# STUDIES ON VARIETAL PERFORMANCE OF CLUSTER BEAN (*Cyamopsis tetragonoloba* (L.) Taub.) UNDER MARATHWADA CONDITION


BY

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B.Sc.(Agri.)




**DISSERTATION**

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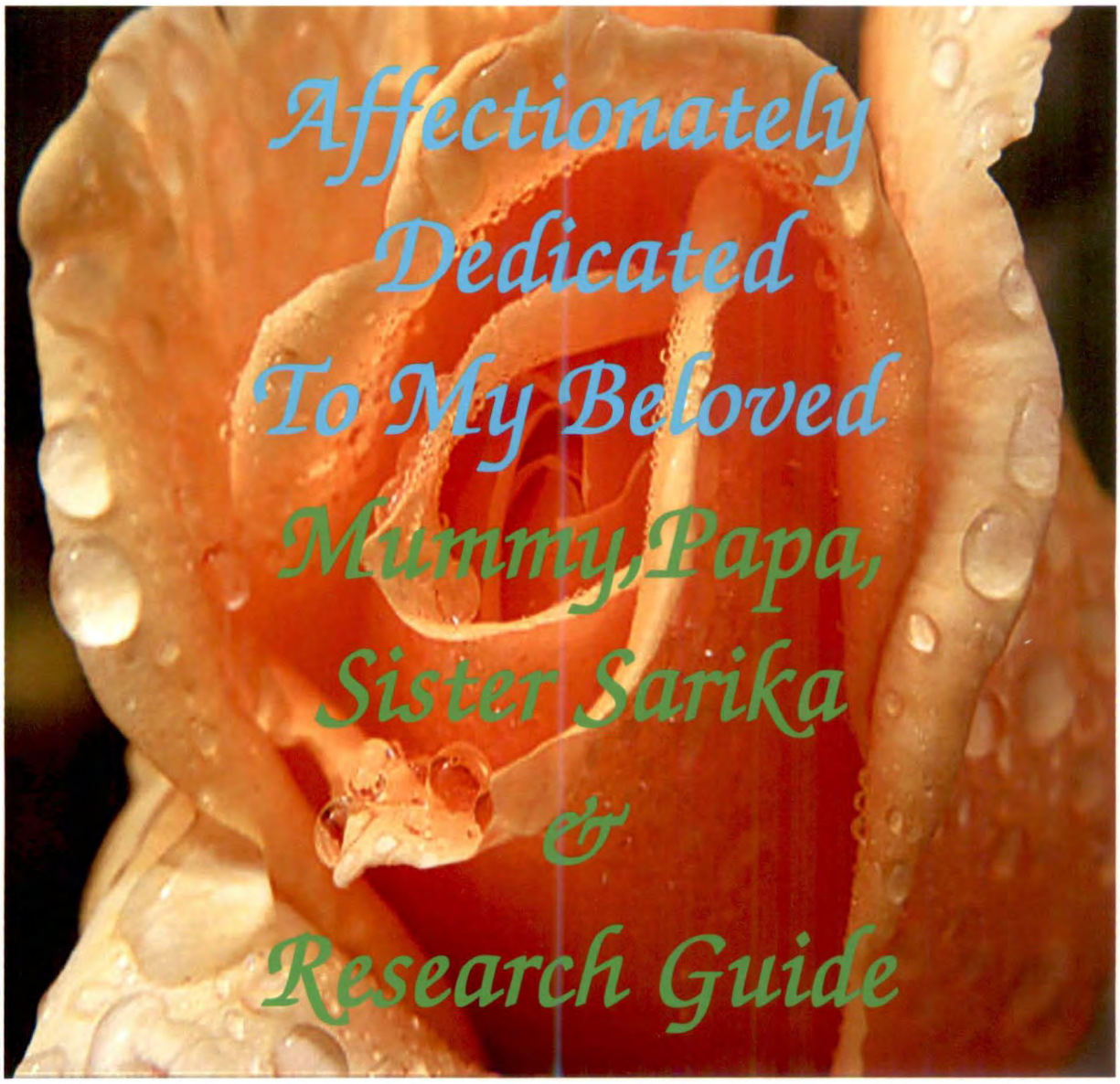
Affectionately
Dedicated
To My Beloved
Mummy,Papa,
Sister Sarika
&
Research Guide

## CANDIDATE'S DECLARATION

*I hereby declare that the dissertation*

*or part thereof, has not been*

*previously submitted by*

*me for a degree of*

*any University.*

Place : PARBHANI
Date : 29 / 05 /2009

( **Adat S.S.** )

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# CERTIFICATE-I

This is to certify that the dissertation entitled **"STUDIES ON VARIETAL PERFORMANCE OF CLUSTER BEAN (*Cyamopsis tetragonoloba* (L.) Taub.) UNDER MARATHWADA CONDITION"** submitted by Shri. **ADAT SANJAY SAVATA** to the Marathwada Agricultural University, Parbhani in partial fulfilment of the requirement for the degree of **MASTER OF SCIENCE (Agriculture)** in the subject of **HORTICULTURE** is record of original and bonafide research work carried out by him under my guidance and supervision. It is of sufficiently high standard to warrant its presentation for the award of the said degree.

I also certify that the dissertation or part thereof has not been previously submitted by him for a degree of any University.

Place : PARBHANI
Date : 29 / 05 /2009

**( S.B. Rohidas )**
Research Guide

# CERTIFICATE-II

This is to certify that the dissertation entitled **"STUDIES ON VARIETAL PERFORMANCE OF CLUSTER BEAN (*Cyamopsis tetragonoloba* (L.) Taub.) UNDER MARATHWADA CONDITION"** submitted by Shri **ADAT SANJAY SAVATA** to the Marathwada Agricultural University, Parbhani in partial fulfilment of the requirement for the degree of **MASTER OF SCIENCE (Agriculture)** in the subject of **HORTICULTURE** has been approved by the student's advisory committee after viva-voce examination in collaboration with the external examiner.

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***"You will be remembered for creating that one page of invention, innovation, discovery or fighting injustice"***

*- A.P.J. Abdul Kalam*

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Date : 29 /05/2009

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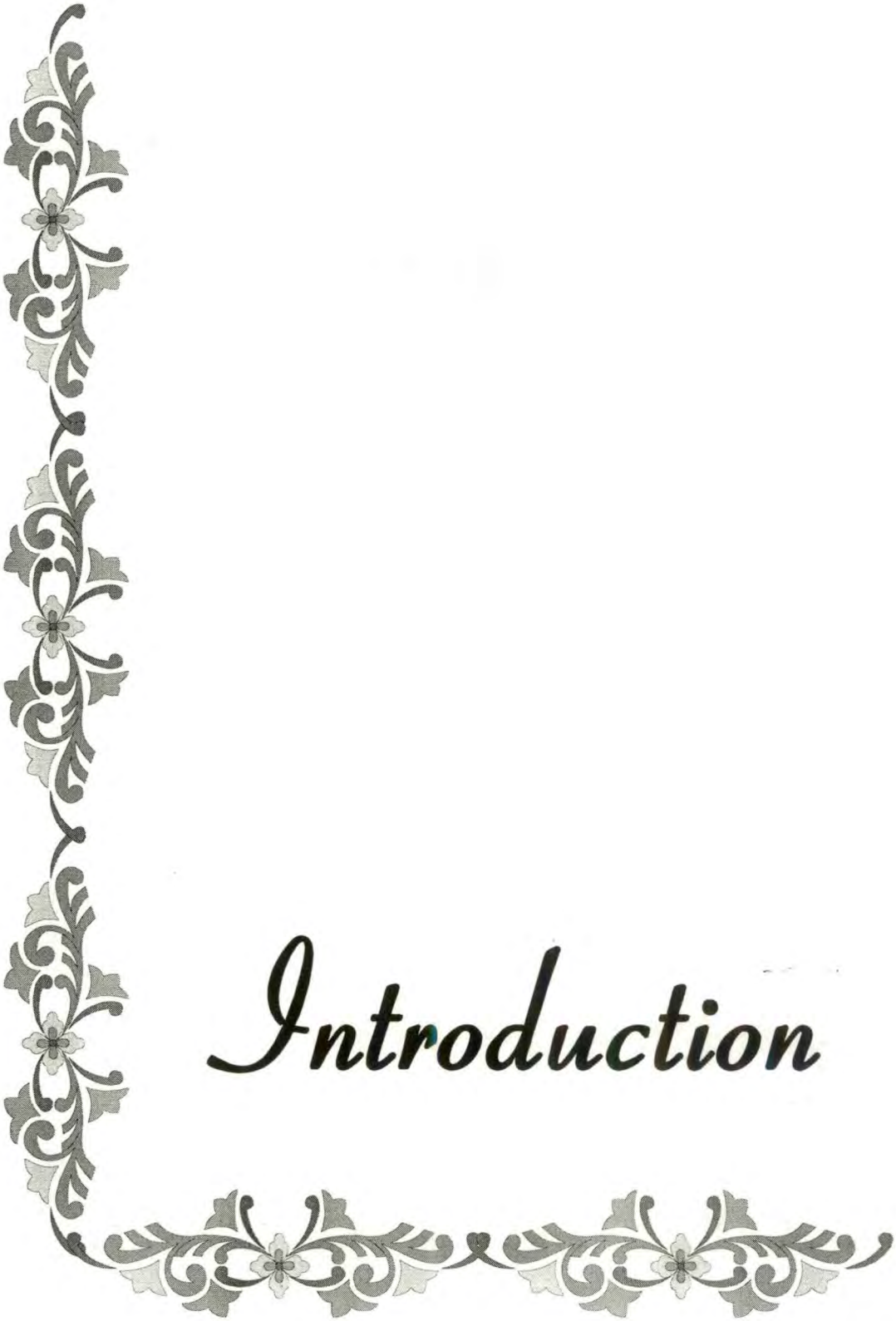
# ABBREVIATIONS

| | | |
|---|---|---|
| % | = | Per cent |
| / | = | per |
| @ | = | at the rate of |
| CD | = | Critical difference |
| cm | = | centimeter(s) |
| Cv. | = | cultivar(s) |
| DAS | = | Days after sowing |
| *et al.* | = | and other |
| etc. | = | etceteras |
| Fig. | = | Figure |
| g | = | gram (s) |
| ha | = | hectare |
| kg | = | kilogram (s) |
| m | = | meter (s) |
| N | = | North |
| No. | = | Number |
| NS | = | Non-significant |
| q | = | quintal (q ) |
| Sig. | = | Significant |
| SE | = | Standard error |
| t | = | tones ( t ) |
| viz., | = | videlicet (namely) |



# Introduction

# Chapter-1

## INTRODUCTION

The vegetables constitute one of the most important component of human diet and are perhaps the best source of almost all vitamins and minerals. They are rightly called as "Protective food" since they impart disease resistance to our body. In addition to their exemplary nutritive value they act as a source of income to growers. During the recent years, the interest in vegetable production has increased rapidly as a result of greater appreciation towards their food value.

Cluster bean or guar (*cyamopsis tetrogonoloba* (L.) Taub) belongs to the tribe galegae (indigoferae) of leguminosae family. The genus consists of three species out of which *cyamopsis tetrogonoloba* is the only member of economic importance.

Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub) commonly known as Guar is multipurpose legume vegetable. It is grown for pod vegetable, seed green fodder and green manuring. By nature it is a drought tolerant hardy legume, hence its cultivation is concentrated in the arid and semi-arid regions of India, Pakistan and South Africa. Major cluster bean cultivating countries are India, Pakistan and Africa. Out which India stands first in area and production. In India, cultivation of cluster bean is concentrated in the north-west regions comprising Haryana which stands first in area and prouduction, Punjab, Rajasthan, Uttar Pradesh, Gujarat and Maharashtra are other cluster bean growing States of India (Chamola and Hasija, 1984).

Cluster bean is an annual erect growing plant, it grows to a height of 2 m with stiff erect branches. Pods are compressed, linear, erect and clustered, double ridge on dorsal side and single ridge on below side, length 4-10 cm, 5-12 seeds per pod with white to grey or black in colour with an average weight of 0.06 g. Green pods contain 81.0 per cent moisture, carbohydrates 10.8 g, protein 3.2 g, fat 0.4 g, mineral 1.4 g , thiamine 0.09 mg, riboflavin 0.09 mg, vitamin C 47 mg, vitamin A – 316 IU per 100 g of pod (Parthasarathy, 2003). The guar seed contain 30-35 per cent protein, 26.8-32.2 per cent gum, 6.1-7.1 per cent oil and 2.99-3.75 per cent minerals.

In respect to it's industrially importance, guar seed having large endosperm that contains glactomonnan gum which forms gel in water commonly known as guar gum, which is used in multifarious, cosmetics, explosive, mining and oil industries, also in dairy products like ice-cream, stabilizer in cheese and textile paper through out world (Smith, 1976). It is used as a glaze in candy products, component in chewing gum, cough drops and candy lozenges, in baking industries for its viscosity and adhesive properties, foam stabilizer in beverages, colloid stabilizer in antiseptic preparation (Wistler Roy, 1982). The crop also has medicinal value for curing diabetes and those having cholesterol levels. Guar meal is not only rich nutritious feed for dairy and poultry animals, but also can become a non conventional oil source as it contains 5 to 6 per cent quality oil.

The total area under vegetable production in India is 67.56 lakh hectare with 1014.34 million tonnes of annual production and productivity of 15 t $ha^{-1}$ (Anonymous, 2006[a]). India produces

approximately 40 per cent of world guar seed production and grown on almost 23.30 lakh hectares area with productivity of 3.227 t $ha^{-1}$ (Anonymous,2006[a]).

In Maharashtra about 3.72 lakh hectare area is under vegetable cultivation producing 404.44 lakh tonnes of vegetables with average productivity of only 10.9 t $ha^{-1}$ (Anonymous, 2006[b]). Among them, area under cluster bean is only 4,671 hectare with production of 1,97,35 tonnes having productivity of 4.225 t $ha^{-1}$.In Marathwada total area under vegetable production is 0.64 lakh hectare with 3,91,394 metric tones of annual production.Among them, area under beans is only 615 hectare with annual production of 854 metric tones having productivity of 1.38 t $ha^{-1}$ (Anonymous, 2006[b]).

Though, the cluster bean have high nutritive value and industrial importance, also there is vast scope for its cultivation, selection of superior variety is necessary for commercial cultivation under Parbhani regions.

Hence, the present trial on "Studies on varietal performance of cluster bean under Marathwada condition" was undertaken with the following objectives.

1. To study the growth and yield performance of cluster bean varieties.
2. To find out the suitable variety for commercial cultivation in Marathwada region.

# Review of Literature

# Chapter-2

## REVIEW OF LITERATURE

Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub) is one of the important vegetable crops grown under tropical and subtropical regions of India. Cluster bean possess a wide range of variability for growth, yield and yield components. Selection of appropriate variety for a given situation can help in improving the yield levels.

A brief review of literature pertaining to attributes of growth and yield aspects in cluster bean and related other vegetable crops are given in thas chapter.

### 2.1 Evaluation

Mital *et al.* (1969) observed the maximum range of variation in total number of pods per plant, followed by plant height, yield and days to maturity in cluster bean. Also reported that the coefficient of variation was high for pods per plant and low for days taken to flower initiation in cluster bean sown in *kharif* season under Jodhpur and Delhi conditions.

Natarajan and Arumugam (1979) investigated about twenty cultivars of pea and recommended two varieties for commercial cultivation in Kodaikanal hills.

Mahale and Jadhav (1982) tested the performance of different guar varieties under Pune conditions and reported that number of branches per plant, number of pods per plant and 1000 grains weight were significantly influenced.

## 2.2 Growth characters

A wide range of variability for germination and growth characters has been reported.

### 2.2.1 Germination

Musil (1946) reported that the constant temperature of $30^0$C appeared to be optimum for germination of guar seed.

Mehta and Desai (1958) studied the effect of soil salinity on the germination of seed of several crop species and reported that the guar seeds exhibited the greatest salt tolerance.

Hymowitz and Matlock (1964) observed the significance difference in germination of guar seeds at different range of temperature and the highest germination of 81 per cent was occurred at $21.1^0$C temperature.

Nagpal and Bhatia (1970) observed changes in chemical constituents during the germination of guar seed and reported that total water soluble carbohydrates decreased progressively from 17.08 to 8.22 mg/seed and dry matter from 34 to 19 mg/seed. The protein content decreased in the beginning but increased slightly 24 hrs after germination.

