial crops like cashew is not desirable. It means that pruning is to be adjusted in such a way that a balanced vegetative growth and reproductive development is occurring particularly in woody perennial crop like cashew. In other words it explains that nutrition aspect of the plant is an important consideration. These results are clearly demonstrating that a pruned plant requires adequate nutrient supply immediately after pruning, failing which there is a probability of low yield through larger fruit drop at various stages.

5.1.5 Nut:

The cashew fruit is kidney shaped drupaceous nut weighing 3-20g (Nair *et al.*, 1979). Normally, the cashew processing units prefer nuts of medium size weighing 5-7 g in order to obtain a uniform size and quality kernels after shelling. In the present study nuts of such quality in terms of weight were obtained in the treatment of pruning the leader shoot in mid-August to mid-September months in both the varieties in the both the years of study. The variety BPP-6 recorded a better quality nut of 5.31 g during 2001-02 and 5.28 g during 2002-03 and found significantly superior. The variety BPP-4 recorded 4.43 g and 4.40 g on an average during 2001-02 and 2002-03 respectively (Table 4.5a and Fig.17a and 17b). It indicates that for processing and export purpose, BPP-6 for export purpose and the BPP-4 variety for local marketing are preferable. Among levels of pruning, leader as well as lateral shoot pruning during both the varieties in both the years of study was found to be significantly superior over other levels of pruning registering a percentage increase as 7.6 % during 2001-02 and 15.1 % during 2002-03 over control (Table 4.5a and Fig.17c). Perhaps it could be probably due to a moderate number of flowering shoots per unit area of tree canopy which in turn might have developed with sufficient total leaf area and accumulated photosynthates. Therefore, in cashew meant for producing quality nuts for processing units it is found necessary to prune both leader and lateral shoots. Contrarily, if nut number is the objective of cashew production, the study indicated that pruning of leader shoots alone is beneficial. It means that the pruning in cashew varies with the purpose for which the cashew plantation is adopted. Further, it is interesting to note that the variety BPP-6 which is an off-season variety and producing correspondingly larger nuts than the other variety BPP-4, pruning of both leader and lateral shoots with the onset of monsoon rains may mitigate the problem of its non-

preference by the commercial growers. It means that pruning of both leader and lateral shoots of BPP-6 is also beneficial in improving the size and weight of nut by producing moderate number of shoots that becomes productive with the accumulation of adequate photosynthates.

5.1.6 Nut yield:

In several crops viz., citrus (Moore, 1959), Guava (Sundarajan and Muthuswamy, 1964) and mango (Rao and Shanmugavelu, 1975), Srihari and Rao (1998) it was reported that pruning was beneficial in increasing the per tree yield. In the present study of cashew, the results presented in the Table 4.5a and shown in Fig 18a, 18b and 18c a significant difference due to varieties, kind of pruning and time of pruning were observed for the character nut yield per tree. The variety BPP-6 with an yield of 2.777 kg per tree was found to be significantly superior over other variety BPP-4 (2.602 kg per tree) during the year 2001-02 while the variety BPP-4 found to be superior during 2002-03 (Table 4.5a and Fig. 18a). The difference in productivity due to variety could be attributed to their response to environmental conditions prevailing in those two years of study. The year 2001-02 which was considered as normal rainy year with timely onset of monsoon under Bapatla conditions, the off-season variety BPP-6 showed its superiority of producing more nut yield per tree. Contrarily, during 2002-03 which was affected with prolonged drought and received late monsoon rains, the vigorous growing variety BPP-4 performed well in recording the higher productivity (Table 4.5a and Fig. 18b). It explains that prolonged moisture stress in the soil might have affected the growth and development of off-season variety BPP-6 and consequently, relatively lower per tree yield was recorded. Among the pruning techniques pruning of leader shoots in mid-July was found to be beneficial during both the years of study to produce higher per tree yield of nuts with

a percentage increase of 23.6 % and 17.68% during 2001-02 and 2002-03 respectively over control (Table 4.5a and Fig.18c). It is interesting to note that the per tree yield of cashew under local agro-climatic conditions was found to be higher during normal rainy year 2001-02 irrespective of variety and pruning technique. This indicates that sufficient rain coupled with higher humidity is an important consideration for increased productivity.

Considering the growth, production of flowering shoots and nut yield of cashew as influenced by the variety, level of pruning and time of pruning from the present study conducted during 2001-02 and 2002-03, it is observed that a moderate incremental growth with large number of flowering shoots could be obtained by pruning the leader shoot in mid-August under local agro-climatic condition of Bapatla. The study further indicated that the vigorous variety BPP-4 and off-season production variety BPP-6 performed well during rainy year compared to the year of 2002-03 which was associated with prolonged dry spell and delayed rains in August-September months. Another important observation from the study indicated that the off-season variety of cashew needs essentially the pruning of leader shoot in mid-August so as to avoid the off-season flowering and to increase productivity in the normal season.

5.2. EFFECT OF PACLOBUTRAZOL:

Paclobutrazol, a promising triazole plant growth regulator, in relatively small quantities is very effective in inhibiting extension growth in a wide range of species. The compound apparently acts by suppressing the synthesis of gibberellins. Accordingly the effects of paclobutrazol on plants were reversed by gibberellin application (Buta *et al.*, 1985, Lee *et al.*, 1985b and Steffens *et al.*, 1985).

Paclobutrazol may also affect plant growth and development by interfering with sterol biosynthesis (Henry, 1985) although this possibility has not been studied thoroughly. The paclobutrazol reduced the stem elongation in many species. Reduced inter-nodal length (Sankhla *et al.*, 1986) and reduced stem weight (Sankhla *et al.*, 1985) accompanied paclobutrazol induced inhibition of stem elongation. Leaf area and dry weight were also reduced by paclobutrazol (Sankhla *et al.*, 1986). The compound has a greater effect on leaf area than dry weight and hence leaf dry weight per unit area was increased after the treatment (Sankhla *et al.*, 1985). In addition, Jaggard *et al.*, (1982) reported that paclobutrazol increased leaf thickness. The production of new leaves after treatment was slightly decreased or relatively unaffected and the number of nodes per plant was reduced lightly or remained unchanged (Sankhla *et al.*, 1986).

The suppression of the growth due to paclobutrazol in the present study could be attributed to inhibitory action on the endogenous production of gibberellic acid. Similar inhibitory action of paclobutrazol was reported by Davies *et al.*, (1986) and Malik and Thind (1994). Thus with its application, the requirement of pruning can be avoided and the flowering pattern can be attended favourably and may ~~be~~ ^{be} resulting² in profuse fruiting. Its use is especially beneficial in crops like cashew where dwarfing rootstock or compact scion cultivars are not available. The practice of soil application of paclobutrazol may also be beneficial in case of high density planting of cashew.

These reports explain the usefulness in controlling the excessive growth of a perennial fruit tree like cashew and as such the application of paclobutrazol at different concentrations was attempted on these two varieties BPP-4 and BPP-6 during the years 2001-02 and 2002-03.

5.2.1. Vegetative growth:

The growth of cashew was studied during the years 2001-02 and 2002-03 with respect to incremental growth in plant height, stem girth and mean canopy spread in response to paclobutrazol using two varieties viz., BPP-4 and BPP-6. The data on these characters, which reflects the growth of cashew plants are presented in Table 4.6 and Fig.19a, 19b and 19c. The results showed that the vigorous variety BPP-4 responded more to the application of paclobutrazol. The triazole compound significantly suppressed the vigorous growth of BPP-4 better than the other non-vigorous variety BPP-6. It could be due to the suppression of gibberellins biosynthesis which is normally more in vigorously growing varieties. The poor response of BPP-6 to the application of paclobutrazol could be attributed to the considerably lower biosynthesis rate of gibberellins as it is a less-vigorous variety compared to BPP-4. Further, it is interesting to note that the suppressive action on both the varieties was more in the second year (prolonged drought year), which could be attributed to the supplementary action of paclobutrazol application to soil in the second year to the residual activity of paclobutrazol of the first year. In other words, the successive year application resulted in suppression of growth at greater intensity. Among the concentrations of paclobutrazol applied, 8 g a.i.tree⁻¹ was found to be significantly superior in suppressing the incremental growth of plant height and incremental growth of mean canopy spread of cashew tree (Table 4.6 and Fig.21a, 21b and 21c). The suppression was found to be 15.8 % and 79.4 % over control during 2001-02 and 2002-03 respectively. The application of paclobutrazol showed an increase in incremental growth in stem girth with increase of concentration. This could be attributed to accumulation of carbohydrates in the stem. Similar results were also reported by Werner (1995) and Sarkar et al., (1998) in mango.

In a perennial tree like cashew when the incremental plant growth was suppressed, it is advisable to observe the number of shoots produced m^{-2} , shoot length and numbers of leaves m^{-2} area of the tree canopy as these are the important characters since they contribute to the production of flowers. Therefore, to make a tree more productive, more number of shoots with greater length and more number of leaves are desirable features. The Table 4.6 and 4.7 and Fig. 22a, 22b and 22c revealed that the vigorously growing variety BPP-4 produced more number of shoots significantly over the other variety BPP-6 due to soil application of paclobutrazol. Among the concentrations of paclobutrazol significant influence of 8 g a.i.tree⁻¹ on all these characters was observed (Table 4.7 and Fig.23a, 23b and 23c). Though it produced more number of shoots but their individual shoot length and developed number of leaves m^{-2} were very much affected thus the lowest shoot length (27.6% and 48.9% during 2001-02 and 2002-03 respectively over control) and less number of leaves m^{-2} (28.9% and 14.1% during 2001-02 and 2002-03 over control) were recorded during both the years of study (Table 4.7 and Fig.24a, 24b and 24c). This reduction could be attributed to more competition among the new large number of shoots developed for photosynthates. The tree that was not treated with paclobutrazol (control) recorded maximum shoot length and large number of leaves m^{-2} of the tree canopy area. It clearly explains that the paclobutrazol not only suppresses the individual shoot length but also leaf production later. These results are in tune with the findings of Anon.(1999), Puspallatha,(2002) in cashew and Kurian and Iyer, (1993a), Kulkarni, (1988), Tongumpai *et al.*, (1993), Sarkar *et al.*, (1998), Hoda *et al.*, (2001), Zora Singh *et al.*; (2000) in mango and Faizan Ahmad *et al.*, (2000) in litchi.

5.2.2. Leaf:

The total leaf area per shoot and the chlorophyll-a and chlorophyll-b content were found to be influenced by the variety and paclobutrazol concentration in both the years of study (Table 4.7 and Fig.25a, 25b and 25c). The vigorously growing BPP-4 variety recorded maximum leaf area per shoot and higher chlorophyll-a (Table 4.7 and Fig.26a, 26b and 26c) and chlorophyll-b contents (Table 4.8 and Fig.27a, 27b and 27c) which could be attributed to the varietal character. While the leaf area per shoot decreased with increased concentration of the paclobutrazol, chlorophyll-a and chlorophyll-b contents were found to be increasing. It indicates that the application of paclobutrazol though suppressing the growth and reducing total leaf area of the shoot, the photosynthetic pigments were not affected and their contents were found to be at higher level. Thus the treatment 8 g a.i.tree⁻¹ of paclobutrazol level recorded maximum contents registering 39.8 % and 27.2 % of chlorophyll-a and 16.8 and 24.7 % of chlorophyll-b over control during both the years of study. The increased photosynthetic efficiency on a leaf area basis may have been due to the presence of thicker leaves which have a larger mesophyll surface area resulting in improved opportunity for CO₂ exchange (Jaggard *et al.*,1982) and delay in the onset of senescence and there by prolonged period of photosynthetic activity of a given leaf (Sankhla *et al.*, 1982). These observations may explain that the triazole compound paclobutrazol could maintain higher level of photosynthetic pigments despite its suppressive action on growth. In other words that the paclobutrazol is improving the photosynthetic efficiency of the individual leaf produced. Perhaps this increased photosynthetic efficiency of the available leaves on the shoots might have made larger photosynthates available for increased productivity in the paclobutrazol treated trees at 8 g a.i. tree⁻¹ of cashew. Similar results of increased chlorophyll contents there by

photosynthetic efficiency of individual leaves due to paclobutrazol reported by Gonzalez *et al.*, (2003) and Hao *et al.*, (1991) in mango.

5.2.3. Flowering:

The data pertaining to the influence of soil application of paclobutrazol on flowering characters like production of flowering and non-flowering shoots m^{-2} area of tree canopy and their ratio were presented in the Table 4.8 and Fig.28a, 28b and 28c). The data indicated a non-significant difference due to variety but significant differences between paclobutrazol concentrations for these characters. It explains that the irrespective of varietal vigour of the plant, paclobutrazol showed similar influence on production of reproductive shoots. Although increased number of flowering shoots was produced with the gradual increased soil application of paclobutrazol, the higher concentrations viz., 8 g a.i.tree⁻¹ and 6 g a.i.tree⁻¹ were found to be on par statistically with each other. Further, it is interesting to note that the maximum production of flowering shoots registering 52.3 % and 87.6 % during 2001-02 and 2002-03 respectively over control and the ratio of flowering to non-flowering shoots m^{-2} of tree canopy were recorded by 6 g a.i.tree⁻¹ of paclobutrazol (Table 4.8 and Fig.29a, 29b and 29c). It explains that there was an optimum level at which balanced vegetative and reproductive growth of the plant occurs. Any further increase in concentrations beyond 6 g a.i.tree⁻¹, it may show an adverse affect on productivity. Thus, this optimum dose of paclobutrazol 6 g a.i.tree⁻¹ through soil application not only showed the maximum ratio of flowering to non-flowering shoots but also recorded more number of panicles m^{-2} area of the tree canopy registering 49.3 % and 90.9% during 2001-02 and 2002-03 over control and large number of hermaphrodite flowers per panicle during both the years of present study.

With respect to time of flowering under local agro-climatic conditions, normally the cashew trees produces flowering in 2 or 3 flushes covering to a period of 60 to 88 days during the period of January to April. In the mixed phase, the hermaphrodite flowers produced in the month of February to March are setting fruits at higher percentage and reaching maturity. But the hermaphrodite flowers produced in the second phase during second fortnight of March to April, even if they set may drop due to increased temperature. Therefore, in cashew under local agro-climatic conditions, it is preferred to have more hermaphrodite flowers for a moderate period of 65-75 days in the early phase. If this is the pre-requisite of duration of flowering, a concentration of 6 g a.i.tree⁻¹ of paclobutrazol application was found to be beneficial as observed from the Table 4.9 and Fig.30a, 30b and 30c.

With respect to number of panicles produced m⁻² area of the canopy, it is observed that both the varieties under study showed similar performance. However, the number of panicles m⁻² of tree canopy increased with an increase in the concentrations of paclobutrazol up to 6 g a.i.tree⁻¹ and thereafter showed a declining trend (Table 4.10 and Fig.31a, 31b and 31c). Contrarily, it is interesting to note that in respect of number of hermaphrodite flowers per panicle, the two varieties showed a difference. The variety BPP-6 recorded maximum hermaphrodite flowers per panicle during 2001-02 while other variety BPP-4 recorded the maximum during 2002-03 (Table 4.9 and Fig.32a). On the careful observations of the data of the two characters viz., number of panicles m⁻² and number of hermaphrodite flowers per panicle for the years 2001-02 and 2002-03 it is noted that a variety that produced more number of panicles m⁻² recorded a lower number of hermaphrodite flowers per panicle (Table 4.9 and Fig. 32b and 32c). This explains that there was a competition for photosynthates to differentiate flower bud into hermaphrodite flowers consequently the tree that

produced more number of panicles showed a relatively lower ability of producing hermaphrodite flowers. Thus it further explains that the number of panicles m^{-2} is not important from the point of productivity but it is the character, number of hermaphrodite flowers per panicle produced in cashew irrespective of the agro-climatic conditions prevailing in the location.

There was an increasing trend of producing hermaphrodite flowers per panicle during both the years of study. It is interesting to note that during 2001-02 the paclobutrazol up to a concentration of 4 g a.i.tree⁻¹ showed higher number of hermaphrodite flowers per panicle compared to the year 2002-03 which was considered as a dry year. However, the concentration 6 g a.i.tree⁻¹ and 8 g a.i.tree⁻¹ recorded a maximum of 96.00 and 101.29 hermaphrodite flowers per panicle respectively during dry year 2002-03 compared to the preceding rainy year 2001-02. The enhanced production of hermaphrodite flowers per panicle during the second year 2002-03 (dry year) at higher doses 6 g a.i.tree⁻¹ and 8 g a.i.tree⁻¹ could be due to maximum suppression of vegetative growth consequent to both dryness and paclobutrazol action together. In other words, it further explains that more suppression of vegetative growth leads to accumulation of larger photosynthates and other organic nutrients in the panicle might have reflected in production of hermaphrodite flowers. Wang *et al.*, (1985) stated that the paclobutrazol increased foliar nutrient contents of N, P, K, Ca, Mg, Mn, Cu, B, Zn, and Sr and also paclobutrazol shifts assimilates partitioning from leaves to shoots. Similarly, Steffens *et al.*, 1985^b) also stated that starch and sorbitol concentration are increased, in the entire plant and that increased starch content may be due to decreased starch hydrolysis and reduced amylase activity. Similar results were reported by Pushpalatha (2002) in cashew, Desai and Chundawat (1994), Tongumpai *et al.*, (1993), Medina-

Urrutia and Campbell (1994), Burondkar *et al.*, (1997), Srihari and Rao (1997), Rao *et al.*, (1997), Zora Singh *et al.*, (2000) and Shinde *et al.*, (2002) in mango.