Yadav *et al.* (1978) observed the significant differences in germination of seeds of different varieties of cluster bean.

### 2.2.2 Plant height

Sanghi *et al.* (1964) observed wide variability of phenotypic variation in plant height of guar in *kharif* season under Bassi (Rajasthan) conditions.

Mital *et al.* (1969) found the wide range in plant height of cluster bean which ranged from 72.7 to 201.8 cm during *kharif* season at Jodhpur.

Tikka *et al.* (1974) reported the range of 60.00 to 145.00 cm plant height in cluster bean during *kharif* season under Vallabhnagar conditions.

Sidhu *et al.* (1982) observed wide variability for plant height in twenty nine varieties of cluster bean in *kharif* season under Hissar conditions. The maximum plant height of 107.63 cm was recorded in HG-29 and followed by 105.8 cm in HG-11 and minimum plant height 60 cm in HG-20.

Dabas *et al.* ($1982^{b}$) observed the mean height of 73.1 in cluster bean varieties during *kharif* season under New Delhi conditions.

Vijay (1988) reported plant height ranging from 34.0 to 110.33 cm in cluster bean during *kharif* season under Gujarat conditions.

Vijay Kumar and Balasubramaniyan (1990) evaluated cluster bean varieties and observed the maximum plant height in variety Guar-80 (156.2 cm) and minimum height in variety HGR-312 (110.6 cm) during *kharif* season under Bhavanisagar conditions.

Gipson and Balakrishnan (1990) reported the range of plant height from 15.5 to 105.63 cm in cluster bean during *kharif* at Madurai.

Singh *et al.* (2003) reported the wide range of variation (90.67 to 143.80 cm)in plant height of different varieties of guar during *kharif* under Durgapura conditions.

Buttar and Aggarwal (2006) observed maximum of 154.00 cm and minimum of 92.8 cm height in cluster bean during *kharif* season at Bathinda.

### 2.2.3 Stem girth

Kirti Singh *et al.* (1974) reported significant differences for stem diameter in different varieties of bhendi. They reported the maximum diameter of stem 2.88 cm in I.C. 8899 and the minimum diameter of 1.66 cm in Kashmiri local variety.

Gondane *et al.* (1995) reported a significant difference for diameter of stem of bhendi variety Pb 57 attained the maximum diameter of 2.40 cm and Vaishali Vadha recorded the minimum diameter of 1.86 cm.

### 2.2.4 Number of branches per plant

Sanghi *et al.* (1964) observed the wide range of branches per plant in cluster bean varieties, which was ranging from 7.05 to 12.25 in *kharif* season under Bassi (Rajasthan) conditions.

Dass *et al.* (1978) observed the wide range of 0 to 9.45 number of branches per plant in cluster bean during *kharif* season under Hissar conditions.

Dabas *et al.* (1982[b]) studied the cluster bean germplasm and reported 11.2 average branches per plant during *kharif* season at New Delhi.

Radhakrishnan and Jebraj (1982) reported that the number of branches per plant in cowpea varied from 1.25 to 4.00.

Sidhu *et al.* (1982) reported 1.20 to 6.50 number of branches per plant in cluster bean in *kharif* season under Hissar conditions.

Gipson and Balakrishnan (1990) found the wide range of branches per plant in cluster bean varieties which was varied from 1.0 to 16.0 during *kharif* season at Madurai.

Vijay Kumar and Balasubramaniyan (1990) reported the maximum number of branches per plant in cluster bean variety HS-51366 (16.0) and the minimum number of branches (8.6) per plant in variety GG-1.

Singh *et al.* (2003) reported the highest coefficient of variation (87.88%) in primary branches per plant and 8.0 to 9.77 branches per plant in cluster bean during *kharif* under Durgapura conditions.

Deepak Arora *et al.* (2005) reported the range of 0.00 to 11.93 branches per plant in cluster bean grown in *kharif* season at Ludhiana.

Buttar and Aggarwal (2006) observed number of branches between 0.4 to 12.2 in cluster bean during *kharif* season under Bhatinda conditions.

### 2.2.5 Number of leaves per plant

Uprety *et al.* (1978) reported that the number of leaves varied from 19.66 ( JC-10) to 43.00 (Pusa Barasati mutant) in cowpea genotypes.

Gupta and Lodhi ( 1979) reported the range of 37 to 98 leaves per plant in cowpea varieties.

Suryanarayana (1982) reported the range of 20.75 to 52.50 leaves per plant in cowpea genotypes under Andhra Pradesh conditions.

Chikkapadhyayaiah (1983) reported the range of 28.88 to 133.90 leaves per plant in cowpea genotypes Bangalore.

Kipgen (1987) reported that Pusa Dofasali variety of cowpea produced highest number of leaves per plant (27.60), whereas Sel 16-B variety recorded the minimum number of leaves (19.26).

Borah and Shadeque (1992) reported 346.27 to 733.58 leaves per plant in Dolichos bean in *kharif* season under Jorhat conditions.

### 2.2.6 Leaf area

Uprety *et al.* (1978) reported that the leaf area per plant varied from 1705.50 $cm^2$ in Pusa Phalguni to 3067.75 $cm^2$ in Pusa Dofasli of cowpea varieties in *kharif* season.

Nangju and Wanki (1980) estimated the leaf area of cowpea at 50 days after sowing and reported that both leaf number and leaf dry weight per plant were highly correlated with leaf area per plant.

Duranti *et al.* (1982) reported that pod yield was positively correlated with leaf area and plant height in French bean.

Borah and Shadeque (1992) observed the range 41.73 to 82.91 $cm^2$ of leaf area in Dolichos bean in *kharif* season under Jorhat conditions.

## 2.3 Yield and yield contributing characters

### 2.3.1 Days required for flower initiation

Mital *et al.* (1969) observed that the number of days taken to flower initiation in guar varieties were ranged from 32 to 45 days in *kharif* season under Jodhpur conditions.

Lobana and Verma (1972) observed the range of 34 to 38 days taken to flower initiation in cluster bean during *kharif* season at Ludhiana.

Tikka *et al.* ( 1974) observed a range of 34.30 to 71.00 days to flower initiation in cluster bean during *kharif* under Vallabhnagar conditions.

Dabas *et al.* ($1982^{b}$) reported average of 62.1 days taken to first flowering in 300 accessions of cluster bean during *kharif* season at New Delhi.

Vijay (1988) observed range of 30 to 39 days required for flower initiation in cluster bean during *kharif* season, under Gujarat conditions.

Gipson and Balakrishnan (1990) recorded wide range of variation for days to first flowering, which varied from 31.5 to 52.5 days in cluster bean during *kharif* season under Madurai conditions.

Solanki and Choudhary (1996) studied the stability analysis in cluster bean and reported the range of 31.6 to 41.0 days taken to first flowering during *kharif* season under Mandor conditions.

Brindha *et al.* (1995) reported that number of days taken to flowering direct effect on pod yield in cluster bean.

Deepak Arora *et al.* (2005) reported 26.33 to 50.67 days for flower initiation in cluster bean during *kharif* season under Punjab conditions.

### 2.3.2 Days required for 50 per cent flowering

Dass *et al.* (1973) observed a narrow range of variability for number of days to 50 per cent flowering in cluster bean in *kharif* season at Hissar.

Natrajaratham *et al.* (1984) observed that the days taken to 50 per cent flowering in different genotypes ranged from 44 to 50 days in cowpea, also reported that the high yielder genotypes flowered 5.7 days earlier than low yielders.

Kipgen (1987) revealed that the days required for 50 per cent flowering ranged from 46.75 to 59.50 days in cowpea in *kharif* season under Konkan conditions.

Roy and Das (2000) observed the range of 35 to 69 days for 50 per cent flowering in pea in rabi season under Diphu (Assam) conditions.

Tyagi *et al.* (2000) reported that seed yield per plant had high significant positive correlation with days to 50 per cent flowering in cowpea.

Singh *et al.* (2003) studied genetic divergence in cluster bean during *kharif* season and reported that days to 50 per cent flowering in cluster bean varieties ranged from 20.00 to 33.83 days under Durgapura conditions.

Rao and Kumar (2003) observed the range of 64 to 73 days required for 50 per cent flowering in chickpea in *kharif* season under Jabalpur conditions.

### 2.3.3 Days required for picking of green pods

Mital *et al.* (1969) reported the range of 64 to 80 days taken to maturity in cluster bean in *kharif* season under Jodhpur conditions.

Vijay (1988) reported that cluster bean pod maturity exhibited positive direct effect on green pod yield and observed range of 42.67 to 59.33 days required for pod maturity in cluster bean in *kharif* season under Godhra (Gujarat) conditions.

Choudhary and Bhatnagar (1995) recorded the correlated response of seed yield in cluster bean and reported that the average number of days from sowing to first picking were 65.48 days during *kharif* season under Mandor, (Rajasthan) conditions.

Mohan *et al.* (2003) reported the range of 53.33 to 119.33 days taken to marketable maturity in pea at Ludhiana.

Deepak Arora *et al.* (2005) observed the range of 40.67 to 63.67 days for pod maturity in cluster bean during *kharif* season at Ludhiana.

### 2.3.4 Number of pods per plant

Sanghi *et al.* (1964) reported the wide range of 52.25 to 96.82 pods per plant in cluster bean in *kharif* season under Bassi (Rajasthan) conditions.

Mital *et al.* (1969) studied the variability in guar and found the range of 18.00 to 158.0 pods per plant during *kharif* season at Jodhpur.

Tikka (1973) reported 46.7 to 314 pods per plant in cluster bean varieties in *kharif* season at Vallabhnagar (Rajasthan).

Vashistha *et al.* (1981) reported that yield of cluster bean per plant and number of pods per cluster were found to have comparatively high genetic coefficients of variation than other characters and reported

4.60 to 11.0 number of pods per cluster in *kharif* season under Haryana conditions.

Dabas *et al.* (1982[b]) reported 96 to 198 number of pods per plant in cluster bean in *kharif* season under New Delhi conditions.

Vijay (1988) reported range of 20.14 to 121.47 number of pods per plant in cluster bean in *kharif* season under Godhra (Gujrat) conditions.

Gipson and Balakrishnan (1990) reported 29.36 to 280.13 pods per plant in cluster bean during *kharif* season under Madurai conditions.

Vijay Kumar and Balasubramaniyan (1990) observed the range of 101 to 256 number of pods per plant in cluster bean in *kharif* season at Bhavanisagar.

Deepak Arora *et al.* (2005) reported the range of 172.31 to 623.34 in cluster bean grown in *kharif* season at Ludhiana.

Buttar and Aggarwal (2006) observed maximum of 137 pods per plant and minimum of 60.4 pods per plant in cluster bean sown in *kharif* season under Bhatinda (Punjab) conditions.

### 2.3.5 Length of pod

Sanghi *et al.* (1964) observed the range of 4.07 to 5.15 cm pod length in cluster bean varieties in *kharif* under Bassi (Rajasthan) condition.

Mital *et al.* (1969) recorded the wide range of pod length in cluster bean varieties which ranging from 4.01 to 9.36 cm in *kharif* season under Jodhpur conditions.

Tikka (1975) reported 4.1 to 11.1 cm pod length in cluster bean varieties in *kharif* season under Vallabhnagar conditions.

Vashistha *et al.* (1981) reported that the length of pods was ranging from 4.80 to 6.40 in *kharif* under Haryana conditions.

Dabas *et al.* (1982[a]) noted that additive, dominance and epistatic gene effects were operating in the inheritance of pod length in cluster bean.

Dabas *et al.* (1982[b]) reported mean pod length of 5.2 cm in cluster bean sown in *kharif* season under New Delhi conditions.

Mahale and Jadhav (1982) reported that the range of 3.70 to 4.30 cm in pod length of cluster bean sown in *kharif* season under Pune conditions.

Sidhu *et al.* (1982) studied different cluster bean varieties and reported wide variation in length of pods from 4.50 to 9.20 cm during *kharif* season under Hissar conditions.

Vijay (1988) reported that length of pod varies from 3 to 11.33 cm in cluster bean varieties sown in *kharif* season under Godhra (Gujarat) conditions.

Gipson and Balakrishnan (1990) studied the variability in cluster bean and observed the pod length ranging from 4.61 to 12.94 cm in *kharif* season under Madurai conditions.

Singh *et al.* (2003) reported that the pod length of 60 cluster bean varieties was ranging from 5.32 to 7.72 cm at Durgapura in *kharif* season.

### 2.3.6 Width of pod

Jana and Chattopadhyay (1977) observed the pod width ranging from 1.3 to 4.1 cm in hyacinth bean at Kalyani in Rabi season.

Singh *et al.* (1979) reported the pod width between 1.39 to 3.50 cm in Indian bean at Hissar.

Baswana *et al.* (1980) reported width of pod ranging from 0.96 to 4.61 cm in dolichus lablab at Hissar.

Pandita *et al.* (1980) observed the pod width ranging from 0.14 to 4.63 cm in Indian bean in *kharif* season under Haryana conditions.

Borah and Shadeque (1992) observed the width of pod ranging from 1.47 to 3.67 cm in dolichos bean at Jorhat (Assam) in *kharif* season.

### 2.3.7 Weight of pod

Baswana *et al.* (1980) observed the maximum pod weight of 10.91 g and minimum of 1.35 g in dolichos bean during *kharif* season at Hissar.

Vijay (1988) observed the weight of pod ranging from 0.20 to 0.83 g in cluster bean during *kharif* season under Godhra, Gujarat conditions.

Gipson and Balakrishnan (1990) observed the range of 1.35 to 5.65 g weight of pod in cluster bean in *kharif* season at Madurai.

Borah and Shadeque (1992) reported the pod weight from 3.52 to 10.09 g in dolichos bean during *kharif* season under Jorhat, Assam conditions.

### 2.3.8 Yield of pods

The yield is the final product of growth and development of a plant and manifested by the interaction of a variety with environment. The yield is a varietal character which is contributed by various components, season and soil condition.

Sanghi and Sharma (1964) reported that the total correlation between yield and number of pods per plant, branches per plant and pod length were significant in cluster bean in *kharif* season under Bassi conditions.

Sanghi *et al.* (1964) recorded genotypic and phenotypic variability in yield and other quantitative characters in guar and reported the wide range of 7.95 to 19.92 g seed yield per plant during *kharif* season at Bassi (Rajasthan).

Mital and Thomas (1969) observed a positive correlation of seed weight with grain yield in cluster bean.

Menon *et al.* (1973) reported that green pod yield was highly correlated with pod length, number of pods and number of cluster per plant.

Baswana *et al.* (1980) reported that the pod yield per plant of Indian bean was ranging from 0.45 to 3.89 kg in *kharif* season under Hissar conditions.

Paroda *et al.* (1980) recorded the mean performance of different varieties of cluster bean and reported maximum seed yield (881 kg/ha) in Naveen and (883 kg/ha) in Suvidha. The minimum seed yield reported (734 kg/ha) in variety RGC 967.

Vashistha *et al.* (1981) reported 0.81 to 2.27 kg green pod yield per plant in cluster bean in *kharif* season under Hissar conditions.

Sidhu *et al.* (1982) reported that the maximum pod yield of 569 g per plant in variety HG-11 of cluster bean during *kharif* season at Hissar.

Vijay (1988) recorded that green pod yield per plant and pod number had high genotypic coefficient of variation as compared to other components and reported 49.67 g to 166.29 g green pod yield per plant in cluster bean in *kharif* season under Godhra (Gujarat) conditions.

Gipson and Balkrishnan (1990) reported that the green pod yield per plant was ranging between 93.75 to 832.35 g in cluster bean during *kharif* season under Madurai conditions.

Deepak Arora *et al.* (2005) reported the range of 0.217 to 0.798 kg pod yield per plant in cluster bean varieties in *kharif* season at Ludhiana.

### 2.3.9 Green pod yield per hectare

Menon *et al.* (1973) reported that green pod yield was highly correlated with the pod length, number of pods and number of clusters per plant in cluster bean.

Paroda *et al.* (1980) recorded the mean performance of different varieties of cluster bean in *kharif* season and reported that the seed yield was varying from 734 to 883 kg $ha^{-1}$ under Durgapura conditions.

Ogunbodede (1989) showed that pods per plant, seeds per pod and seed weight together account for about 92 per cent of yield variation in cowpea.

Vijay Kumar and Balasubramaniyan (1990) evaluated the cluster bean varieties and reported that the pod yield was ranging from 57.39 to 154.19 q $ha^{-1}$ in *kharif* season under Bhavanisagar conditions.