Sex ratio in cashew is another important consideration for productivity as the plant produces a large number of male flowers. In the present study the data presented in Table 4.9 and Fig.33a, 33b and 33c showed that the variety BPP-6 registered the lowest male to hermaphrodite flower ratio of 6.57. Among the concentrations of paclobutrazol applied, 6 g a.i.tree⁻¹ concentration was found to be superior. The same concentration was found to be superior for other characters viz., percent fruit set during 2001-02 and number of fruits per panicle during both years of study. These results are revealing that the variety BPP-6 which is considered as an off-season (late season) variety responded well to the soil application of paclobutrazol through suppressing of vegetative growth, prevention of off-season flowering and accumulation of carbohydrates in the newly developed shoots for higher production of hermaphrodite flowers per panicle.

5.2.4. Inflorescence:

With respect to fruit characters viz., per cent fruit set, number of fruits panicle⁻¹ and number of fruits per square meter of tree canopy, the variety BPP-6 was found to be significantly superior over BPP-4 when the trees were applied with 6 g a.i.tree⁻¹ of paclobutrazol through soil. This application of 6 g a.i.tree⁻¹ of paclobutrazol perhaps might have avoided the off-season flowering and fruiting and diverted the photosynthates for higher percentage of fruit set (Table 4.9 and Fig.34a, 34b and 34c) and there by maximum number of fruits panicle⁻¹ (Table 4.10 and Fig.36a, 36b and 36c) as well as per unit area of the tree canopy in the main season. This explanation is strengthened by the observations made by Bailey *et al.*, (1986).

They reported that paclobutrazol application resulted in accumulated photosynthates, which stimulated the floral initiation in *Hydrangea macrophylla*. In this connection another interesting observation made was that the trees of BPP-6 applied with 6 g a.i. paclobutrazol only avoided the off-season flowering while the other trees of BPP-6, which were not included in the trial along with control, showed off-season flowering as usual. Thus it explains that the growth retardant paclobutrazol may be useful in avoiding undesirable off-season flowering and nut production and thereby improves the productivity of the main season.

Further, the variety BPP-4 recorded maximum number of nuts that reached maturity in both the years of study when it was supplied with 6 g a.i.tree⁻¹ of paclobutrazol tree⁻¹. This could be attributed to the difference in size of the nut and number of nuts formed on the panicle of these two varieties under study. Since the nut size of BPP-6 was larger and bold and produced in larger number per panicle as well as per unit area of the tree canopy (Table 4.10 and Fig.35a). There might have been more competition for nutrients and photosynthates and hence there was higher percentage of dropped nuts in the variety BPP-6. As such the other variety BPP-4 which recorded comparatively lower number of nuts panicle⁻¹ as well as tree canopy unit area that might have shown as optimum conditions of partitioning the nutrients and photosynthates among the nuts. Thus the variety BPP-4 recorded maximum number of nuts that reached maturity with less percentage of nut drop in the present study. These characters when considered with respect to paclobutrazol concentration 6 g a.i. tree⁻¹ recorded maximum nut drop (Table 4.10 and Fig.35b and 35c). Normally, whenever there was higher number of fruits (nuts), competition among themselves may develop and results in drop also. One interesting observation to be considered in the present study was that both the number of nuts developed and their

drop were in similar trend in both the varieties under study irrespective of paclobutrazol concentrations. In this connection it is worthwhile to mention about the importance of nutritional level in the plant system of a tree like cashew. In mango earlier workers (Werner and Schaffer, 1995) reported that higher level of paclobutrazol disturbed the nutrient supply to the developing fruit on the plant and resulted in the dropping of fruits. This reason could also be attributed to the higher percentage of drop of nuts in the present study at higher level of paclobutrazol application.

5.2.5. Nut:

In both the years of present study, the nut weight was found to be higher with variety BPP-6 applied with 6 g a.i.tree⁻¹ of paclobutrazol. The boldness and large size of nuts are genetical characteristics of the BPP-6 compared to BPP-4 registering an increased weight of 31.7 % and 15.9% during 2001-02 and 2002-03 respectively over control. Among the concentration of paclobutrazol there was a gradual increase in nut weight with increased concentration up to 6 g a.i.tree⁻¹ followed by a declining trend thereafter. Perhaps, the increased suppression of growth and consequent accumulation of photosynthates with increase in concentration of paclobutrazol might have enhanced the weight of the nut. A still higher level of the triazole compound beyond 6 g a.i.tree⁻¹ might have not only suppressed the growth but also disturbed the supply of photosynthates to the nut and consequently there was a fall in the nut weight. Therefore, it is found to be beneficial to limit the concentration at 6 g a.i.tree⁻¹ in cashew whenever applied through soil (Table 4.10 and Fig.37a, 37b and 37c).

5.2.6. Nut yield:

Regarding the nut yield tree⁻¹, the variety BPP-4, which is a vigorous growing variety, recorded significantly maximum nut yield of 1.701 and 1.669 kg tree⁻¹ during 2001-02 and 2002-03 respectively (Table 4.10 and Fig.38a). It could be probably be due to the large number of small and moderately sized nuts that reached maturity with comparatively less nut drop. Among the concentrations of paclobutrazol, the significantly superior maximum nut yield per tree of 2.500 and 2.591 kg tree⁻¹ were recorded by 6 g a.i.tree⁻¹ of paclobutrazol during the years 2001-02 and 2002-03 respectively (Table 4.10 and Fig.38b and 38c).

Considering the growth, production of flowering shoots and nut yield tree⁻¹ as influenced by variety and concentration of paclobutrazol conducted during 2001-02 and 2002-03, it is observed that the vigorously growing variety BPP-4 responded well to the application of 6 g a.i.tree⁻¹ of the paclobutrazol through soil registered an increased yield by 268 % and 257 % over control during 2001-02 and 2002-03 respectively over control. This better performance of BPP-4 was mainly through the production of larger number of flowering shoot, panicles, more number of hermaphrodite flowers, and more number of nuts that reached maturity with the less percentage of nut drop. The study further indicated that application of paclobutrazol at very high concentration of 8 g a.i.tree⁻¹ to the cashew tree is harmful as it was found to be affecting not only the growth but also the productivity of the tree. Another interesting observation from the investigation was that the off-season variety BPP-6 could be made into a more productive in the main season by application of 6 g a.i. paclobutrazol through soil. It is also noted from the study that during the year 2002-03, which was considered as dry year by virtue of the low rainfall, the trees, which were treated with paclobutrazol, sustained better compared to other cashew

trees. This could be attributed to the observation made by Steffens *et al.*, (1983) who stated that plants treated with paclobutrazol typically used less water than untreated plants. They explained that it is due to reduced leaf area or altered conductance to water vapour flux. Steffens and Wang (1984) also reported similar views that from the treated apple seedlings less ethylene is evolved and are able to withstand drought conditions than control.

5.3 EFFECT OF ALAR:

The growth retardant alar / SADH (succinic acid 2,2-dimethyl hydrazide) has been used for many years to reduce excessive shoot growth. The mode of action of daminozide in light of structural similarities with 2-oxo-glutaric acid, it is reported that daminozide would also block gibberellic acid formation as an inhibitor of 2-oxo-glutarate dependent di-oxygenases (Rademacher,1993). This hypothesis has later been proved by working with an enzyme preparation derived from cotyledons of *Phaseolus coccineus* and by analyzing the GA's of treated peanut plants (Brown *et al.*,1997). With this background it was proposed to study the influence of SADH (Alar) on growth and development of cashew varieties BPP-4 and BPP-6 with different concentrations. The observations were recorded and the data after proper analysis were discussed in the foregoing paragraphs.

5.3.1. Vegetative growth:

On the observation of growth character viz., incremental growth in plant height, stem girth and mean canopy spread, it was noted that there were differences on the influence of alar between 2001-02 and 2002-03 (Table 4.11 and Fig.39a, 39b and 39c). In the second year of study 2002-03 which was considered as a drought year, the study showed statistically significant differences between the two varieties and

alar concentrations. The variety BPP-4 responded more to the alar sprays indicating the ability to respond to the treatments. Normally, the variety BPP-4 is a vigorously growing variety perhaps due to increased synthesis of gibberellins. Since this could be suppressed by the alar, the response of the tree in suppression of growth was observed. Since, during the year 2001-02 there was a normal rainfall favouring a good climate the response of the cashew to the treatments was found to be non-significant for growth characters particularly incremental growth through stem girth (Table 4.11 and Fig. 40a, 40b and 40c). The concentrations showed significant differences only during second year 2002-03 of the study. However, 1000 ppm double spray for more suppression of incremental growth in plant height, 500 ppm double spray for the incremental stem girth, and 1000 ppm triple spray for the suppression of tree canopy spread was recorded superior performance compared to other concentrations (Table 4.11 and Fig. 41a, 41b and 41c). This variation could be due to variation in plant nutrition, micro-climatic around the plant and the higher concentration of alar decreased the levels of gibberellins in the leaf tissue and resulted in differential growth.

With respect to shoots produced by both the varieties of cashew in response to spray application of alar, it is noted that BPP-4 responded favourably in producing more number of shoots per m^{-2} (Table 4.11 and Fig. 42, 42b and 42c) with greater shoot length but with respect to number of leaves m^{-2} , BPP-6 recorded considerably more number of leaves. This could probably be due to the varietal character of an off-season variety producing more number of leaves at every node developed with shorter inter node of the newly produced shoots. Consequently, BPP-6, the off-season variety recorded more number of leaves m^{-2} area of the tree canopy. Contrarily the BPP-4, the vigorous variety produced more number of leaves with increased shoot length by

application of growth retardant alar (Table 4.12 and Fig. 43a, 43b and 43c). Among the spraying treatments 500 ppm double and 500 ppm triple sprays for increasing number of shoots m^{-2} , water spray and 500 ppm single spray for increased shoot length and number of leaves m^{-2} recorded maximum values (Table 4.12 and Fig. 44a, 44b and 44c). Contrarily, suppression of shoot length and number of leaves at higher concentration of 1000 ppm triple spray could be attributed to accumulated alar solution in the plant system. Therefore, it explains that for increased production of shoot, which could become productive, alar may be applied as a single dose.

5.3.2 Leaf:

In the present study the number of leaves m^{-2} area of tree canopy, leaf area per shoot (Table 4.12 and Fig. 45a, 45b and 45c) and chlorophyll-b content were found to be decreasing not only with increased concentration of alar sprayings, but also with increased number of sprayings. However, the chlorophyll-a alone was found to be increasing with the increase in concentration of alar and increase in number of sprayings. Similar results were reported by Milatovic (2001).

With respect to the varieties, BPP-6 recorded maximum values for these leaf characters compared to the vigorous variety BPP-4. This could be probably be due to the genetic character of the off-season variety BPP-6 in producing more number of leaves with more leaf area and chlorophyll-a content compared to the other variety BPP-4. It is interesting to note that BPP-6, the off-season variety when sprayed with alar, total leaf area and chlorophyll-a content (Table 4.12 and Fig. 46a, 46b and 46c) and chlorophyll-b (Table 4.13 and Fig. 47a, 47b and 47c) were found to be increasing with increase in the number of sprays. This explains that the spraying of ala

repeatedly further increased the synthesis of chlorophyll content and thus might have increased the photosynthetic efficiency of leaf.

5.3.3. Flowering:

The flower characters in cashew viz., number of flowering shoots m^{-2} , number of non-flowering shoots m^{-2} of tree canopy and ratio of flowering to non-flowering shoots as influenced by the foliar spraying of alar at 500 ppm and 1000 ppm in both the varieties of BPP-6 and BPP-4 are presented in (Table 4.13 and Fig. 48a, 48b and 48c). The variety BPP-6 was found to be superior over BPP-4 when the ratio of flowering to non-flowering shoots was worked out as it responded well to the application of alar in both the years of study. With respect to alar concentrations, 1000 ppm concentration was found to be registering higher ratio of flowering to non-flowering shoots. This could be probably due to more number of flowering shoots and decreased non-flowering shoots recorded during both the years of study (Table 4.13 and Fig.49a, 49b and 49c). This could be attributed to the accumulated photosynthates in the shoots for differentiation into flower buds in the plant.

Considering the growth, leaf and flowering to non-flowering shoot ratio, it is noticed that the off-season variety BPP-6 responded well in reducing the vegetative growth, producing more number of leaves and higher flowering to non-flowering ratio. It means that the influence of alar on vigorously growing variety like BPP-4 was found to be not as effective as in off-season varieties BPP-6. Therefore, in cashew, wherever off-season flowering is noticed, a common spray of alar at 1000 ppm concentration either twice or thrice is adaptable in order to prevent the off-season flowering, diverting the photosynthates for reproductive growth and thus for increased production of main crop.

Although the variety BPP-6 recorded more number of fruits (nuts) per panicle area in both the years of study, it showed less number of nuts reaching maturity. Contrarily, the variety BPP-4 which recorded significantly less number of nuts per panicle, showed more number of nuts reaching maturity m^{-2} in both the years of study. It indicates that more number of fruits per panicle might have experienced with more competition for nutrients and photosynthates and thus might have showed less number of nuts reaching maturity in case of variety BPP-6. This finding was clearly reflected with the more drop of the fruits m^{-2} area of the tree canopy in the variety BPP-6 (Table 4.15 and Fig.55a).

With regard to concentration of alar concentrations 1000 ppm single spray during 2001-02 and two sprayings during 2002-03 recorded more number of fruits (nuts) per panicle. However, it was 1000 ppm double spray of alar that showed more number of nuts reaching maturity m^{-2} of the tree canopy area in both the years of study. It could probably be due to more accumulation of food material consequent to suppression of vegetative growth by alar at double spray of 1000 ppm concentration. Further, comparatively less fruit drop was also observed with the 1000 ppm double spray of alar to record more number of nuts reaching maturity (Table 4.15 and Fig.55b and 55c).

5.3.5. Nut:

The characteristic feature of the variety BPP-6 producing large size and bold nuts was reflected by registering higher values of nut weight during both the years of study (Table 4.15 and Fig.57a). The higher nut weight was due to larger size a bold size of the nut, which was genetically controlled varietal character. With regard to concentration and number of sprayings of alar 500 ppm triple spray during 2001-02

and 1000 ppm single spray during 2002-03 recorded maximum nut weight of 6.00g and 5.37 g respectively (Table 4.15 and Fig.57b and 57c).

5.3.6. Nut yield:

However, the nut yield tree⁻¹, a maximum of 1.889 kg tree⁻¹ was recorded by BPP-4 during 2001-02 and 1.684 kg tree⁻¹ by BPP-6 during 2002-03 (Table 4.15 and Fig.58a). This change of the varietal performance during the both the years of study could be attributed to drastic influence of moisture stress during drought year 2002-03 on the vigorous variety BPP-4 rather than off-season variety BPP-6. This finding was confirmed with our earlier statement that the prolonged dry spell affects adversely the vigorous variety than off-season variety. In other words, it could be explained that in off-season (late season) variety like BPP-6, the prolonged dry spell not only affected the off-season production but also suppressed the vegetative growth and thus might have made the tree to yield more in the normal main season.

However, the nut yield tree⁻¹ was found to be maximum with the 1000 ppm double spray during 2001-02 (2.113 kg) and 1000 ppm single spray during 2002-03 (1.863 kg) It indicates that to reap greater nut yield tree⁻¹ a higher concentration of 1000 ppm at two sprays in rainy year and a single spray in drought year were found to be adequate (Table 4.15 and Fig.58b and 58c).

From the results and discussion of the three experiments viz., i) effect of time and level of pruning ii) effect of soil application of paclobutrazol and iii) effect of foliar spray application of alar on cashew vigorous variety BPP-4 and off-season (late season) variety BPP-6 during the year 2001-02 and 2002-03 it is observed that soil application of paclobutrazol 6.0 g a.i.tree⁻¹ was found to be beneficial and superior over other techniques like level and time of pruning and foliar spray of alar. The

paclobutrazol soil application not only suppressed the excessive vegetative growth of vigorous variety BPP-4 but also prevented the off-season flowering in BPP-6 and directed the photosynthates for increased production of main season. However, it is advisable to undertake further studies in cashew with the application of paclobutrazol in respect of the time interval to be maintained in its application. In case the chemical paclobutrazol is not available the next best technique to control not only vegetative growth but also to promote productivity pruning of leader shoot in mid-July to mid-August was found to be beneficial in cashew under local agro climatic condition of Bapatla.

5.4 CORRELATION COEFFICIENTS:

The correlation co-efficients as observed from the data of the Table.16 revealed that the nut yield was having highly significant positive association with plant height increment, number of panicles m^{-2} area of the surface canopy, number of hermaphrodite flowers panicle⁻¹, number of nuts panicle⁻¹ and number of nuts reached maturity m^{-2} , indicating that these characters are contributing for the enhancement of nut yield in cashew nut directly.