Brindha *et al.* (1995) reported that the pod length had positively correlated with yield and number of days taken to flowering exhibited direct effect on pod yield in cluster bean.

### 2.3.10 Crop duration

Shivashankar and Kulkarni (1989) observed the crop duration between 90 to 115 days in field bean at Bangalore.

Rajput *et al.* (1990) reported that the crop duration was ranging from 93 to 111 days in cowpea under Wakawali (Maharashtra) conditions.

# Material and Methods

# Chapter-3

# MATERIAL AND METHODS

The details regarding the materials used and methods followed during the course of present investigation have been explained in this chapter.

## 3.1 Experimental Site

The present investigation on "Studies on varietal performance of cluster bean under Marathwada condition" was carried out at Horticultural Research Scheme (Vegetable), Department of Horticulture, Marathwada Agricultural University, Parbhani during *kharif* season of the year 2008-09. The site was selected on the basis of suitability of the land for cultivation of cluster bean.

## 3.2 Climate

Parbhani is situated in the sub-tropical region at the latitude $19^0$, 16' N. Longitude $76^0$, 47' and has an altitude of 409 meters above mean sea level. The average annual rainfall is about 750 mm and received in 65 rainy days and occasionally in winter season. The mean minimum temperature ranges from $8.3^0$C in winter to about $18^0$C in summer. The maximum temperature ranges from $37.77^0$C to $46.11^0$C. The humidity varies from 18 per cent to 92 per cent. The details of meteorological data were recorded at Meteorological

Observatory, Marathwada Agricultural University, Parbhani. The data for *kharif* 2008-09 is presented in APPENDIX-I.

### 3.3 Soil

The experiment was conducted on medium black soil of moderate fertility and good drainage.

### 3.4 Experimental details

The experiment was laid out in a Randomized Block Design with 10 varieties as treatments replicated three times in the field as shown in Fig.1.

**Varieties**

| | | | |
|---|---|---|---|
| $T_1$ | Selection Sarika | $T_6$ | Samruddhi |
| $T_2$ | Malav 51 | $T_7$ | Varun |
| $T_3$ | Jyoti 51 | $T_8$ | Navlakha (Local) |
| T4 | Nylon 55 | $T_9$ | Abhijeet (Local) |
| $T_5$ | Ankur Rani | $T_{10}$ | Pusa Navbahar (Check) |

#### 3.4.1 Plot size

Gross plot size : 3.6 m x 3.0 m

Net plot size : 3.0 m x 2.7 m

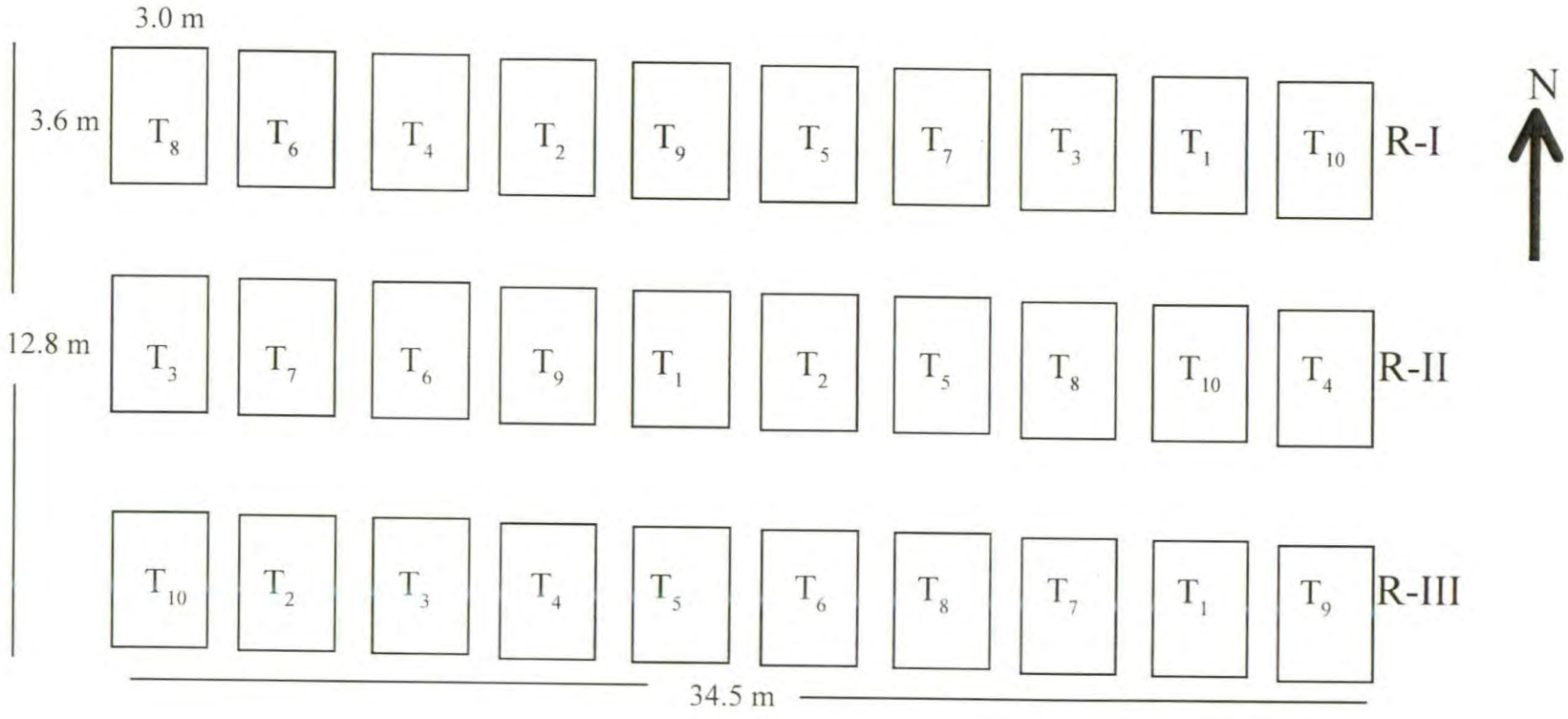
Spacing : 60 x 30 cm

#### 3.4.2 Plant population

Gross plot : 60 plants

Net plot : 32 plants

**3.4.3 Date of sowing** : 8th August, 2008.




| | | |
|---|---|---|
| Design | : | Randomized Block Design |
| Num ber of treatments | : | Ten |
| Numbr of replications | : | Three |
| Plant spacing | : | 60 cm x 30 cm |

**Fig. 1. PLAN OF LAYOUT OF EXPERIMENTAL PLOT**

### 3.5 Details of cultural operations of experimental crop.

The details regarding important cultural operations carried out in the experimental field during the course of investigation are presented as below.

#### 3.5.1 Preparation of land

The experimental plot was brought to the fine tilth by one ploughing clod crushing and two harrowings. The plot was then leveled and kept clean. The bed of 3.6 m x 3.0 m size were prepared 50 cm width on all sides of treatment plot for proper drainage.

#### 3.5.2 Seed material

The seeds of experimental varieties of cluster bean were obtained from the different seeds companies. The seeds were treated with Captan @ 2 g/lit and then sown in experimental plot as per layout.

| Sr.No. | Name of variety | Source |
|---|---|---|
| 1 | Selection Sarika | Deepa seeds, Jalna |
| 2 | Malav 51 | Malav seeds, Pvt. Ltd., Ratlam |
| 3 | Jyoti 51 | Patel seeds corporation, Baroda |
| 4 | Nylon 55 | Sardar seeds company Pvt. Ltd., Jodhpur |
| 5 | Ankur Rani | Ankur seeds Pvt. Ltd., Nagpur |
| 6 | Samruddhi | Kranti seeds, Nanded |
| 7 | Varun | Varun seeds Pvt. Ltd., Nanded |
| 8 | Navlakha | Navlakha seeds Pvt. Ltd., Pune |
| 9 | Abhijeet | Abhijeet seeds, Nashik |
| 10 | Pusa Navbahar | MAU, Parbhani |

### 3.5.3 Application of manures and fertilizers

Farm yard manures was applied @ 10 tonnes per hectare which was mixed thoroughly with the soil. The fertilizers were applied @ 15 kg nitrogen (N), 50 kg phosphorus ($P_2O_5$) and 50 kg potash ($K_2O$) per hectare, through urea, single super phosphate and muriate of potash, respectively. The full dose of phosphorus and potash was applied at the time of sowing. The nitrogen was applied in two equal split doses and the first dose was given along with phosphorus and potash at the time of sowing. The second split dose of nitrogen was applied 30 days after sowing.

### 3.5.4 Sowing

The seeds were sown at 30 cm apart. The 2 to 3 seeds were dibbled at each spot. Thinning of plot was done 10 days after sowing, retaining only one healthy seedling per spot.

### 3.5.5 Other cultural operations

Three weedings were undertaken at monthly interval after sowing. The earthing up was carried out after the application of second dose of nitrogen.

### 3.5.6 Plant protection measures

Alternate spraying of endosulphan @ 1.5 ml/lit and phosphamidon @ 4 ml/lit for the control of insects and pests and spray of bavistin @ 1 g/lit was given after 50 days interval for control of diseases.

### 3.5.7 Harvesting

The pods were harvested at full grown but tender characteristic size and colour. The picking of pod was done at 65.08 days after sowing at 8 days interval.

### 3.6 Observations

Observations on various characters were recorded on five competitive randomly selected plants for each varieties and average was worked out to represent treatment mean of the replication.

#### 3.6.1 Growth characters

The growth characters viz., height of the plant, stem girth, number of branches, number of leaves recorded on $30^{th}$, $60^{th}$ and $90^{th}$ days after sowing. The leaf area was recorded at 90 days after sowing.

##### 3.6.1.1 Germination

The days required for germination and germination percentage was recorded in field.

##### 3.6.1.2 Plant height (cm)

The height of plant was measured from the base i.e. from ground level to the top most growing tip at a 30 days interval by scale, then the average of plant height was worked out.

##### 3.6.1.3 Stem girth (cm)

Stem girth at 10 cm height above ground level was measured on five selected plants at a 30 days interval by scale and average stem girth was worked out.

##### 3.6.1.4 Number of branches per plant

The number of branches per plant was counted on five selected plants at 30 days interval and average number of branches were worked out.

##### 3.6.1.5 Number of leaves per plant

The total number of leaves were counted on five selected plants at 30 days interval and average number of leaves per plant was worked out.

### 3.6.1.6 Leaf area ($cm^2$)

The leaf area of each variety was determined by Leaf area meter.

### 3.6.2 Yield and yield contributing characters

### 3.6.2.1 Days required for flower initiation

Days required for commencement of flower from date of sowing was recorded and average was worked out.

### 3.6.2.2 Days required for 50% flowering

Days required to flowering of 50% plants in a plot was recorded in each variety.

### 3.6.2.3 Days required for first picking of green pods

Days required for first picking of green pods was recorded on five selected plants and average days for first picking of green pods was worked out.

### 3.6.2.4 Number of pods per plant

The total number of pods per plant at every harvest were counted on five selected plants and average was worked out.

### 3.6.2.5 Length of pod (cm)

The length of 5 selected pods of selected plant of a variety were recorded from the proximal end of pod to distal end and average pod length was worked out.

### 3.6.2.6 Width of pod (cm)

The width of 5 selected pods of selected plant of a variety were recorded and average width was worked out.

#### 3.6.2.7 Weight of pod (g)

Weight of 5 selected pods of each selected plant of a variety were recorded and average was worked out.

#### 3.6.2.8 Green pod yield per plant (g)

The yield of green tender pods of five selected plants per plot was recorded and average yield per plant was worked out.

#### 3.6.2.9 Green pod yield per plot (kg) and yield per hectare (q)

The yield of green pods per plot were recorded from the plot of each variety and green pod yield per hectare was calculated from green pod yield per plot.

#### 3.6.2.10 Crop duration (days)

Crop duration was recorded from date of sowing to the final harvesting of pod.

### 3.7 Statistical Analysis

Data was statistically analyzed by using mean standard error and coefficient of variation. They were calculated as per the procedure given by Panse and Sukhatme (1967).

# Results

# Chapter-4

## RESULTS

The present investigation entitled "Studies on varietal performance of cluster bean under Marathwada condition" was undertaken with ten varieties of cluster bean in three replications with following objectives.

1. To study the growth and yield performance of cluster bean varieties
2. To find out suitable variety for commercial cultivation in Marathwada region

The data were recorded on five randomly selected competitive plants from each variety in each replication. The characters studied were grouped as under:

4.1 Growth characters

4.1.1 Days required for germination

4.1.2 Germination percentage

4.1.3 Plant height at 30 days interval (cm)

4.1.4 Stem girth at 30 days interval (cm)

4.1.5 Number of branches per plant at 30 days interval

4.1.6 Number of leaves per plant at 30 days interval

4.1.7 Leaf area ($cm^2$)

4.2 Yield contributing characters

4.2.1 Days required for flower initiation

4.2.2 Days required for 50 per cent flowering

4.2.3 Days required for first picking of green pods

4.2.4 Number of pods per plant

4.2.5 Length of pod (cm)

4.2.6 Width of pod (cm)

4.2.7 Weight of pod (g)

4.2.8 Green pod yield per plant (g)

4.2.9 Green pod yield per plot (kg) and pod yield per hectare (q)

4.2.10 Crop duration (days)

## 4.1 Growth characters

The growth characters studied in the present investigation were days required for seed germination, germination percentage, plant height, stem girth, number of branches per plant, number of leaves and leaf area per plant.

### 4.1.1 Days required for seed germination

Days required for seed germination was recorded in each variety of cluster bean and presented in Table 1.

It is revealed from the data, days required for germination does not varied significantly among the different cluster bean varieties. Most of varieties get germinated within 3.95 to 5.36 days. However, the early germination was recorded in variety Varun (3.95 days) and Malav 51 (4.03 days) as compared to other varieties; whereas cluster bean variety Selection Sarita (5.36 days) and Pusa Navbahar (5.26 days) required more days for germination.

**Table 1. Days required for seed germination and germination percentage by different varieties of cluster bean**

| Sr. No. | Variety | Days required for seed germination | Germination (per cent) |
|---|---|---|---|
| 1 | Selection Sarika | 5.36 | 86.90 |
| 2 | Malav 51 | 4.03 | 92.33 |
| 3 | Jyoti 51 | 4.30 | 91.07 |
| 4 | Nylon 55 | 4.46 | 88.33 |
| 5 | Ankur Rani | 4.70 | 90.16 |
| 6 | Samruddhi | 4.33 | 90.10 |
| 7 | Varun | 3.95 | 93.83 |
| 8 | Navlakha (Local) | 4.33 | 88.51 |
| 9 | Abhijeet (Local) | 4.70 | 87.43 |
| 10 | Pusa Navbahar (Check) | 5.26 | 90.70 |
| | 'F' test | Sig. | Sig. |
| | SE ± | 0.231 | 0.983 |
| | CD at 5% | 0.687 | 2.916 |

### 4.1.2 Germination per cent

The seed germination percentage of different varieties of cluster bean was recorded and presented in Table 1.

It is revealed from the data, germination percentage was varied significantly among the different cluster bean varieties. The germination was ranged from 86.90 to 93.83 per cent. The highest germination percentage was noticed in Varun (93.83 per cent), which was

**Table 12: Correlation of independent variable with satisfaction regarding illumination.**

| Satisfaction<br><br>Independent variable | Better Visibility of work station | Placement of Light fixture | Reflectance of light | Curtains for Avoiding glare | Wattage of tube | Control safety | Light on the work place | Intensity of light | Placement of light | Type of light |
|---|---|---|---|---|---|---|---|---|---|---|
| **Age group** | | | | | | | | | | |
| Group-I (35-45Yr) | 0.06 $^{NS}$ | 0.19* | -0.00 $^{NS}$ | 0.19* | -0.03 $^{NS}$ | 0.08 $^{NS}$ | 0.25** | -0.03 $^{NS}$ | 0.27** | 0.08 $^{NS}$ |
| Group-II (45 & above) | 0.13 $^{NS}$ | 0.03 $^{NS}$ | -0.01 $^{NS}$ | 0.19* | -0.06 $^{NS}$ | 0.06 $^{NS}$ | 0.15 $^{NS}$ | 0.21* | 0.01 $^{NS}$ | 0.00 $^{NS}$ |
| **Type of work** | | | | | | | | | | |
| Group-I (Clerk) | 0.01 $^{NS}$ | -0.08 $^{NS}$ | -0.01 $^{NS}$ | 0.21* | -0.04 $^{NS}$ | 0.06 $^{NS}$ | 0.00 $^{NS}$ | -0.04 $^{NS}$ | -0.01 $^{NS}$ | -0.02 $^{NS}$ |
| Group-II (Adm) | -0.04 $^{NS}$ | 0.00 $^{NS}$ | 0.11 $^{NS}$ | -0.10 $^{NS}$ | -0.12 $^{NS}$ | -0.07 $^{NS}$ | 0.12 $^{NS}$ | 0.10 $^{NS}$ | 0.19* | 0.12 $^{NS}$ |
| **Eye Sight** | | | | | | | | | | |
| Group-I (SS) | 0.09 $^{NS}$ | -0.10 $^{NS}$ | 0.26** | -0.05 $^{NS}$ | -0.16 $^{NS}$ | -0.00 $^{NS}$ | -0.15 $^{NS}$ | 0.00 $^{NS}$ | -0.14 $^{NS}$ | 0.28** |
| Group-II (N) | 0.19* | -0.05 $^{NS}$ | 0.06 $^{NS}$ | -0.05 $^{NS}$ | 0.15 $^{NS}$ | 0.10 $^{NS}$ | -0.08 $^{NS}$ | -0.04 $^{NS}$ | -0.00 $^{NS}$ | 0.17 $^{NS}$ |
| Group-III (LS) | -0.09 $^{NS}$ | 0.06 $^{NS}$ | -0.22* | 0.19* | 0.20* | -0.03 $^{NS}$ | 0.17 $^{NS}$ | 0.16 $^{NS}$ | 0.03 $^{NS}$ | -0.02 $^{NS}$ |
| Group-IV (BF) | 0.21* | -0.14 $^{NS}$ | 0.09 $^{NS}$ | -0.16 $^{NS}$ | 0.07 $^{NS}$ | 0.11 $^{NS}$ | 0.02 $^{NS}$ | 0.06 $^{NS}$ | -0.18 $^{NS}$ | 0.15 $^{NS}$ |

*Denotes significance at 5% level

** Significance 1% level N.S. = Non significant value

at par with Malav 51 (92.33 per cent) and Jyoti 51 (91.07 per cent), whereas cluster bean variety Selection Sarika (86.90 per cent) recorded lower germination percentage which was at par with Abhijeet (87.43 per cent), Nylon 55 (88.33 per cent) and Navlakha (88.51 per cent).

### 4.1.3 Plant height (cm)

Plant height at 30 days interval was recorded in each variety of cluster bean and presented in Table 2 and illustrated by Fig. 2.

**Table 2. Plant height of different varieties of cluster bean at various stages of growth**

| Sr. No. | Variety | Plant height (cm) | | |
|---|---|---|---|---|
| | | 30 DAS | 60 DAS | 90 DAS |
| 1 | Selection Sarika | 18.63 | 34.11 | 65.98 |
| 2 | Malav 51 | 21.16 | 42.52 | 89.12 |
| 3 | Jyoti 51 | 20.50 | 41.72 | 75.85 |
| 4 | Nylon 55 | 17.20 | 32.65 | 59.63 |
| 5 | Ankur Rani | 18.95 | 33.95 | 56.71 |
| 6 | Samruddhi | 18.50 | 31.90 | 68.65 |
| 7 | Varun | 22.32 | 52.80 | 92.46 |
| 8 | Navlakha (Local) | 19.96 | 34.95 | 65.29 |
| 9 | Abhijeet (Local) | 19.24 | 34.96 | 65.98 |
| 10 | Pusa Navbahar (Check) | 18.76 | 40.60 | 71.43 |
| | 'F' test | NS | Sig. | Sig. |
| | SE ± | 1.034 | 1.205 | 0.880 |
| | CD at 5% | 3.068 | 3.574 | 2.612 |

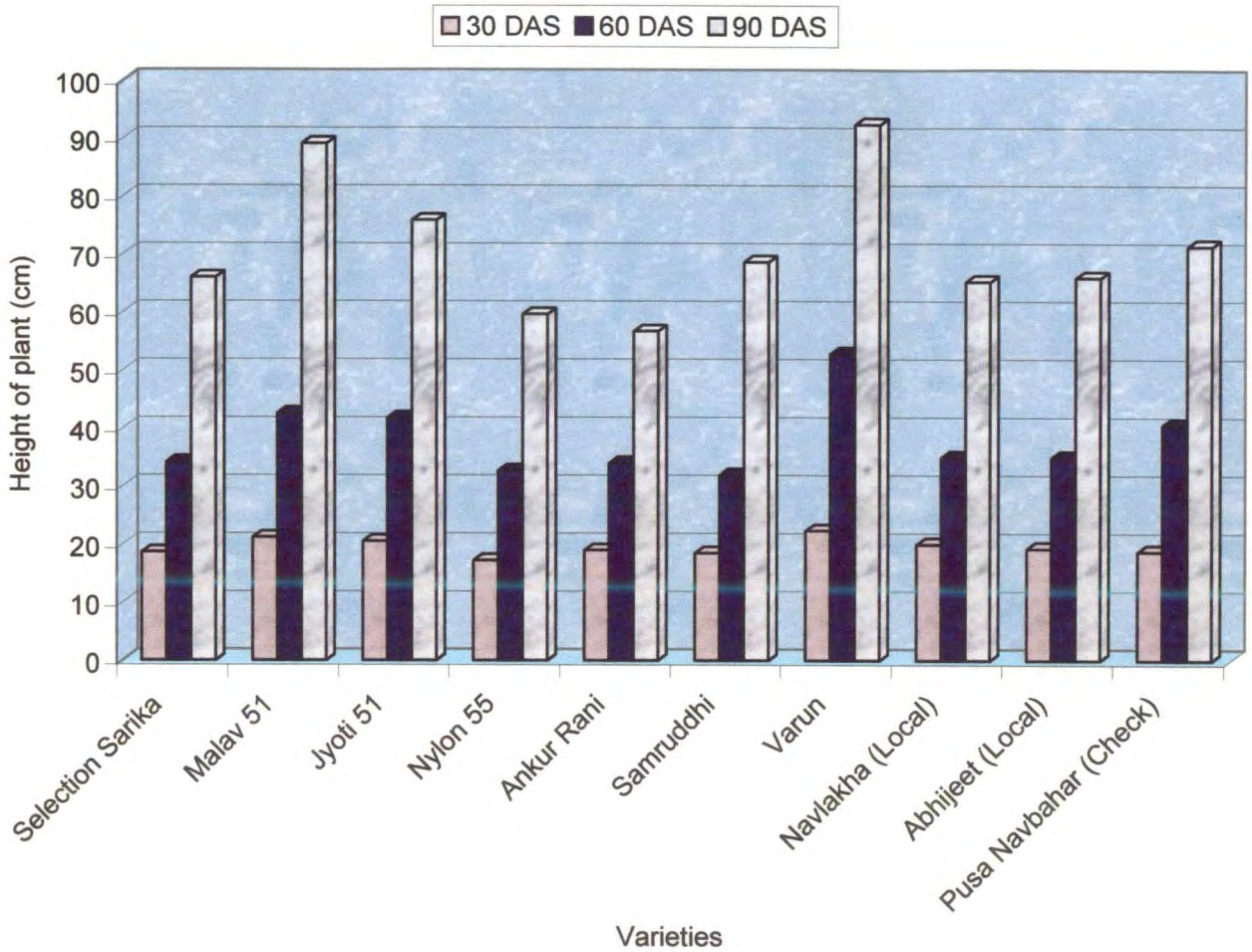



Fig. 2. Plant height of different varieties of cluster bean at various stages of growth.

In respect of plant height at 30 days after sowing, plant height does not varied significantly among different varieties. The plant height was recorded from 17.20 to 22.32 cm. However, maximum plant height was recorded in variety Varun (22.32 cm), which was at par with Malav 51 (21.16 cm) and Jyoti 51 (20.50 cm). The minimum plant height was recorded in variety Nylon 55 (17.20 cm).

In respect of plant height at 60 days after sowing, plant height was significantly varied significantly among different varieties. Significantly maximum plant height was recorded in variety Varun (52.80 cm), which was significantly superior over all other varieties. Significantly minimum plant height was recorded in variety Samruddhi (31.90 cm), which was at par with Nylon 55 (32.65 cm), Selection Sarika (34.11 cm), Navlakha (34.95 cm) and Abhijeet (34.96 cm). Varieties Jyoti 51 (41.72 cm) and Malav 51 (42.52 cm) recorded intermediate plant height and were at par with Pusa Navbahar (40.60 cm).

In relation to plant height at 90 days after sowing, significantly maximum plant height was recorded in variety Varun (92.46 cm) followed by Malav 51 (89.12 cm) which was significantly superior over all other varieties. Significantly minimum plant height was recorded in variety Ankur Rani (56.71 cm). Varieties Navlakha (65.29 cm), Abhijeet (65.98 cm) and Selection Sarika (65.98 cm) recorded intermediate plant height and were at par with each other. Variety Samruddhi (68.65 cm) was found to be at par with Pusa Navbahar (71.43 cm).

### 4.1.4 Stem girth of plant (cm)

Stem girth of plant was recorded at 10 cm height above ground level at 30 days interval and presented in Table 3.and illustrated by Fig. 3.

**Table 3. Stem girth of different varieties of cluster bean at various stages of growth**

| Sr. No. | Variety | Stem girth (cm) | | |
|---|---|---|---|---|
| | | 30 DAS | 60 DAS | 90 DAS |
| 1 | Selection Sarika | 2.61 | 2.90 | 3.11 |
| 2 | Malav 51 | 2.87 | 3.17 | 3.88 |
| 3 | Jyoti 51 | 2.71 | 3.07 | 3.77 |
| 4 | Nylon 55 | 2.38 | 2.83 | 3.30 |
| 5 | Ankur Rani | 2.27 | 2.60 | 3.63 |
| 6 | Samruddhi | 2.54 | 2.67 | 3.70 |
| 7 | Varun | 2.98 | 3.27 | 3.98 |
| 8 | Navlakha (Local) | 2.17 | 2.93 | 3.03 |
| 9 | Abhijeet (Local) | 2.37 | 2.63 | 3.34 |
| 10 | Pusa Navbahar (Check) | 2.67 | 2.98 | 3.71 |
| | 'F' test | NS | Sig. | Sig. |
| | SE ± | 0.368 | 0.263 | 0.347 |
| | CD at 5% | 1.094 | 0.780 | 1.030 |

Stem girth of plant was significantly varied at various stages of plant growth. Stem girth was increased significantly among all varieties of cluster bean.

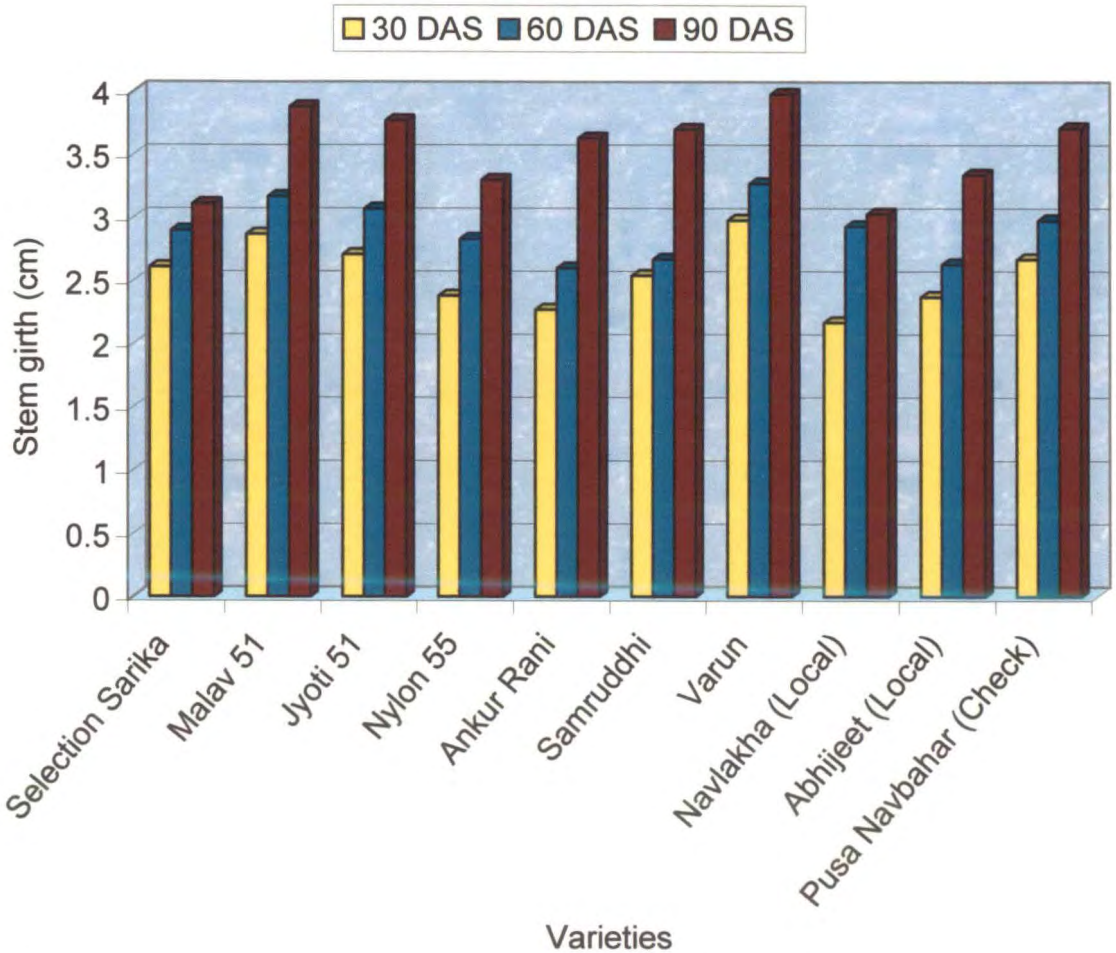



Fig. 3. Stem girth of plant of different varieties of cluster bean at various stages of growth.

In respect of stem girth at 30 days after sowing, maximum stem girth was recorded in Varun (2.98 cm) which was highest overall the varieties. The minimum stem girth was recorded in Navlakha (2.17 cm). Varieties Selection Sarika (2.61 cm), Jyoti 51 (2.71 cm) were found at par with Pusa Navbahar (2.67 cm).

In respect of stem girth at 60 days after sowing, significantly maximum stem girth was recorded in variety Varun (3.27 cm) which was found to be at par with Malav 51 (3.17 cm), Jyoti 51 (3.07 cm) and Pusa Novbahar (2.98 cm). Significantly the minimum stem girth was recorded in variety Ankur Rani (2.60 cm).

In respect of stem girth at 90 days after sowing, significantly maximum stem girth was recorded in variety Varun (3.98 cm) followed by Malav 51 (3.88 cm) and Jyoti 51 (3.77 cm).While, minimum stem girth was recorded in Navlakha (3.03 cm). Varieties Ankur Rani (3.63 cm), Samruddhi (3.70 cm) and Pusa Navbahar (3.71 cm) recorded intermediate stem girth.

### 4.1.5 Number of branches per plant

Number of branches of cluster bean varieties at various stages of growth were recorded at 30 days interval and presented in Table 4 and illustrated by Fig. 4.

Data presented in Table 4 indicated that the number of branches per plant varied significantly at stages of growth.

At 30 days after sowing the highest number of branches per plant was recorded in variety Varun (0.67), which was significantly superior over all the varieties. It was further observed that most of the

varieties under study had no any branching pattern except Varun, Malav 11, Jyoti 51 and Samruddhi at this stage of growth.

**Table 4. Number of branches per plant different varieties of cluster bean at various stages of growth**

| Sr. No. | Variety | Number of branches | | |
|---|---|---|---|---|
| | | 30 DAS | 60 DAS | 90 DAS |
| 1 | Selection Sarika | 0.00 | 1.00 | 1.50 |
| 2 | Malav 51 | 0.27 | 1.33 | 2.30 |
| 3 | Jyoti 51 | 0.20 | 1.20 | 2.27 |
| 4 | Nylon 55 | 0.00 | 1.20 | 1.22 |
| 5 | Ankur Rani | 0.00 | 1.10 | 1.33 |
| 6 | Samruddhi | 0.07 | 1.13 | 1.84 |
| 7 | Varun | 0.67 | 1.40 | 2.33 |
| 8 | Navlakha (Local) | 0.00 | 1.00 | 1.44 |
| 9 | Abhijeet (Local) | 0.00 | 1.00 | 1.42 |
| 10 | Pusa Navbahar (Check) | 0.00 | 1.13 | 1.70 |
| | 'F' test | Sig. | NS | Sig. |
| | SE ± | 0.075 | 0.179 | 0.223 |
| | CD at 5% | 0.223 | 0.532 | 0.663 |

Similarly at 60 days after sowing highest number of branches per plant was recorded in variety Varun (1.40), which was significantly superior over all the varieties under study. The lowest number of branches per plant were recorded in three varieties Selection Sarika (1.00), Navlakha (1.00) and Abhijeet (1.00).