Similarly, the plant height increment showed significant positive correlation with number of shoots m^{-2} , number of hermaphrodite flowers panicle⁻¹, number of fruits panicle⁻¹ and nut weight and non-significant but positive correlation with number of panicles m^{-2} and number of nuts reached maturity m^{-2} . However, it is interesting to note that the canopy spread was found to be significantly and negatively correlated with all characters. These results are explaining that the yield attributing characters are affected if the canopy spread is increased laterally. It explains that in a crop like cashew, the lateral spread of canopy may not be desirable as it causes shade

due to interruption of light, leading to less photosynthetic efficiency and productivity. In other words, the plant height increment may be desirable for obtaining greater nut yield through increased production of number of shoots, number of panicles and number of hermaphrodite flowers panicle⁻¹ of the tree canopy in cashew. Similar results were reported by Anitha *et al.*, (1991).

The yield attributing characters viz., number of hermaphrodite flowers panicle⁻¹, number of panicles m⁻², number of nuts panicle⁻¹ and number of nuts reached maturity were significantly and positively correlated with each other. It explains that the vegetative growth particularly canopy spread is to be controlled through any means of cultural practice either by pruning or by application of growth retardant for an increase in productivity. Similar results were reported by Manoj *et al.*, (1994).

Summary

CHAPTER VI

SUMMARY

Cashew (*Anacardium occidentale* L.), an important foreign exchange earning plantation crop of India is characterized by spreading branches and irregular shape and therefore, the canopy manipulation and containment by way of pruning or application of plant growth substances as an orchard management practice has not been attempted so far. Further, in a crop like this for sustainable production, proper management of canopy is felt essential. With this in view an attempt was initiated to study the growth and development of two distinct cashew varieties as influenced by techniques of pruning as well as application of growth retarding substances like paclobutrazol and Alar during 2001-02 (normal rainy year) and 2002-03 (prolonged dry spell with late rains). The results recorded in the present study are summarized below.

6.1 PRUNING TRIAL:

6.1.1 Growth:

The minimal increment of growth through plant height and canopy spread was recorded by pruning of leader and lateral shoot in mid-August in normal rainy year and leader shoot alone in mid-July. The off-season variety BPP-6 responded positively to pruning during the both years of study to produce minimal plant height and canopy spread.

The stem girth increment and number of shoots m^{-2} area of surface canopy were influenced with an increase in the variety BPP-4 on pruning of leader and lateral shoot pruning in mid-July during 2001-02 (rainy year) and mid-September during 2002-03 (dry year).

The variety BPP-6 during 2001-02 and BPP-4 during 2002-03 showed significantly superior response to pruning for the character shoot length, when pruned in mid-August to mid-September pruning of the leader shoot during 2001-02 (rainy year) and lateral shoot during 2002-03 (dry year).

6.1.2 Leaf:

The variety BPP-4 recorded significantly maximum number of leaves m^{-2} area of canopy during both the years of study. Pruning of leader shoot alone showed significantly superior performance of producing maximum number of leaves m^{-2} area of tree canopy during both the years of study in mid-July during 2001-02 (rainy year) and mid-September (2002-03).

With respect to total leaf area per shoot, the off-season variety BPP-6 during 2001-02 and vigorous variety BPP-4 during 2002-03 (dry year) recorded significantly maximum leaf area per shoot. Pruning in mid-September of leader and lateral shoot during 2001-02 (rainy year) and leader shoot alone during 2002-03 (dry year) recorded significantly superior production of leaf area shoot $^{-1}$ in the present study.

6.1.3 Flowering:

The vigorous variety BPP-4 recorded significantly maximum number of flowering shoots m^{-2} area of tree canopy during both the years of study. Pruning of leader shoot alone in mid-August during 2001-02 (rainy year) and in mid-September during 2002-03 recorded significantly maximum number of flowering shoots m^{-2} area of tree canopy.

With respect to number of panicles m^{-2} area of the canopy surface, the vigorous variety BPP-4 during 2001-02 showed superior performance of producing maximum number of panicles while it was on par with other variety BPP-6. Leader

shoot pruning as well as lateral shoot pruning which were on par with each other showed significantly superior performance for maximum number of panicles m^{-2} area of canopy during 2001-02 (rainy year) when pruned in mid-August followed by mid-September. During 2002-03 (dry year), pruning of leader shoot alone in mid-September recorded maximum number of panicles per square meter area of tree canopy.

The total time of flowering (duration in days) showed significant difference with variety and level of pruning but non-significant difference with variety and level of pruning but non-significant in respect of time during both the years of study. Variety BPP-6 showed flowering period for a period of 94.04 days during both the years of study. Pruning of leader and lateral shoots during both the years of study recorded maximum period of flowering time i.e. longer duration of flowering.

6.1.4 Inflorescence:

The vigorous variety BPP-4 recorded significant maximum number of hermaphrodite flowers panicle^{-1} during 2001-02 (133.60) and 2002-03 (117.23). Pruning of leader and lateral shoots in the month of mid-August during 2001-02 (rainy year) recorded 135.34 and in mid-July during 2002-03 (dry year) recorded 122.93 maximum number of hermaphrodite flowers panicle^{-1} .

In terms of male to bisexual flowers sex ratio, vigorous variety BPP-4 recorded the lower ratio of 4.7 and 4.5 during 2001-02 and 2002-03 respectively. Pruning of both leader and lateral shoots in mid-July during 2001-02 (rainy year) and mid-September during 2002-03 (dry year) recorded significantly the lowest male to bisexual flowers sex ratio.

In case of number of nuts that reached maturity m^{-2} , the vigorous variety BPP-4 recorded a maximum of 48.58 during 2001-02 and 31.45 during 2002-03. Pruning of both leader and lateral shoots in cashew in mid-August during 2001-02 (rainy year) and mid-July during 2002-03 (dry year) recorded maximum number of nuts.

Pertaining to percentage of fruit set during, maximum percentage of fruit set was recorded by the off-season variety BPP-6 during both the years of study. The control i.e., without pruning recorded maximum percentage of fruit set during both the years of study.

6.1.5 Nut weight and yield:

Non-significant difference were recorded due to variety and time of pruning for the character number of fruits (nuts) per panicle but pertaining to the level of pruning, pruning of leader shoots recorded maximum number of fruits (nuts) per panicle (5.53 and 3.76 during 2001-02 and 2002-03 respectively).

With respect to nut weight, the off-season variety BPP-6 recorded maximum nut weight of 5.31 g during 2001-02 and 5.28 g of during 2002-03 and found significantly superior. Pruning of leader and lateral shoots during mid-July, during 2001-02 (rainy year) and mid-August, during 2002-03 (dry year) recorded maximum nut weight.

The off-season variety BPP-6 during 2001-02 (rainy year) and vigorous variety BPP-4 during 2002-03 (dry year) recorded maximum nut yield tree^{-1} of 2.777 kg and 2.449 kg respectively. Pruning of leader shoot in mid-July was found to be significantly superior over all other treatments and recorded the maximum nut yield 2.853 kg tree^{-1} and 2.565 kg tree^{-1} during 2001-02 and 2002-03 respectively.

6.2 PACLOBUTRAZOL:

6.2.1 Growth:

The vigorous variety BPP-4 responded better than the other variety BPP-6 to the soil application of 8 g a.i. tree⁻¹ of paclobutrazol during both the years of study (2001-02 and 2002-03) by recording low plant height increment. During 2001-02 the reduction in plant height increment was 15.8% while during 2002-03 the reduction was to an extent of 79.4% compared to control.

The incremental mean canopy spread was the lowest with the vigorous variety BPP-4 significantly during 2001-02 and non-significantly during 2002-03. The lowest incremental mean canopy spread was recorded by BPP-4 at 2 g a.i. tree⁻¹ of paclobutrazol soil application during 2002-03. The percentage reduction in mean canopy spread increment due to paclobutrazol application was 45% during 2001-02 and 69.8% during 2002-03.

The vigorous variety BPP-4 recorded 35.62 number of shoots m⁻² during 2001-02 and 28.85 number of shoots m⁻² during 2002-03. Paclobutrazol application at 4 g a.i. tree⁻¹ of paclobutrazol recorded a maximum of 38.17 number of shoots m⁻² during 2001-02 and 33.20 number of shoots m⁻² during 2002-03. Among the interactions also BPP-4 with 4 g a.i. tree⁻¹ of paclobutrazol recorded maximum number of shoots m⁻² during both the years of study.

For the character shoot length, non-significant difference between two varieties was recorded during both the years of study. Among concentrations, plants treated with soil application of 2 to 8 g a.i. tree⁻¹ of paclobutrazol recorded lower shoot length compared to control during both the years of study. The concentrations 2, 4, and 6 g a.i. tree⁻¹ soil application of paclobutrazol recorded shoot length on par

with each other during both the years of study. However, the higher concentrations of 8 g a.i. tree⁻¹ of paclobutrazol recorded significant reduction in shoot length (14.75 cm during 2001-02 and 9.67 cm during 2002-03).

6.2.2 Leaf:

During 2001-02 non-significant and during 2002-03 significant differences were recorded between varieties for the character number of leaves m⁻² area of tree canopy. Decreased number of leaves m⁻² area of tree canopy with gradual increase of concentrations of soil application of paclobutrazol was observed during both the years of study. The treatment 8 g a.i tree⁻¹ recorded the lowest number of leaves m⁻² of 256.26 during 2001-02 and 319.20 number of leaves m⁻² of canopy area during 2002-03.

Pertaining to total leaf area per shoot, the off-season variety BPP-6 recorded significantly the lowest 546.31 cm² during 2001-02 and 529.47 cm² during 2002-03. Among the concentrations there was a declining trend of leaf area per shoot with increased concentrations of paclobutrazol. The concentrations of 8 g a.i tree⁻¹ recorded the lowest leaf area per shoot of 442.33 cm² during 2001-02 and 430.69 cm² during 2002-03.

The vigorous variety BPP-4 recorded a maximum of 1.423 and 1.336 mg/g of chlorophyll-a content during 2001-02 and 2002-03 respectively and 1.448 mg/g and 1.443 mg/g of chlorophyll-b during 2001-02 and 2002-03 respectively. An increasing trend of chlorophyll-a and chlorophyll-b content were recorded with increasing concentrations of paclobutrazol during both the years of study. The concentration of 8 g a.i. tree⁻¹ of paclobutrazol recorded 1.725 mg/g and 1.425 mg/g of chlorophyll-a

during 2001-02 and 2002-03 respectively and 1.665 mg/g and 1.624 mg/g of chlorophyll-b content during 2001-02 and 2002-03 respectively.

6.2.3 Flowering:

No significant difference was recorded between the varieties for the character number of flowering shoots m^{-2} of the tree canopy area during both the years of study. An increasing trend of producing flowering shoots m^{-2} was recorded with an increase in the concentrations of paclobutrazol upto 6 g a.i.tree⁻¹ and there after a declining trend during both the years of study. Among the interactions BPP-6 with 6 g a.i.tree⁻¹ recorded a maximum of 28.50 and 27.27 number of flowering shoots m^2 during 2001-02 and 2002-03 respectively.

The vigorous variety BPP-4 during 2001-02 and off-season variety BPP-6 during 2002-03 recorded significantly minimum number of non-flowering shoots m^{-2} area. The number of non-flowering shoots m^{-2} decreased with increased concentration of paclobutrazol up to 8 g a.i.tree⁻¹ during 2001-02 and up to 6 g a.i.tree⁻¹ during 2002-03. Among the interactions, BPP-4 with 8 g a.i.tree⁻¹ during 2001-02 and BPP-4 with 6 g a.i.tree⁻¹ during 2002-03 recorded the lowest 1.58 and 3.50 number of non-flowering shoots m^{-2} during 2001-02 and during 2002-03 respectively.

Significant difference for duration of flowering in days was observed between two varieties and among the concentrations and non-significant differences for their interactions. The variety BPP-4 with 6 g a.i.tree⁻¹ during 2001-02 and 4 to 6 g a.i.tree⁻¹ (4 g a.i.tree⁻¹ and 6 g a.i.tree⁻¹ were on par each other) during 2002-03 recorded 69.83 and 69.50 days during 2001-02 and 2002-03 respectively.

The varieties showed non-significant difference while concentrations of paclobutrazol and interactions effects recorded significant differences. The interaction

of BPP-6 with 6 g a.i.tree⁻¹ recorded 29.83 and 28.58 maximum number of panicles m⁻² during 2001-02 and 2002-03 respectively.

6.2.4 Inflorescence:

With regard to number of hermaphrodite flowers per panicle, variety BPP-6 recorded maximum number with 8 g a.i.tree⁻¹ during 2001-02 (100.79) and BPP-4 with 8 g a.i.tree⁻¹ (117.08) during 2002-03.

Significantly, the lowest male to bisexual flowers sex ratio of 6.90 due to variety and 4.32 due to concentrations was recorded by BPP-4 during 2002-03 with an application of 8 g a.i.tree⁻¹. Among the interactions, BPP-4 with 8 g a.i.tree⁻¹ recorded the lowest male to bisexual flower sex ratio of 2.98.

The variety BPP-6 with 6 g a.i.tree⁻¹ during 2001-02 and with 4 g a.i.tree⁻¹ of paclobutrazol during 2002-03 recorded the maximum percentage of fruit set of 6.88 and 6.13 respectively.

The variety BPP-6 recorded significantly maximum number of fruits (nuts) per panicle during both the years of study. An increasing trend of number of fruits (nuts) per panicle was observed up to a 6 g a.i.tree⁻¹ followed by a fall thereafter was observed during both the years of study. A maximum of 3.58 and 4.79 number of fruits per panicle was recorded by 6 g a.i.tree⁻¹ of paclobutrazol treatment.

The variety BPP-4 (29.16 and 24.23) and soil application of 6 g a.i.tree⁻¹ of paclobutrazol (38.40 and 31.04) recorded maximum number of nuts that reached maturity m⁻² during 2001-02 and 2002-03.

6.2.5 Nut weight and yield:

The off-season (late season) variety BPP-6 recorded significant superiority for the character nut weight recording 5.83 g and 5.49 g during 2001-02 and 2002-03 respectively. An increase in trend of nut weight was observed up to 6 g a.i.tree⁻¹ (6.48 g and 5.67 g during 2001-02 and 2002-03 respectively). Among the interactions BPP-6 with 6 g a.i.tree⁻¹ (6.50 g) during 2001-02 BPP-4 with 6g a.i.tree⁻¹ (5.91 g) during 2002-03 recorded maximum nut weight.

The variety BPP-4, 6g a.i.tree⁻¹ paclobutrazol concentrations and among interactions V1C3 recorded significant superiority during both the years of study. A maximum nut yield tree⁻¹ of 2.767 kg during 2001-02 and 2.983 kg during 2002-03 was recorded by the variety BPP-4 with an application of 6 g a.i.tree⁻¹ of paclobutrazol.

6.3 ALAR:

6.3.1 Growth:

The minimal incremental plant height was recorded by BPP-6 when sprayed alar at 500 ppm concentration triple spray on BPP-6 during both the years of study while the variety BPP-4 recorded the minimum incremental plant height when sprayed alar 1000 ppm single spray during 2002-03.

Significant differences due to varieties and alar concentrations were observed for stem girth increment during 2002-03 (dry year) only. The variety BPP-4 recorded minimum incremental stem girth 4.5 cm and 2.5 cm during 2001-02 and 2002-03 respectively when sprayed alar at 500 ppm double spray.

The minimum incremental mean canopy spread was recorded by both the varieties when sprayed alar at 1000 ppm triple spray during 2002-03.

The variety BPP-4 on spraying alar at 500 ppm double spray and BPP-6 at 500 ppm triple spray during 2001-02 recorded maximum number of shoots (57.00 each) while BPP-4 and BPP-6 with alar 500 ppm triple spray recorded maximum number of shoots of 36.00 and 37.50 respectively during 2002-03.

The variety BPP-4 recorded a maximum shoot length of 17.93 cm during 2001-02. Among the treatments control (water spray) recorded significant maximum shoot length of 19.50 cm and 18.25 cm during 2001-02 and 2002-03 respectively while alar treated plants recorded lower shoot length of 14.0 to 18.75 cm during 2001-02 and 19.25 to 13.50 during 2002-03.

6.3.2 Leaf:

The variety BPP-6 recorded significantly maximum number of 354.3 and 369.0 number of leaves m^{-2} during 2001-02 and 2002-03 respectively. Among spray treatments, the control (water spray) recorded maximum number of 399.2 and 400.0 during 2001-02 and 2002-03 respectively. It was the control which was on par with 500 ppm single spray during both the years of study (394.8 and 399.0).

The off-season variety BPP-6 recorded significantly maximum leaf area per shoot of 669.7 cm^2 and 691.3 cm^2 during 2001-02 and 2002-03 respectively. Among the spray treatments the control (water spray) significantly recorded maximum leaf area of 778.3 cm^2 and 783.9 cm^2 during 2001-02 and 2002-03 respectively.