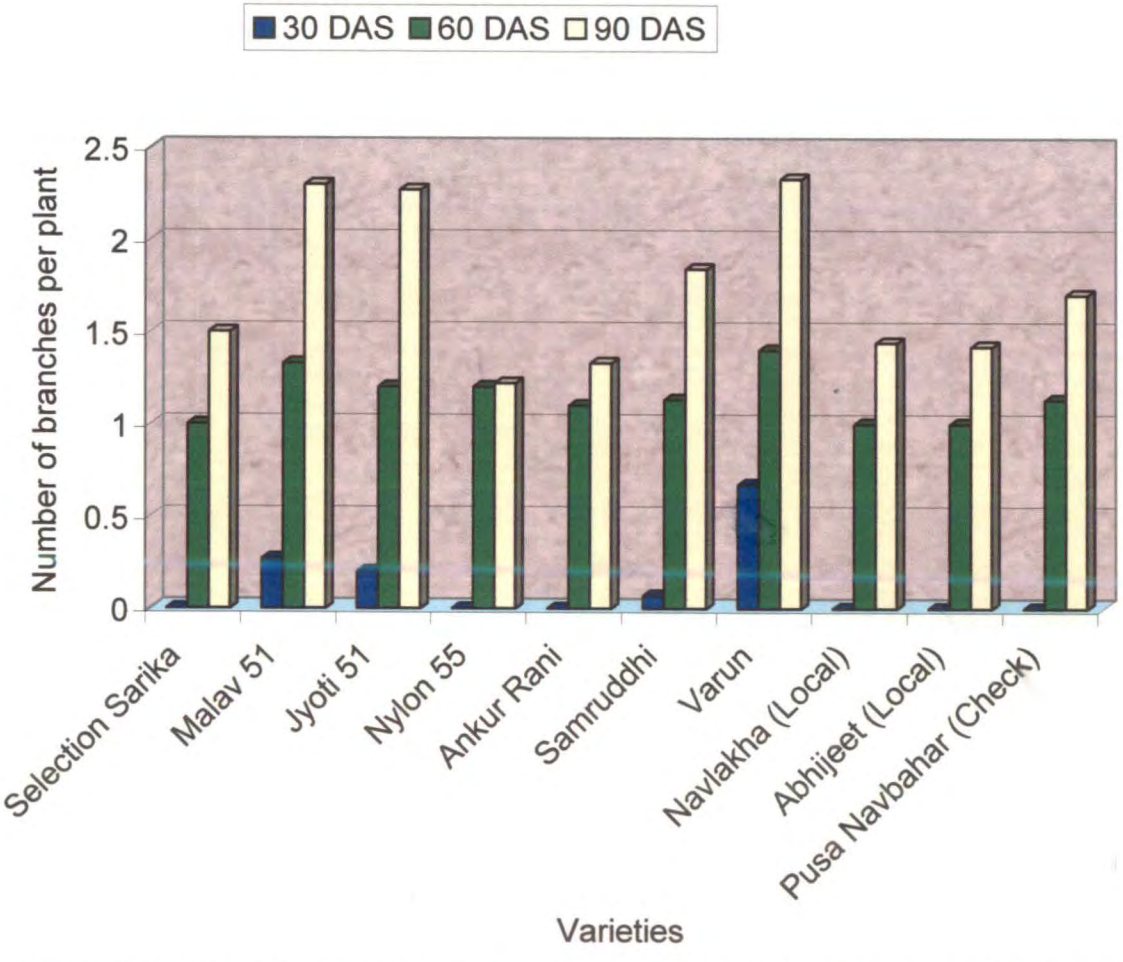



Fig. 4. Number of branches per plant of different varieties of cluster bean at various stages of growth.

Similarly at 90 days after sowing, highest number of branches per plant was recorded in variety Varun (2.33), which was at par with Malav 51 (2.30), Jyoti 51 (2.27), Samruddhi (1.84). The lowest number of branches per plant were recorded in variety Nylon 55 (1.22) which was found to be at par with Ankur Rani (1.33), Abhijeet (1.42), Navlakha (1.44) and Pusa Navbhar (1.70).

### 4.1.6 Number of leaves per plant

Number of leaves per plant was recorded in each variety of cluster bean at 30 days interval and presented in Table 5 and illustrated by Fig. 5.

**Table 5. Number of leaves of different varieties of cluster bean at various stages of growth**

| Sr. No. | Variety | Number of leaves | | |
|---|---|---|---|---|
| | | 30 DAS | 60 DAS | 90 DAS |
| 1 | Selection Sarika | 7.60 | 11.23 | 40.93 |
| 2 | Malav 51 | 8.35 | 11.68 | 51.47 |
| 3 | Jyoti 51 | 7.95 | 12.81 | 38.60 |
| 4 | Nylon 55 | 6.20 | 10.40 | 28.60 |
| 5 | Ankur Rani | 7.80 | 10.57 | 42.33 |
| 6 | Samruddhi | 7.40 | 11.23 | 47.80 |
| 7 | Varun | 8.60 | 12.98 | 52.12 |
| 8 | Navlakha (Local) | 7.12 | 10.83 | 32.53 |
| 9 | Abhijeet (Local) | 7.20 | 10.95 | 33.20 |
| 10 | Pusa Navbahar (Check) | 7.90 | 11.23 | 36.80 |
| | 'F' test | Sig. | Sig. | Sig. |
| | SE ± | 0.388 | 0.406 | 1.222 |
| | CD at 5% | 1.151 | 1.204 | 3.627 |

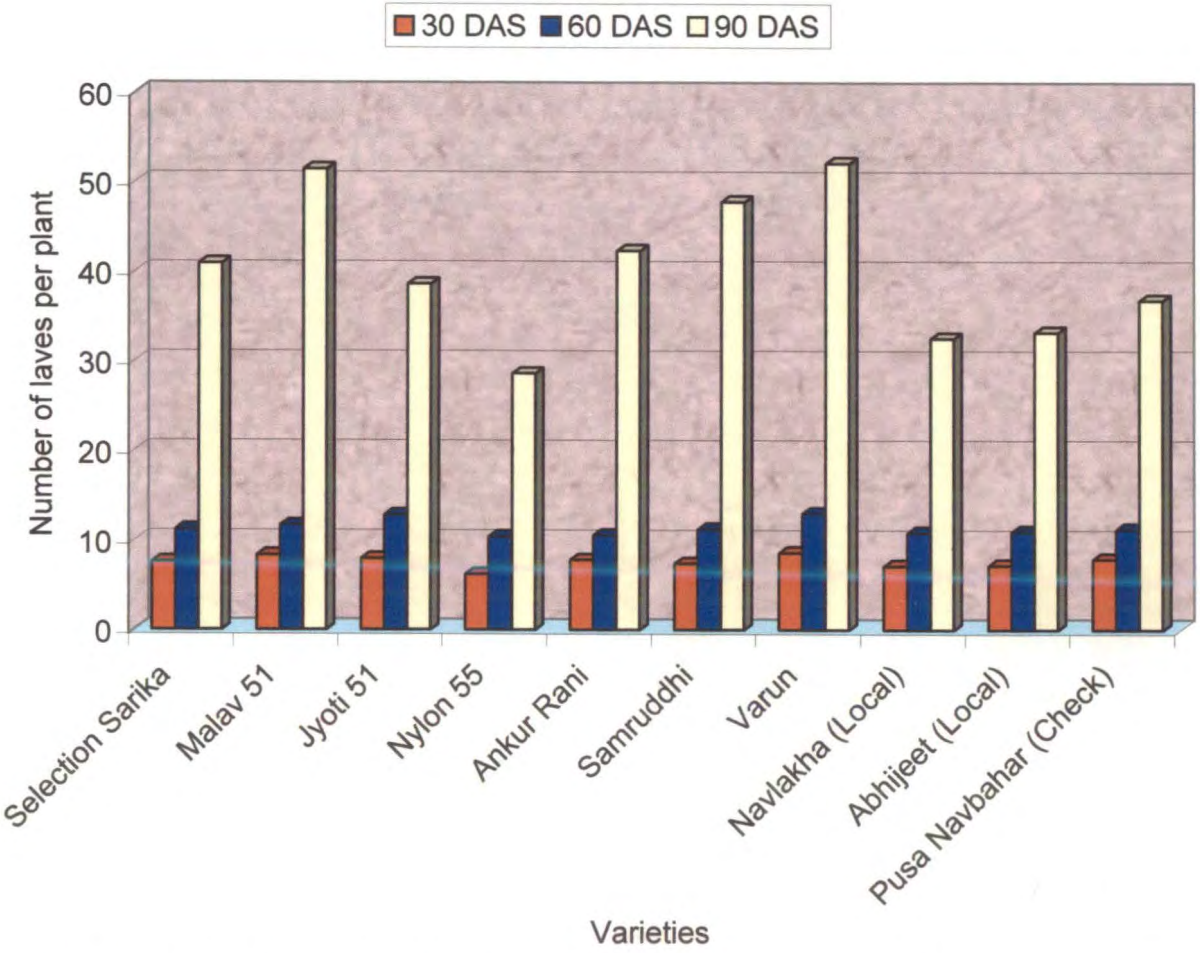



Fig. 5. Number of leaves of different varieties of cluster bean at various stages of growth.

Data from Table5 revealed that the number of leaves per plant in different cluster bean varieties varied significantly at different stages of growth.

At 30 days after sowing, the variety Varun (8.60) recorded maximum number of leaves, which was highest over all other varieties. Significantly the minimum number of leaves increased in variety Nylon 55 (6.20) followed by Navlakha (7.12).

At 60 days after sowing the maximum number of leaves per plant recorded in variety Varun (12.98) which was significantly superior over rest of the varieties except Jyoti 51 (12.81). Significantly the minimum number of leaves per plant recorded in variety Nylon 55 (10.40).

At 90 days after sowing, the maximum number of leaves per plant recorded in variety Varun (52.12), which was significantly superior over the rest of the treatments. However, it was found to be at par with Malav 51 (51.47). The minimum number of leaves per plant recorded in variety Nylon 55 (28.60). Varieties Navlakha (32.53), Abhijeet (33.20) was found to be at par with Pusa Navbahar (36.80).

### 4.1.7 Leaf area ($cm^2$)

Leaf area was recorded in each variety of cluster bean and presented in Table 6 and illustrated by Fig. 6.

Data presented in Table 6 indicated that leaf area was significantly influenced by different varieties. Highest leaf area was recorded in variety Varun (93.38 $cm^2$), which was significantly superior over all other varieties followed by Pusa Navbahar (87.04 $cm^2$). The lowest

leaf area was recorded in Malav 51 (50.81 $cm^2$) followed by Nylon 55 (55.62 $cm^2$).

**Table 6. Leaf area of different varieties of cluster bean**

| Sr. No. | Variety | Leaf area ($cm^2$) |
|---|---|---|
| 1 | Selection Sarika | 80.40 |
| 2 | Malav 51 | 50.81 |
| 3 | Jyoti 51 | 73.29 |
| 4 | Nylon 55 | 55.62 |
| 5 | Ankur Rani | 77.54 |
| 6 | Samruddhi | 59.92 |
| 7 | Varun | 93.38 |
| 8 | Navlakha (Local) | 77.32 |
| 9 | Abhijeet (Local) | 68.33 |
| 10 | Pusa Navbahar (Check) | 87.04 |
| | 'F' test | Sig. |
| | SE ± | 0.484 |
| | CD at 5% | 1.436 |

## 4.2 Yield and yield contributing characters

In cluster bean, the yield contributing characters studied in present investigation were days required for flower initiation, days required for 50% flowering, days required for first picking of green pods, number of pods per plant, pod length, pod width and weight of pod, green pod yield per plant, yield per plot and yield per hectare and crop duration.

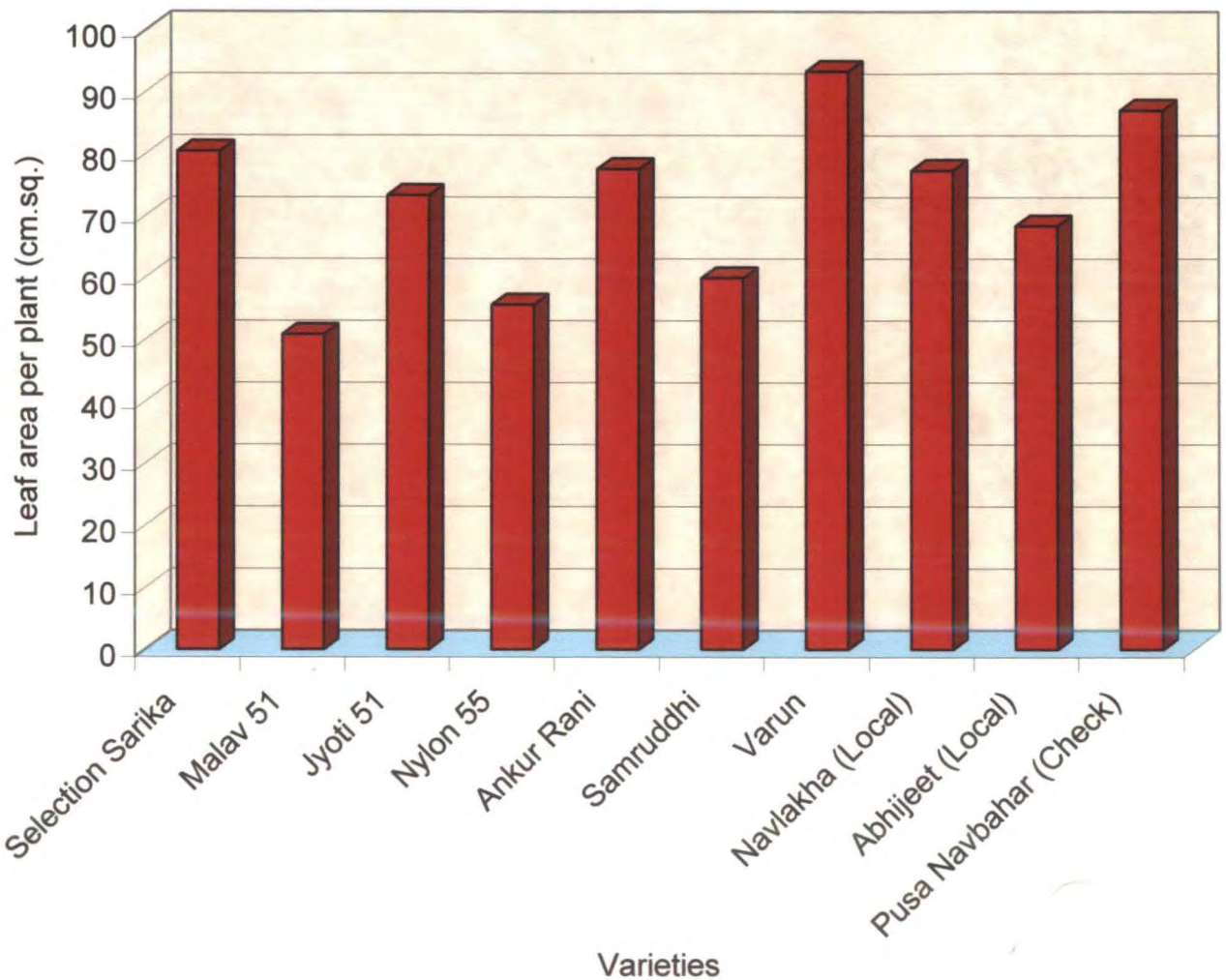



Fig. 6 Leaf area of different varieties of cluster bean

### 4.2.1 Days required for flower initiation

Days required for flower initiation were recorded in each variety of cluster bean and presented in Table 7 and illustrated by Fig. 7.

Days required for flower initiation were significantly varied among different varieties. Earliest flower initiation was recorded in variety Malav 51 (25.73 days) which was significantly superior over Varun (31.33 days) and Pusa Navbahar (32.27 days). Variety Selection Sarika (33.93 days) recorded significantly maximum number of days for flower initiation.

### 4.2.2 Days required for 50 per cent flowering

Days required for 50 per cent flowering were recorded in each variety of cluster bean and presented in Table 7. and illustrated by Fig. 7.

Data presented in Table indicated that, days required for 50 per cent flowering was influenced by each variety of cluster bean. Most of the varieties required 31.43 to 40.67 days for 50 per cent flowering. However, the minimum number of days required for 50 per cent flowering were recorded in variety Malav 51 (31.43 days) as compared to other varieties, whereas, cluster bean variety Pusa Navbahar (39.67 days) and Varun (40.67 days) required more days for 50 per cent flowering.

### 4.2.3 Days required for first picking of green pods

Number of days required for first picking of green pods were recorded in each variety of cluster bean and presented in Table 7 and illustrated by Fig. 7.

**Table 7. Days required for flower initiation, fifty per cent flowering and first picking of green pods by different varieties of cluster bean**

| Sr. No. | Variety | Days required for flower initiation | Days required for 50% flowering | Days for first picking of green pods |
|---|---|---|---|---|
| 1 | Selection Sarika | 33.93 | 39.33 | 44.33 |
| 2 | Malav 51 | 25.73 | 31.43 | 40.13 |
| 3 | Jyoti 51 | 26.07 | 32.67 | 39.63 |
| 4 | Nylon 55 | 28.67 | 35.67 | 44.33 |
| 5 | Ankur Rani | 27.77 | 34.33 | 47.67 |
| 6 | Samruddhi | 29.23 | 35.25 | 39.23 |
| 7 | Varun | 31.33 | 40.67 | 38.87 |
| 8 | Navlakha (Local) | 27.13 | 35.25 | 41.20 |
| 9 | Abhijeet (Local) | 27.53 | 34.33 | 41.27 |
| 10 | Pusa Navbahar (Check) | 32.27 | 39.67 | 42.60 |
| | 'F' test | Sig. | Sig. | Sig. |
| | SE ± | 1.042 | 0.680 | 0.913 |
| | CD at 5% | 3.093 | 2.018 | 2.709 |

Data presented in Table revealed that the days required for first picking of green pods were significantly varied among different varieties. Minimum days for first picking of green pods were recorded in variety Varun (38.87 days), which was at par with Samruddhi (39.23 days), Jyoti 51 (39.63 days), Malav 51 (40.13 days), Navlakha (41.20 days) and

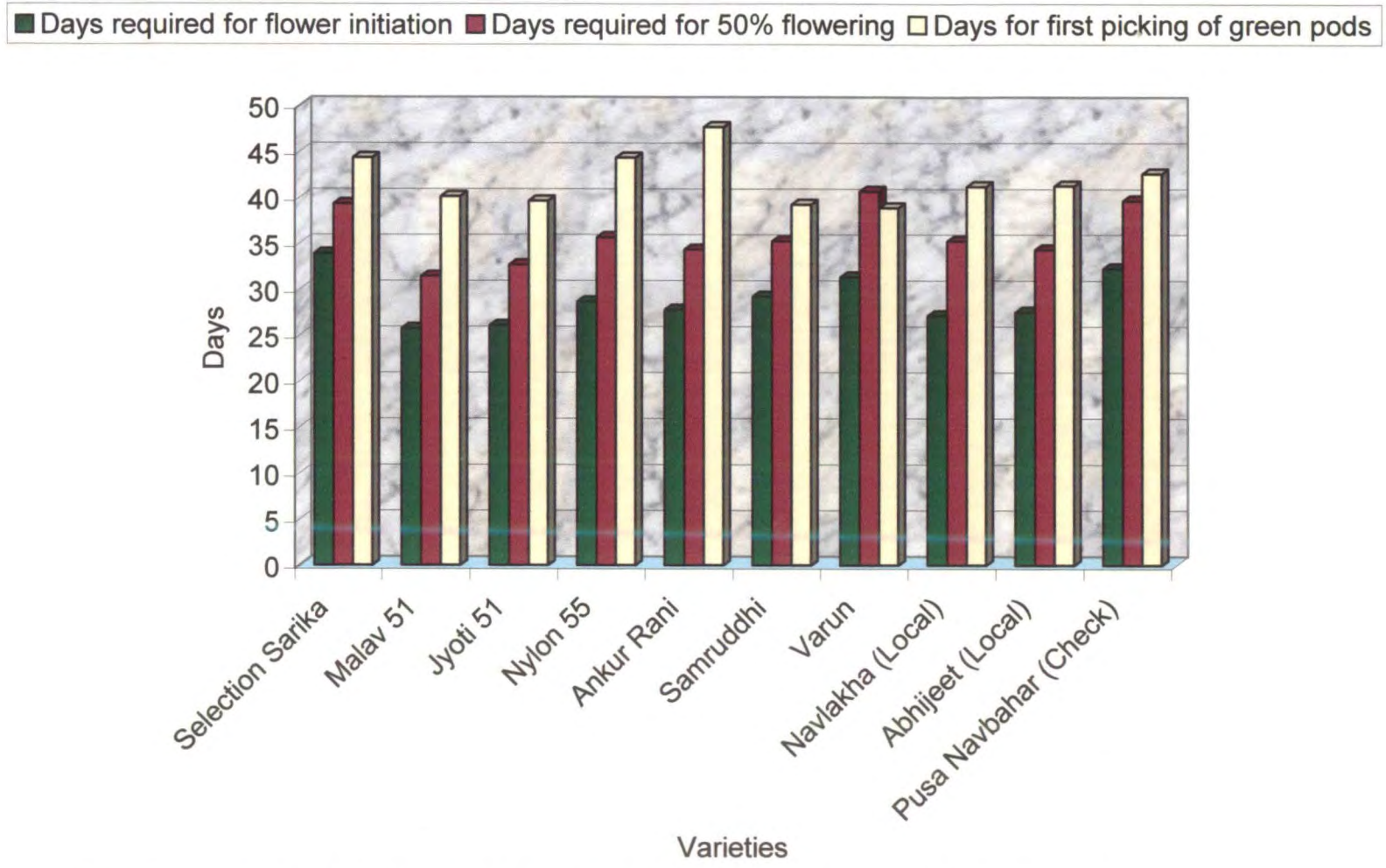



Fig. 7 Days required for flower initiation, fifty per cent flowering and first picking of green pods by different varieties of cluster bean

Abhijeet (41.27 days). More days for first picking of green pods were required by Ankur Rani (47.67 days) as compared to other varieties.

### 4.2.4 Number of pods per plant

Number of pods per plant were counted at each picking and total number of pods in each variety was counted lastly and presented in Table 8 and illustrated by Fig. 8.

Data from the Table revealed that number of pods per plant among all varieties was varied significantly from 37.40 to 71.43. The variety Varun (71.43) produced the highest number of pods per plant which was significantly superior over all other varieties. The lowest number of pods per plant was produced by variety Ankur Rani (37.40) followed by Nylon 55 (40.50). Variety Jyoti 51 (66.47) was found at par with the improved variety Pusa Navbahar (65.60).

### 4.2.5 Length of pod (cm)

Length of pods in each variety of cluster bean was measured and presented in Table 8 and illustrated by Fig. 9.

Length of pod was significantly varied among different varieties of cluster bean which was varied from 7.09 cm to 12.59 cm. Significantly maximum length of pod was recorded in variety Varun (12.59 cm), which was at par with Malav 51 (11.13 cm). The minimum length of pod was recorded in variety Ankur Rani (7.09 cm), which was at par with Abhijeet (7.81 cm), Navlakha (7.91 cm), Selection Sarika (8.48 cm) and Pusa Navbahar (8.83 cm).

**Table 8. Number of pods per plant, pod length, pod width and weight of pod of different varieties of cluster bean**

| Sr. No. | Variety | No. of pods per plant | Length of pod (cm) | Width of pod (cm) | Weight of pod (g) |
|---|---|---|---|---|---|
| 1 | Selection Sarika | 50.80 | 8.48 | 0.70 | 2.16 |
| 2 | Malav 51 | 68.70 | 11.13 | 0.86 | 2.50 |
| 3 | Jyoti 51 | 66.47 | 9.33 | 0.84 | 2.46 |
| 4 | Nylon 55 | 40.50 | 8.05 | 0.73 | 2.27 |
| 5 | Ankur Rani | 37.40 | 7.09 | 0.70 | 2.10 |
| 6 | Samruddhi | 47.20 | 9.31 | 0.78 | 1.98 |
| 7 | Varun | 71.43 | 12.59 | 0.96 | 2.67 |
| 8 | Navlakha (Local) | 57.50 | 7.91 | 0.66 | 1.69 |
| 9 | Abhijeet (Local) | 61.60 | 7.81 | 0.68 | 1.86 |
| 10 | Pusa Navbahar (Check) | 65.60 | 8.83 | 0.76 | 2.35 |
| | 'F' test | Sig. | Sig. | NS | NS |
| | SE ± | 0.547 | 0.626 | 0.101 | 0.209 |
| | CD at 5% | 1.623 | 1.858 | 0.302 | 0.620 |

### 4.2.6 Width of pod (cm)

Width of pod was measured in each variety of cluster bean and presented in Table 8.

Data in Table 8 revealed that, maximum pod width was recorded in variety Varun (0.96 cm), which was highest as compared to other varieties. Significantly the minimum pod width was recorded in

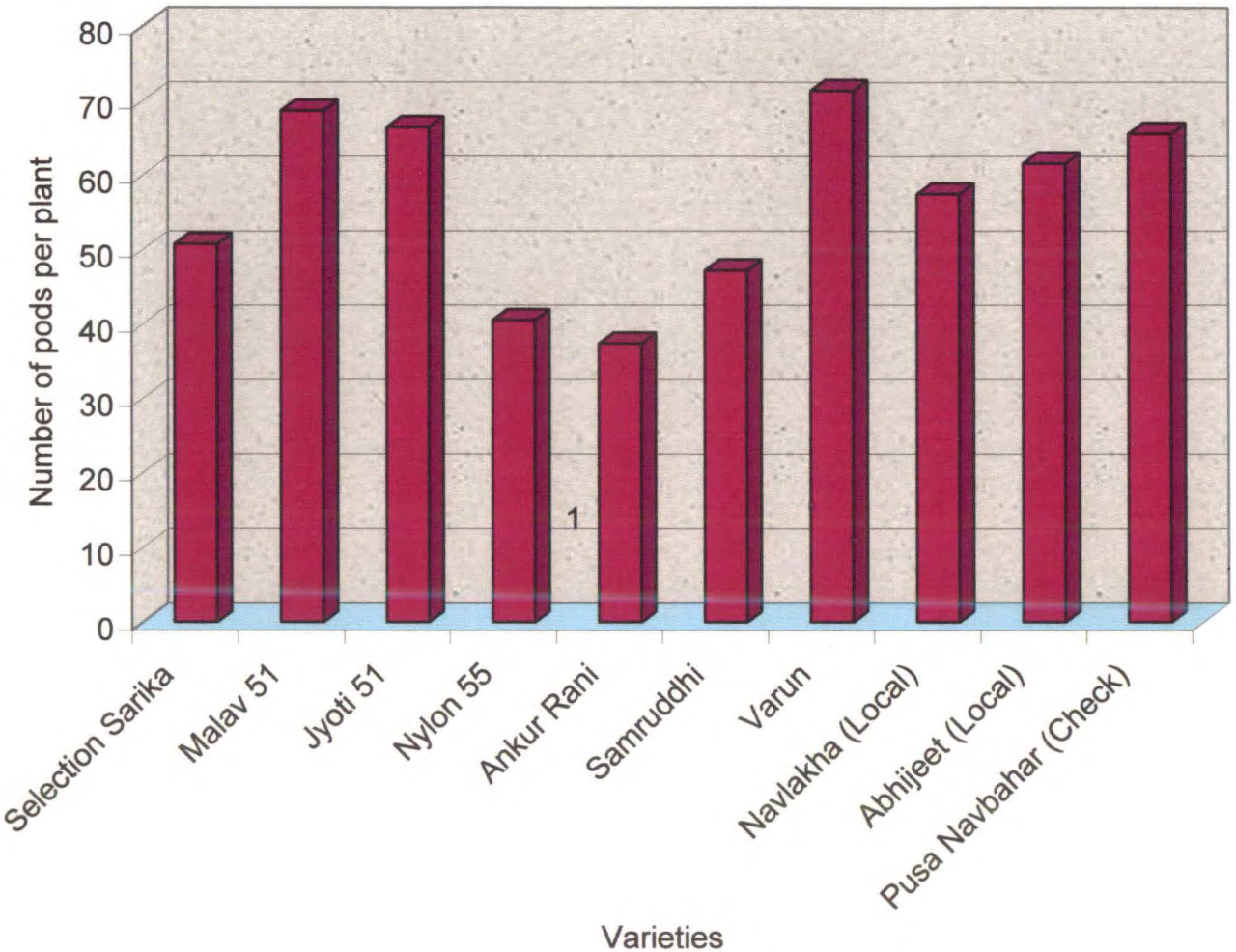



Fig. 8. Number of pods per plant of different varieties of cluster bean

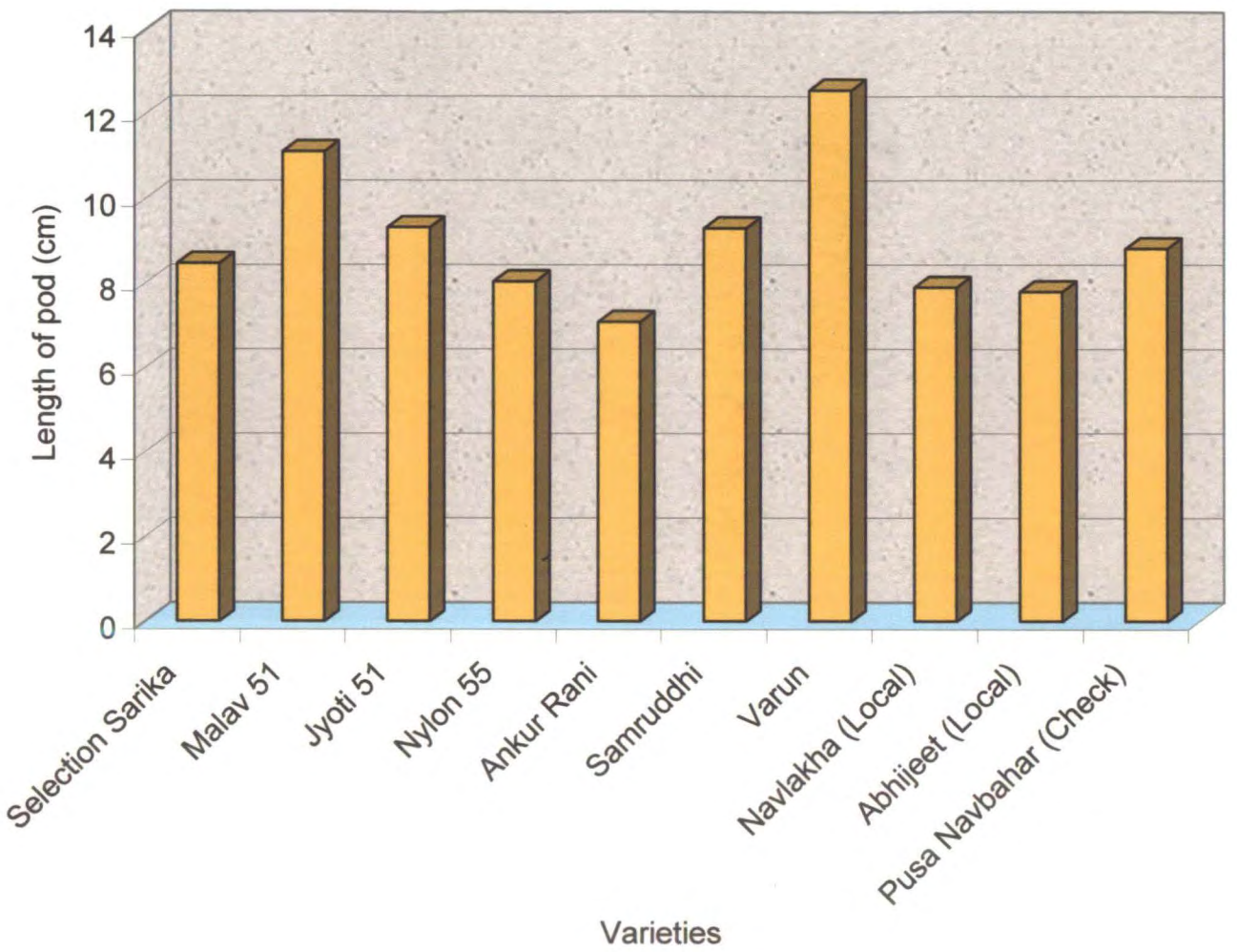



Fig. 9. Length of pod of different varieties of cluster bean.