The off-season variety BPP-6 recorded significantly higher chlorophyll-a content of 1.432 and 1.415 mg/g during 2001-02 and 2002-03 respectively. Among alar spray treatments, V1C6 (BPP-4 with alar 1000 ppm triple spray) during 2001-02 and the V2C6 (BPP-6 with alar 1000 ppm triple spray) during 2002-03 recorded significant maximum chlorophyll-a content.

Pertaining to chlorophyll-b content, BPP-4 during 2001-02 (1.261 mg/g) and other variety BPP-6 during 2002-03 (1.329 mg/g) recorded maximum chlorophyll-b content. Among interactions, V1C1 (BPP-4 with alar 500 ppm single spray 1.352 mg/g) during 2001-02 and the treatment V2C2 (BPP-6 with alar 500 ppm double spray) during 2002-03 recorded significant maximum chlorophyll-b content.

6.3.3 Flowering:

The variety BPP-4 during 2001-02 (33.7) and BPP-6 during 2002-03 (33.5) recorded significantly maximum number of flowering shoots m^{-2} area of surface canopy. Among the interactions V1C5 (BPP-4 with alar 1000 ppm double spray) during 2001-02 and V2C5 (BPP-6 with alar 1000 ppm double spray) during 2002-03 recorded a maximum of 38.0 and 38.9 number of flowering shoots m^{-2} area of tree canopy.

The variety BPP-6 during 2001-02 and BPP-4 during 2002-03 recorded significantly a minimum of 14.70 and 4.39 number of non-flowering shoots m^{-2} respectively. Among the treatments V2C4 (BPP-6 with alar 1000 ppm single spray) recorded minimum of 11.0 and 2.63 number of non-flowering shoots m^{-2} during 2001-02 and 2002-03 respectively.

The variety BPP-4 recorded significantly short duration of flowering of 80.0 and 79.6 days during 2001-02 and 2002-03 respectively. Among interactions V1C2 (BPP-4 with alar 500 ppm double spray) during both the years of study recorded the shortest duration of 72.0 days.

With regard to number of panicles m^{-2} variety BPP-4 during 2001-02 (28.48) and BPP-6 during 2002-03 (26.75) recorded maximum number of panicles m^{-2} . Among interactions of varieties and concentrations V1C3 (BPP-4 with alar 500 ppm

triple spray) during 2001-02 and V2C3 ((BPP-6 with alar 500 ppm double spray) during 2002-03 recorded a maximum of 33.13 and 35.75 number of panicles m⁻² area of tree canopy respectively.

6.3.4 Inflorescence:

In case of hermaphrodite flowers per panicle the vigorous variety BPP-4 recorded significantly maximum number of 189.9 and 153.7 hermaphrodite flowers per panicle during 2001-02 and 2002-03 respectively. Among interactions the V1C5 (BPP-4 with alar 1000 ppm double spray) during 2001-02 and V1C4 (BPP-4 with alar 1000 ppm single spray) during 2002-03 recorded significantly maximum of 263.4 and 275.1 number of hermaphrodite flowers per panicle respectively.

The vigorous variety BPP-4 showed significant superiority of recording the lowest male to bisexual flowers sex ratio of 2.99 and 5.35 during 2001-02 and 2002-03 respectively. Among interactions of variety with alar concentrations, the lowest sex ratio of male to bisexual flowers was recorded by V1C5 (BPP-4 with alar 1000 ppm double spray) during 2001-02 and V1C3 (BPP-4 with alar 500 ppm triple spray) during 2002-03 recording 2.00 and 1.01 respectively.

With respect to percentage of fruit set the off-season variety BPP-6 recorded significantly maximum of 5.24 and 7.90 percentage of fruit set during 2001-02 and 2002-03 respectively. Among interactions of variety and alar concentrations V2C4, V2C5 and V2C3 (BPP-6 with alar 1000 ppm single, double spray and 500 ppm triple spray) during 2001-02 and V2C3 and V1C4 (BPP-6 with alar 500 ppm triple spray and BPP-4 1000 ppm single spray) recorded maximum percentage of fruit set.

The variety BPP-4 recorded significantly maximum number of fruits per panicle (6.01) during 2001-02 and on par with BPP-6 during 2002-03 (5.28). Among

interactions of variety and alar spray concentrations V1C4 (BPP-4 with alar 1000 ppm double spray during 2001-02) and V1C5 (BPP-4 with alar 1000 ppm triple spray during 2002-03) recorded 8.60 and 7.12 maximum number of fruits per panicle respectively.

The maximum number of nuts that reached maturity m^{-2} of 29.12 and 30.34 were recorded by the variety BPP-4 during 2001-02 and 2002-03 respectively. Among alar spray concentrations C5 (1000 ppm double spray of alar) recorded a maximum number of 33.31 and 34.31 number of nuts reached maturity m^{-2} during 2001-02 and 2002-03 respectively. Interaction affect of variety and alar spray concentrations recorded non-significant differences.

6.3.5 Nut weight and yield:

The vigorous variety BPP-4 recorded significantly higher nut yield tree⁻¹ of 1.889 kg and 1.629 kg during 2001-02 and 2002-03 respectively. Among concentrations of alar, spraying 1000 ppm double spray recorded significant nut yield tree⁻¹ of 2.113 kg and 1.863 kg during 2001-02 and 2002-03 respectively. The interaction of V1C5 (BPP-4 with alar 1000 ppm double spray) recorded a maximum of 2.325 kg and 1.900 kg tree⁻¹ during 2001-02 and 2002-03 respectively.

The off-season variety BPP-6 recorded significantly maximum nut weight of 5.77 g and 5.10 g during the years 2001-02 and 2002-03 respectively. Among interactions V2C5 (BPP-6 with alar spray of 1000 ppm double spray) and V2C4 ((BPP-6 with alar 1000 ppm single spray) recorded 6.20g and 5.80 g during 2001-02 and 2002-03 respectively.

6.4 CORRELATION COEFFICIENTS:

The characters plant height increment, number of panicles m^{-2} , number of hermaphrodite flowers per panicle, number of fruits per panicle, number of nuts that reached maturity m^{-2} recorded significantly positive correlation with nut yield tree^{-1} of cashew. A non-significant positive correlation of number of fruits per panicle and nut weight with nut yield was recorded. A significant negative correlation of canopy spread increment with number of panicles m^{-2} and non-significant negative correlation with number of hermaphrodite flowers per panicle, number of fruits per panicle, number of nuts reached maturity m^{-2} , nut weight and nut yield tree^{-1} were also recorded. Number of panicles m^{-2} , number of hermaphrodite flower per panicle and number of fruits per panicle showed positive correlation with each other.

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Appendices

APPENDIX-I
WEEKLY METEOROLOGICAL DATA FOR THE YEAR 2001

Stan- dard week	Period	Rain-fall (mm)	Rainy days	Air temperature (°C)		Relative humidity (%)	
				Max.	Min.	0716h	1416h
1	01-07 Jan	--	--	28.9	19.0	89	72
2	08-14	--	--	29.0	17.6	94	70
3	15-21	--	--	29.4	17.3	94	68
4	22-28	--	--	30.3	16.2	89	66
5	29-04 Feb	--	--	29.1	14.8	94	69
6	05-11	--	--	31.9	17.8	93	65
7	12-18	--	--	30.1	17.8	96	67
8	19-25	--	--	31.4	20.8	95	74
9	26-04 Mar	--	--	31.4	21.8	80	74
10	05-11	--	--	31.7	21.1	81	62
11	12-18	--	--	32.6	20.9	84	62
12	19-25	--	--	32.4	23.9	82	76
13	26-01 Apr	--	--	33.3	26.5	76	76
14	02-08	--	--	33.7	23.7	77	69
15	9-15	146.2	3	31.5	27.8	88	79
16	16-22	5.5	1	32.7	26.2	73	73
17	23-29	--	--	33.3	26.0	77	75
18	30-06 May	--	--	33.9	28.2	77	81
19	07-13	--	--	40.4	28.3	66	58
20	14-20	--	--	40.2	27.8	64	54
21	21-27	--	--	41.2	28.9	49	45
22	28-03 Jun	34.0	3	41.1	28.5	52	47
23	04-10	27.0	3	35.2	25.7	82	69
24	11-17	17.2	2	38.5	25.1	70	51
25	18-24	2.4	1	36.9	26.1	58	47
26	25-01	--	--	38.9	28.2	52	33
27	02/7-08/7 Jul	0.9	--	37.1	28.1	54	43
28	09/7-15/7	8.5	1	37.8	27.1	57	42
29	16/7-22/7	6.0	1	35.1	25.7	67	53
30	23/7-29/7	55.5	2	34.9	25.1	84	75
31	30/7-05/8 Aug	111.2	5	33.7	23.8	85	77
32	06/8-12/8	40.6	3	32.5	24.2	88	77
33	13/8-19/8	63.4	4	32.6	24.9	82	67
34	20/8-26/8	7.6	1	33.2	24.9	78	78
35	27/8-02/9 Sept	8.9	1	34.6	25.5	70	59
36	03/9-09/9	21.2	2	34.5	25.6	82	78
37	10/9-16/9	49.9	2	33.1	24.9	83	80
38	17/9-23/9	3.7	1	33.0	24.3	85	76
39	24/9-30/9	140.3	4	31.3	24.3	91	85
40	01/10-07/10 Oct	224.2	6	30.9	24.4	92	85
41	08/10-14/10	35.3	2	31.8	24.7	90	82
42	15/10-21/10	59.5	4	30.5	24.2	92	87
43	22/10-28/10	5.4	1	31.7	23.6	92	81
44	29/10-04/11 Nov	--	--	32.2	22.0	87	72
45	05/11-11/11	43.1	2	28.8	22.7	93	92
46	12/11-18/11	9.8	1	30.4	23.9	94	85
47	19/11-25/11	--	--	31.2	21.2	94	82
48	26/11-02/12Dec	--	--	30.3	20.3	91	84
49	03/12-09/12	--	--	30.2	17.8	93	73
50	10/12-16/12	--	--	29.9	17.4	96	72
51	17/12-23/12	--	--	28.6	18.4	88	71
52	24/12-31/12	--	--	28.7	17.8	93	68