Varun

Malav-51

Jyoti-51

Pusa Navbahar(Check)

Plate 1. Pods of Promising Varieties of Cluster bean

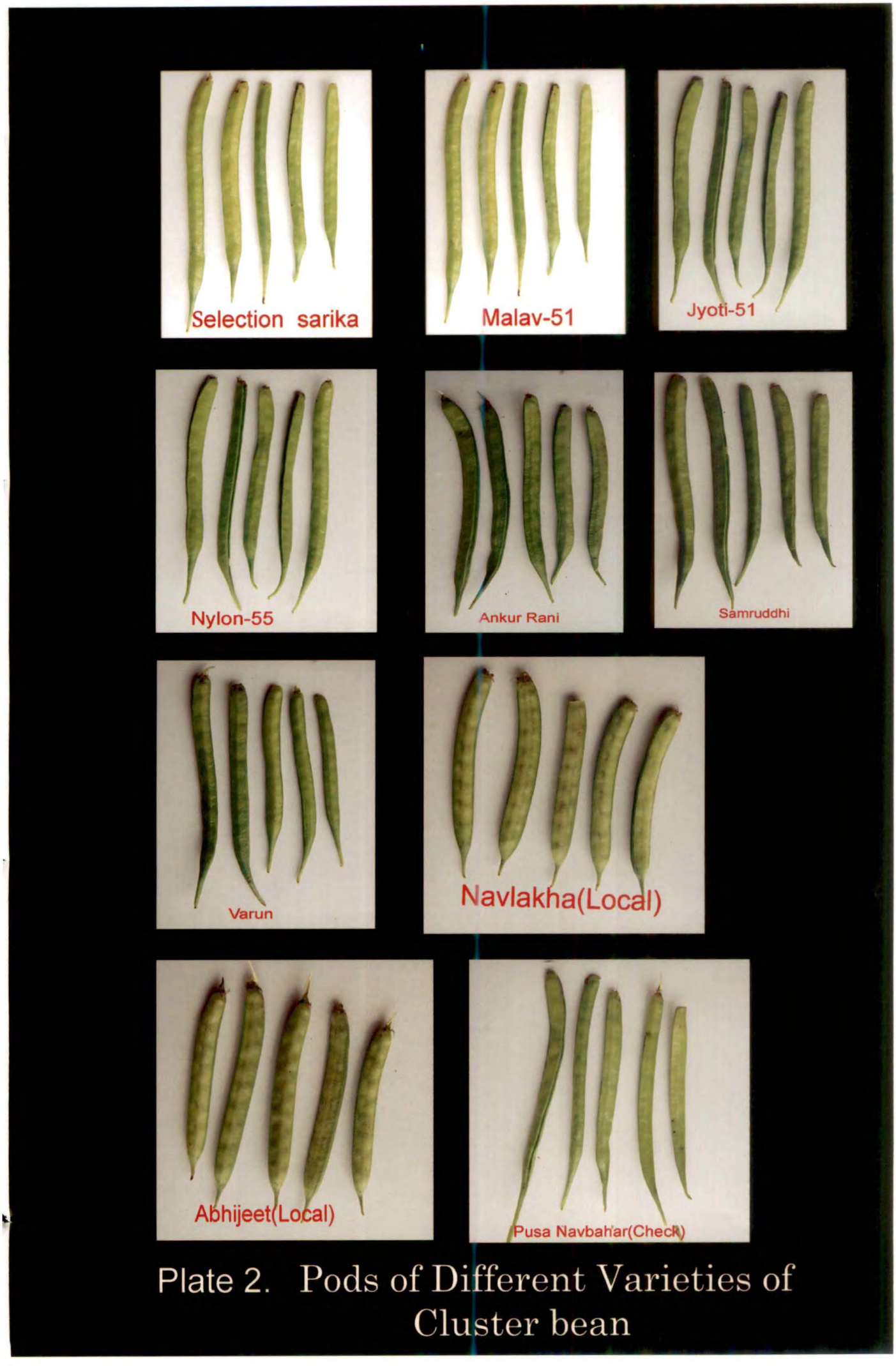



Plate 2. Pods of Different Varieties of Cluster bean

variety Navlakha (0.66 cm) followed by Abhijeet (0.68 cm). Intermediate pod width recorded in Nylon 55 (0.73 cm), Pusa Navbahar (0.76 cm) and Samruddhi (0.78 cm).

### 4.2.7 Weight of pod (g)

Weight of pod in each variety of cluster bean was measured and presented in Table 8.

Data presented in Table indicated that ,highest pod weight was recorded in variety Varun (2.67 g), which was maximum over all other varieties. Lowest pod weight was recorded in variety Navlakha (1.69 g) followed by Abhijeet (1.86 g). The intermediate pod weight was recorded in varieties Nylon 55 (2.27 g), Pusa Navbahar (2.35 g) and Jyoti 41 (2.46 g).

### 4.2.8 Green pod yield per plant (g)

Yield of green pods per plant were recorded in each variety and presented in Table 9.

Data from the Table revealed that yield of green pods per plant were significantly varied among different varieties. Significantly highest green pod yield per plant was recorded in variety Varun (182.97 g), which was significantly superior over all other varieties under study. Significantly lowest green pod yield per plant was recorded in variety Ankur Rani (82.28 g) which was at par with Samruddhi (90.46 g), varieties Jyoti 51 (164.25 g) and Malav 51 (167.17 g) were at par with each other and were found superior over Pusa Navbahar (143.27 g).

**Table 9. Yield of pods per plant, yield per plot and yield per hectare of different varieties of cluster bean**

| Sr. No. | Variety | Yield of pods per plant (g) | Yield per plot (kg) | Yield per hectare (q) |
|---|---|---|---|---|
| 1 | Selection Sarika | 112.96 | 7.14 | 66.14 |
| 2 | Malav 51 | 167.17 | 8.75 | 81.02 |
| 3 | Jyoti 51 | 164.25 | 8.22 | 76.16 |
| 4 | Nylon 55 | 93.45 | 5.80 | 53.78 |
| 5 | Ankur Rani | 82.28 | 4.59 | 42.55 |
| 6 | Samruddhi | 90.46 | 5.65 | 52.33 |
| 7 | Varun | 182.97 | 9.44 | 87.50 |
| 8 | Navlakha (Local) | 100.25 | 6.22 | 57.65 |
| 9 | Abhijeet (Local) | 107.43 | 6.52 | 60.44 |
| 10 | Pusa Navbahar (Check) | 143.27 | 7.07 | 65.48 |
| | 'F' test | Sig. | Sig. | Sig. |
| | SE ± | 3.437 | 0.641 | 0.474 |
| | CD at 5% | 11.01 | 1.902 | 1.406 |

### 4.2.9 Yield per plot (kg) and yield per hectare (q)

Yield of green pods per plot and yield per hectare were recorded in each variety of cluster bean and presented in Table 9 and illustrated by Fig. 10.

Data presented in Table indicated that green pod yield per plot and green pod yield per hectare were significantly influenced by different varieties.

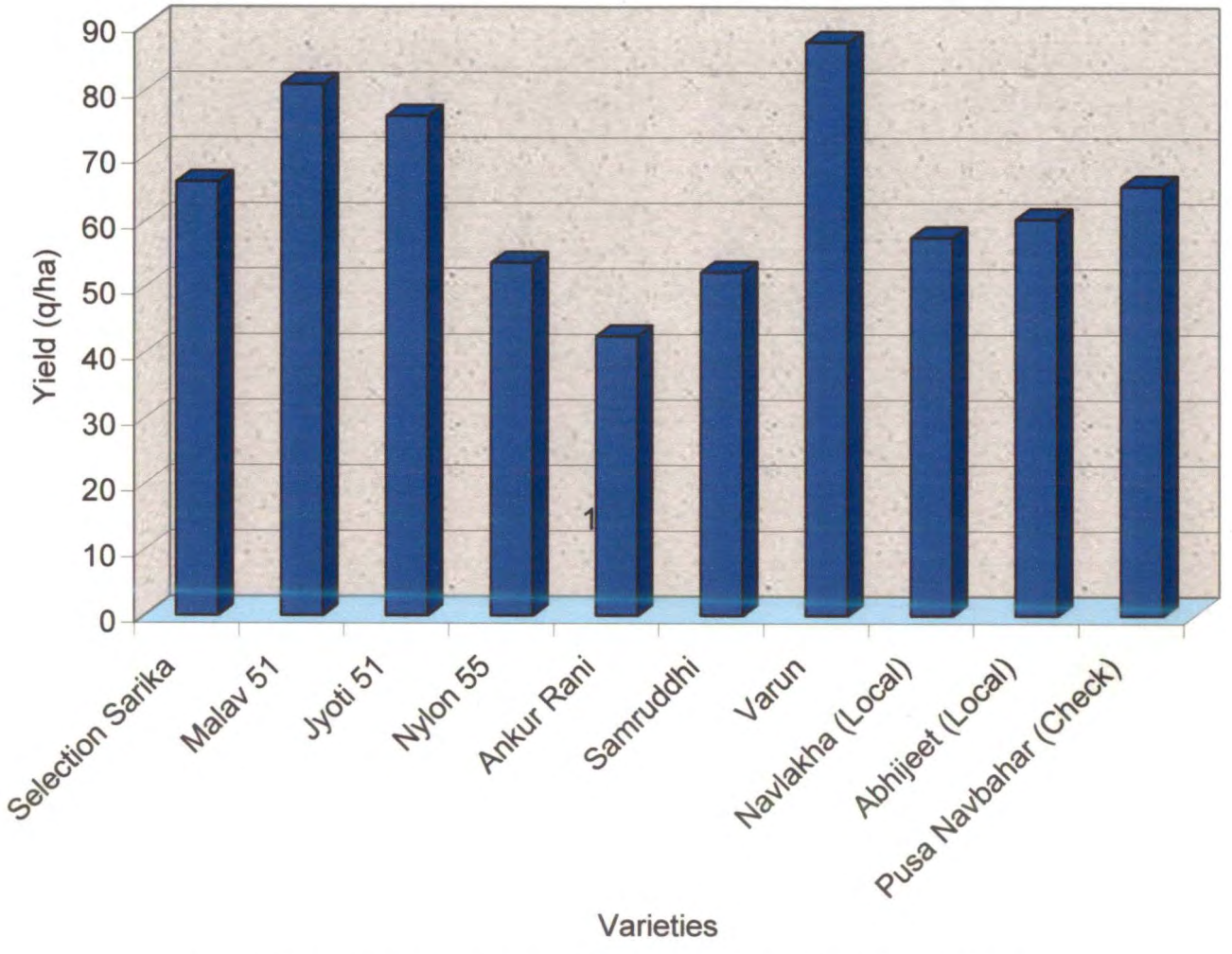



Fig. 10. Yield per hectare of different varieties of cluster bean

Varun

Malav-51

Jyoti-51

Pusa Navbahar (Check)

Plate 3. Plot View of Promising Varieties of Cluster bean

As regards to the green pod yield per plot, highest green pod yield per plot was recorded in variety Varun (9.44 kg) which was found maximum as compared to other varieties and was found to be at par with Malav 51 (8.75 kg) significantly the lowest green pod yield per plot was recorded in variety Ankur Rani (4.59 kg), which was at par with Samruddhi (5.65 kg), Nylon 55 (5.80 kg) and Navlakha (6.22 kg). Varieties Abhijeet (6.52 kg), Samruddhi (7.14 kg), Jyoti 51 (8.22 kg) were found at par with Pusa Navbahar (7.07 kg).

In respect of green pod yield per hectare. Significantly highest green pod yield per hectare was recorded in variety Varun (87.50 q) which was significantly superior over all other varieties. Significantly the lowest green pod yield per hectare was recorded in variety Ankur Rani (42.55 q) followed by Samruddhi (52.33 q) and Nylon 55 (53.78 q), varieties Jyoti 51 (76.16 q), Malav 51 (81.02 q) and Varun (87.50 q) were superior over Pusa Navbahar (65.48), whereas variety Selection Sarika (66.14 q) found at par with Pusa Navbahar (65.48).

### 4.2.10 Crop duration (days)

Days from sowing to final picking were recorded in each variety of cluster bean and presented in Table 10.

Data of crop duration revealed that, crop duration was significantly varied among different varieties. Significantly maximum crop duration were recorded in variety Varun (107.07 days), which was highest as compared to other varieties and found at par with Malav 51 (106.80). Significantly minimum crop duration was recorded in variety Selection

**Table 10. Crop duration as influenced by different varieties of cluster bean**

| Sr. No. | Variety | Crop duration (days) |
|---|---|---|
| 1 | Selection Sarika | 92.87 |
| 2 | Malav 51 | 106.80 |
| 3 | Jyoti 51 | 100.86 |
| 4 | Nylon 55 | 94.27 |
| 5 | Ankur Rani | 93.87 |
| 6 | Samruddhi | 99.13 |
| 7 | Varun | 107.07 |
| 8 | Navlakha (Local) | 95.27 |
| 9 | Abhijeet (Local) | 95.33 |
| 10 | Pusa Navbahar (Check) | 103.73 |
| | 'F' test | Sig. |
| | SE ± | 1.040 |
| | CD at 5% | 3.086 |

Sarika (92.87 days) which was at par with Ankur Rani (93.87 days), Nylon 55 (94.27 days), Navlakha (95.27 days) and Abhijeet (95.33 days), Pusa Navbahar recorded 103.73 days crop duration which was at par with Jyoti 51 (100.86 days).

# Discussion

# Chapter-5

# DISCUSSION

The present investigation on "Studies on varietal performance of cluster bean under Marathwada condition" was carried out in *kharif* season of year 2008-2009 with ten varieties of cluster bean with following objectives.

1. To study the growth and yield performance of cluster bean varieties
2. To find out the suitable variety for commercial cultivation in Marathwada region.

The results obtained during the present investigation are discussed below under the following headings.

## 5.1 Growth characters

The growth characters studied in present investigation are days required for seed germination, germination percentage, plant height, stem girth, number of branches per plant, number of leaves and leaf area.

### 5.1.1 Days required for seed germination

Days required for seed germination does not significantly varied among different varieties of cluster bean. Almost all varieties get germinated within 3.95 to 5.36 days. However, variety Varun germinated earlier (3.95 days) than others including Pusa Navbahar (5.26 days).

It might be due to the similar and uniform chemical changes occurs during the germination process. These findings are in close agreement with the findings of Nagpal and Bhatia (1970) in cluster bean.

### 5.1.2 Germination percentage

Germination per cent recorded non significant differences among different cluster bean varieties. All the varieties under study recorded the germination per cent within 87.43 to 93.33 per cent. Variety Varun (93.83 per cent), Malav 51 (92.33 per cent) and Jyoti 51 (91.07 per cent) recorded more germination as compared to Pusa Navbahar (90.70%).

This might be due to the similar atmospheric conditions, uniform seed and similar chemical changes occurs during the germination process. Similar results were also reported by Mehta and Desai (1958) and Hymowitz and Matlock (1964) in cluster bean. Yadav *et al.* (1975) also reported the significant differences in germination of seeds of nine varieties of cluster bean.

### 5.1.3 Plant height

The plant height was significantly influenced at various plant growth stages except 30 DAS. The plant height at 60 DAS and 90 DAS, variety Varun recorded significantly superior plant height i.e. 52.80 and 92.46 cm respectively among all other varieties.

It might be due to the genetic constitution of different varieties of cluster bean. These findings are in close confirmation with the findings of Sanghi *et al.* (1964); Mital *et al.* (1969); Tikka *et al.* (1974); Mahale and Jadhav (1982); Dabas *et al.* (1982[b]); Vijaykumar and Balasubramaniyan (1990) Gipson and Balakrishnan (1990) and Buttar and Aggarwal (2006) in cluster bean.

### 5.1.4 Stem girth

Stem girth of plant was significantly varied at various stages of plant growth in different cluster bean varieties. Variety Varun recorded significantly maximum stem girth at 30 DAS ( 2.98 cm), 60 DAS (3.27 cm) and at 90 DAS (3.98 cm) than Pusa Navbahar (2.67 cm) at 30 DAS, (2.98 cm) at 60 DAS and (3.71 cm) at 90 DAS. Significantly minimum stem girth was recorded in variety Navlakha (2.17 cm) at 30 DAS, (2.93 cm) at 60 DAS and (3.03 cm) at 90 DAS.