APPENDIX-II
WEEKLY METEOROLOGICAL DATA FOR THE YEAR 2002

Stan- dard week	Period	Rain-fall (mm)	Rainy days	Air temperature (°C)		Relative humidity (%)	
				Max.	Min.	0716h	1416h
1	01-07 Jan	68.8	1	28.1	16.8	89	66
2	08-14	0.4	--	28.0	17.4	93	66
3	15-21	--	--	28.4	16.5	97	71
4	22-28	--	--	29.8	21.1	93	84
5	29-04 Feb	3.6	1	29.4	19.5	94	70
6	05-11	--	--	29.2	18.2	89	74
7	12-18	--	--	30.8	19.1	96	72
8	19-25	--	--	31.4	16.8	97	66
9	26-04 Mar	--	--	32.3	17.9	95	67
10	05-11	--	--	31.3	21.9	86	72
11	12-18	--	--	32.1	20.2	92	70
12	19-25	--	--	32.6	21.6	88	73
13	26-01 Apr	--	--	32.5	26.4	75	73
14	02-08	--	--	32.9	24.7	80	73
15	19-15	--	--	33.0	24.9	75	67
16	16-22	--	--	33.1	27.1	77	74
17	23-29	--	--	33.8	27.8	78	74
18	30-06 May	--	--	34.1	27.5	73	73
19	07-13	--	--	41.5	30.5	52	39
20	14-20	6.8	1	40.2	28.8	55	42
21	21-27	16.3	1	39.4	27.0	64	61
22	28-03 Jun	1.9	--	39.1	26.8	64	59
23	04-10	83.1	5	36.5	26.3	82	70
24	11-17	2.2	1	36.1	26.9	73	62
25	18-24	11.3	2	33.2	25.2	77	60
26	25-01	0.5	--	36.4	27.0	61	61
27	02/7-08/7 Jul	--	--	38.6	29.3	57	42
28	09/7-15/7	5.9	1	39.3	28.1	64	47
29	16/7-22/7	4.9	1	35.0	26.0	67	56
30	23/7-29/7	49.9	3	36.0	25.6	70	60
31	30/7-05/8 Aug	66.9	4	33.6	25.2	85	75
32	06/8-12/8	35.9	3	31.0	23.6	85	72
33	13/8-19/8	3.0	0	33.6	25.0	70	52
34	20/8-26/8	21.1	1	34.0	25.0	76	64
35	27/8-02/9 Sept	65.9	2	33.0	24.0	82	75
36	03/9-09/9	25.4	3	34.0	25.0	78	68
37	10/9-16/9	5.2	1	34.0	24.9	72	68
38	17/9-23/9	6.3	2	36.0	25.0	78	69
39	24/9-30/9	5.3	1	37.0	25.0	73	65
40	01/10-07/10 Oct	4.0	1	34.0	25.0	82	73
41	08/10-14/10	59.0	6	31.0	24.0	94	86
42	15/10-21/10	184.7	4	31.0	23.0	92	83
43	22/10-28/10	1.6	0	29.0	23.0	92	84
44	29/10-04/11 Nov	3.7	1	30.0	21.0	84	78
45	05/11-11/11	32.4	1	30.0	21.0	90	86
46	12/11-18/11	--	--	31.0	21.0	91	77
47	19/11-25/11	--	--	29.0	18.0	87	69
48	26/11-02/12Dec	--	--	31.0	17.8	93	69
49	03/12-09/12	--	--	30.0	18.4	90	65
50	10/12-16/12	--	--	30.0	17.7	97	74
51	17/12-23/12	--	--	30.0	17.0	95	74
52	24/12-31/12	--	--	30.0	18.0	89	69

APPENDIX-III
WEEKLY METEOROLOGICAL DATA FOR THE YEAR 2003

Stan- dard week	Period	Rain-fall (mm)	Rainy days	Air temperature (°C)		Relative humidity (%)	
				Max.	Min.	0716h	1416h
1	01-07 Jan	0.80	0	29.0	19.0	93	72
2	08-14	--	--	29.0	17.0	92	63
3	15-21	--	--	29.0	15.0	91	60
4	22-28	--	--	29.4	17.0	97	73
5	29-04 Feb	--	--	30.0	17.9	96	60
6	05-11	--	--	30.0	19.0	93	65
7	12-18	--	--	30.0	21.0	88	72
8	19-25	--	--	31.0	20.0	89	69
9	26-04 Mar	--	--	31.0	21.0	88	67
10	05-11	--	--	31.5	21.0	82	70
11	12-18	5.40	1	32.0	25.0	80	73
12	19-25	0.10	0	33.0	23.0	81	65
13	26-01 Apr	--	--	32.0	23.7	80	76
14	02-08	--	--	34.8	26.0	79	72
15	19-15	0.30	--	33.0	25.6	76	75
16	16-22	--	--	33.0	27.0	79	80
17	23-29	--	--	33.9	25.0	77	75
18	30-06 May	--	--	34.0	28.0	77	78
19	07-13	--	--	35.0	26.0	75	69
20	14-20	--	--	39.0	28.0	64	54
21	21-27	--	--	43.0	29.0	59	56
22	28-03 Jun	2.90	1	44.0	29.0	47	40
23	04-10	3.40	0	44.0	30.0	50	49
24	11-17	47.7	2	35.0	26.0	75	67
25	18-24	54.1	4	37.0	26.0	65	50
26	25-01	9.70	1	34.3	25.6	76	60
27	02/7-08/7 Jul	27.4	3	32.4	24.8	77	65
28	09/7-15/7	104.0	6	33.0	24.2	87	76
29	16/7-22/7	29.2	3	31.2	24.3	89	73
30	23/7-29/7	30.5	3	32.1	24.9	85	75
31	30/7-05/8 Aug	24.9	2	32.4	24.1	87	77
32	06/8-12/8	55.1	2	33.0	25.3	84	71
33	13/8-19/8	9.9	2	34.6	25.8	77	58
34	20/8-26/8	50.2	2	30.8	24.5	85	77
35	27/8-02/9 Sept	3.4	0	33.9	25.3	76	60
36	03/9-09/9	0.3	0	35.3	26.0	66	49
37	10/9-16/9	22.0	2	35.6	25.0	67	64
38	17/9-23/9	106.8	5	33.3	23.4	87	79
39	24/9-30/9	21.0	2	30.9	24.6	89	79
40	01/10-07/10 Oct	29.2	4	31.3	24.3	88	84
41	08/10-14/10	4.2	1	31.9	24.3	85	70
42	15/10-21/10	36.6	3	30.4	24.1	88	79
43	22/10-28/10	90.1	3	29.6	22.4	89	80
44	29/10-04/11 Nov	21.1	1	31.8	23.5	90	73
45	05/11-11/11	14.2	1	31.3	22.5	88	73
46	12/11-18/11	--	--	30.8	21.0	87	69
47	19/11-25/11	--	--	30.7	19.1	86	69
48	26/11-02/12Dec	--	--	30.3	19.0	91	68
49	03/12-09/12	--	--	30.0	17.4	92	62
50	10/12-16/12	--	--	28.4	18.3	90	73
51	17/12-23/12	--	--	28.5	17.3	90	67
52	24/12-31/12	56.9	2	27.2	20.0	92	81

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