These might be due to different genetic constitution of different cluster bean varieties. These findings are in close conformity with Kirti Singh *et al.* (1974) in bhendi vegetable crop.

### 5.1.5 Number of branches per plant

Number of branches per plant was significantly varied among different cluster bean varieties. Maximum number of branches per plant were recorded in variety Varun at 30 DAS (0.67) at 60 DAS (1.40) and at 90 DAS (2.33) than Pusa Navbahar (0.00) at 30 DAS, (1.13) at 60 DAS and (1.70) at 90 DAS. Minimum number of branches per plant were recorded in variety Samruddhi (0.07) at 30 DAS, Selection Sarika (1.00), Navlakha (1.00) and Abhijeet (1.00) at 60 DAS and at 90 DAS in variety Nylon 55 (1.22).

This might be due to different genetic constitution of different cluster bean varieties. Similar results were reported by Sanghi *et al.* (1964), Dass *et al.* (1978); Sidhu *et al.* (1982); Gipson and Balakrishnan (1990); Singh *et al.* (2003), Deepak Arora *et al.* (2005) and Buttar and Aggarwal (2006) in cluster bean.

### 5.1.6 Number of leaves per plant

Number of leaves per plant was significantly varied among the different cluster bean varieties. Highest number of leaves per plant were recorded in variety Varun (8.60) at 30 DAS, (12.98) at 60 DAS and at 90 DAS (52.12) than Pusa Navbahar (7.90) at 30 DAS), (11.23) at 60 DAS and (36.80) at 90 DAS. Lowest number of leaves per plant recorded in variety Nylon 55 (6.20) at 30 DAS, (10.40) at 60 DAS and (28.60) at 90 DAS.

This might be due to different genetic constitutions performed by different cluster bean varieties. These findings are in close conformity with Uprety *et al.* (1978); Gupta and Lodhi (1979); Suryanarayana (1982) and Chikkapadyaiah (1983) in cowpea.; Rao *et al.* (1998) in cluster bean.

### 5.1.7 Leaf area

Leaf area per plant was significantly influenced by different varieties. Highest leaf area was recorded in variety Varun (93.38 $cm^2$), which was significantly superior over all other variety, followed by Pusa Navbahar (87.04 $cm^2$). Lowest leaf area was recorded in Variety Malav 51 (50.81 $cm^2$) followed by Nylon 55 (55.62 $cm^2$).

It might be due to different genetic factors present in different varieties. Similar findings were reported by Uprety *et al.* (1978) in cowpea; Borah and Shadeque (1992) in Dolichos bean, Kanase *et al.* (2006) in soybean.

## 5.2 Yield and yield contributing characters

In cluster bean, the yield contributing characters studied in present investigation were days required for flower initiation, days required

for 50 per cent flowering, days required for first picking of green pods, number of pods per plant, pod length, pod width and weight of pod, green pod yield per plant, yield per plot and yield per hectare and crop duration.

### 5.2.1 Days required for flower initiation

Days required for flower initiation were significantly varied among different cluster bean varieties. Earliest flower initiation was recorded in variety Malav 51 (25.73 days) followed by Jyoti 51 (26.07 days) and Navlakha (27.13 days), however, variety Selection Sarika required more days for flower initiation (33.93 days) as compared to Pusa Navbahar (32.27 days).

It might be due to the different genetic constitution of different cluster bean varieties. These results are in confirmation with those of Mital *et al.* (1969); Lobana and Verma (1972); Tikka *et al.* (1974); Dabas *et al.* (1982[b]); Vijay (1988); Gipson and Balakrishnan (1990) and Deepak Arora *et al.* (2005) in cluster bean under varied agroclimatic conditions.

### 5.2.2 Days required for 50 per cent flowering

Days required for 50 per cent flowering does not influenced by different varieties, all most all the varieties required 31.43 to 40.67 days for 50 per cent flowering. Minimum days required for 50 per cent flowering by variety Malav 51 (31.43 days). However, maximum days were required in Varun (40.67 days) followed by Pusa Navabahar (39.67 days).

It might be due to the suppression of genetic effect by environmental effect in similar climatic condition to all varieties. These findings are in close conformity with Dass *et al.* ( 1973) and Singh *et al.*

(2003) in cluster bean; Natrajaratham *et al.* (1984); Kipgen ( 1987) in cowpea; Rao and Kumar (2003) in chickpea.

### 5.2.3 Days required for first picking of green pods

Days required for first picking of green pods were significantly influenced by different cluster bean varieties. Significantly early picking of green pods were recorded in variety Varun (38.87 days), followed by Samruddhi (39.23 days) and Jyoti 51 (39.63 days). Variety Navlakha (41.20 days) and Abhijeet (41.27 days) get picked earlier than Pusa Navbahar (42.60 days). Significantly maximum days were required by variety Ankur Rani (47.67 days) as against Pusa Navbahar required 42.60 days for first picking of green pods.

This might be due to the different genetic constitutions performed by different cluster bean varieties. These results are in confirmation with those recorded by Mital *et al.* (1969), Vijay (1988), Choudhary and Bhatnagar (1995) and Deepak Arora *et al.* (2005) in cluster bean, Mohan *et al.* (2003) in pea.

### 5.2.4 Number of pods per plant

Number of pods per plant was significantly varied among different cluster bean varieties. Variety Varun recorded significantly maximum number of pods per plant (71.43) i.e. 5.83 more pods than Pusa Navbahar (65.60), followed by Malav 51 (68.70) and Jyoti 51 (66.47). Significantly minimum number of pods per plant were recorded by Ankur Rani (37.40) as compared to Pusa Navbahar (65.60).

It might be due to early flowering, crop duration and different genetic constitution of different cluster bean varieties. These findings are

close conformity with the findings of Sanghi *et al.* (1964); Mital *et al.* (1969); Tikka (1975); Vijay (1988); Gipson and Balakrishnan (1990) and Buttar and Aggarwal (2006) in cluster bean.

### 5.2.5 Length of pod

Length of pod was significantly varied among different cluster bean varieties. Variety Varun recorded significantly maximum pod length (12.59 cm) i.e. 3.76 cm more pod length compared to Pusa Navbahar (8.83 cm), followed by Malav 51 (11.13 cm) and Jyoti 51 (9.33 cm). Whereas variety Ankur Rani recorded significantly minimum pod length (7.09 cm).

It might be due to various genetic factors present in each variety. These results are in close conformity with those of Sanghi *et al.* (1964); Mital *et al.* (1969); Tikka (1975); Vashistha *et al.* (1981); Dabas *et al.* (1982[a]); Sidhu *et al.* ( 1982); Vijay (1988); Gipson and Balakrishnan (1990) and Singh *et al.* (2003) in cluster bean.

### 5.2.6 Width of pod

Width of pod was significantly influenced by different cluster bean varieties. Significantly maximum pod width was recorded in variety Varun (0.96 cm) i.e. 0.20 cm more width than Pusa Navbahar (0.76 cm), followed by Malav 51 (0.86 cm) and Jyoti 51 (0.84 cm) and Navlakha (0.66 cm).

These might be due to the various genetic factors present in each variety. Similar results were reported by Jana and Chattopadhay (1977) in hyacianth bean; Singh *et al.* (1979) and Pandita *et al.* (1980) in Indian bean and Borah and Shadeque (1992) in dolichos bean.

### 5.2.7 Weight of pod

Weight of pod was significantly varied among different cluster bean varieties. Significantly maximum weight of pod was recorded in variety Varun (2.67 g) i.e. 0.32 g more weight than Pusa Navbahar (2.35 g), followed by Malav 51 (2.50 g) and Jyoti 51 (2.46 g). Whereas significantly minimum pod weight was recorded in variety Navlakha (1.69 g).

It might be due to more length of pod, width of pod, maximum number of seeds per pod and test weight of each variety. Similar findings were reported by Vijay (1988); Gipson and Balakrishnan (1990) in cluster bean; Baswana *et al.* (1980) and Borah and Shadeque (1992) in dolichos bean.

### 5.2.8 Green pod yield per plant

Green pod yield per plant was significantly varied among different cluster bean varieties. Variety Varun recorded significantly maximum green pod yield per plant (182.97 g) i.e. 39.70 g more yield than Pusa Navbahar (143.27 g), followed by Malav 51 (167.17 g) and Jyoti 51 (164.25 g). Significantly minimum green pod yield per plant was recorded in variety Ankur Rani (82.28 g) followed by Samruddhi (90.46 g) and Nylon 55 (93.45 g).

It might be due to number of pods per plant and weight of each pod, length of pod, width of pod, number of seeds per pod and crop duration in different cluster bean varieties. Similar results were reported by Sanghi and Sharma (1964), Menon *et al.* (1973); Vashistha *et al.* (1981); Sidhu *et al.* (1982); Vijay (1988); Gipson and Balakrishnan (1990) and

Vijaykumar and Balasubramaniyan (1990); Deepak Arora *et al.* (2005) in cluster bean;

### 5.2.9 Green pod yield per plot and yield per hectare

Green pod yield per plot and yield per hectare were significantly influenced by different cluster bean varieties. In respect of pod yield per plot, variety Varun recorded significantly maximum yield (9.44kg), followed by Malav 51 (8.75 kg) and Jyoti 51 (8.22 kg). Significantly minimum yield per plot was recorded in Ankur Rani (4.59kg).

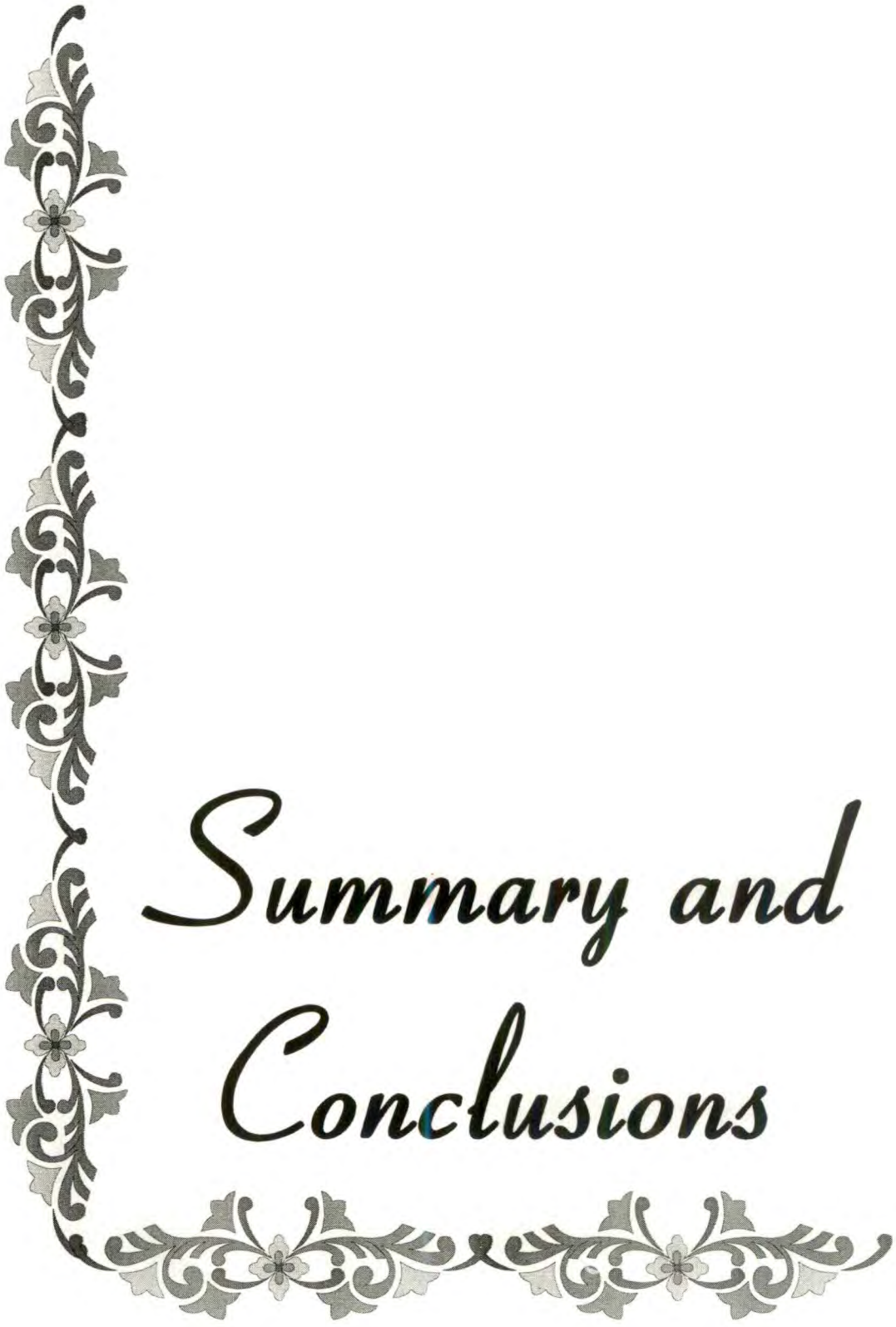
As regards, the green pod yield per hectare, variety Varun recorded significantly maximum yield (87.50 q), by recording 22.02 q i.e. 33.62 per cent more yield than Pusa Navbahar (65.48 q), followed by Malav 51 (81.02 q) and Jyoti 51 (76.16 q), whereas variety Ankur Rani (42.55 q) recorded significantly minimum green pod yield per hectare.

These might be due to more number of pods per plant, weight of pod, length of pod, crop duration and green pod yield per plant. Similar results were obtained by Menon *et al.* (1973); Vijay Kumar and Balasubramaniyan (1990); Brindha *et al.*(1995); Vijay (1988); Sanghi *et al.* (1964); Sanghi and Sharma (1964) in cluster bean; Ogunbodede (1989) in cowpea.

### 5.2.10 Crop duration

Crop duration was significantly varied among different cluster bean variety. Significantly maximum crop duration was recorded by variety Varun (107.07 days), followed by Malav 51 (106.80 days), Pusa Navbahar (103.73 days) and Jyoti 51 (100.86 days). Significantly minimum crop duration was recorded in variety Selection Sarika (92.87 days).

These might be due to genetic constitutions of different varieties. Similar results were reported by Rajput *et al.* (1990) in cowpea, Shivasankar and Kulkarni (1989) in field bean.



# Summary and Conclusions

# Chapter-5

# SUMMARY AND CONCLUSIONS

The present investigation entitled "Studies on varietal performance of cluster bean (*Cymopsis tetragonoloba* (L.) Taub) under Marathwada condition" was carried out at Horticultural Research Scheme (Vegetable), Department of Horticulture, Marathwada Agricultural University, Parbhani during *kharif* season of the year 2008-09.

All the characters of ten varieties under study were varied significantly during the present investigation. The results of present investigation are summarized and concluded as below.

## 6.1 Growth characters

Among the ten varieties of cluster bean under study, the days required for seed germination were not varied significantly among the different varieties of cluster bean. Days required for germination of seed were ranged from 3.95 to 5.36 days. Minimum number of days for germination required by variety Varun (3.95 days) as compared to Pusa Navbahar (5.26 days).

In case of germination percentage, cluster bean varieties showed significant differences among themselves. The seed germination percentage ranged from 86.90 to 93.83 per cent. Variety Varun recorded highest germination percentage (93.83 per cent). The lowest germination percentage was observed in Selection Sarika (86.90 per cent).

In respect of plant height at 30 days after sowing shows non significant differences among themselves. The plant height varied between 17.20 cm (Nylon 55) to 22.32 cm (Varun).

At 60 days after sowing the plant was increased and height ranged 31.90 cm (Samruddhi) to 52.80 cm (Varun). The variety Pusa Navbahar recorded plant height of 40.60 cm.

At 90 days, maximum and superior plant height was recorded in variety Varun (92.46 cm) followed by Malav 51 (89.12 cm), Jyoti 51 (75.85 cm) and Pusa Navbahar (71.43 cm). The minimum plant height was recorded in variety Ankur Rani (56.71 cm).

In relation to stem girth, variety Varun recorded maximum stem girth at 30 DAS (2.98 cm), at 60 DAS (3.27 cm) and at 90 DAS (3.98 cm), whereas minimum stem girth was recorded in variety Navlakha (2.17 cm) at 30 DAS, Ankur Rani (2.60 cm) at 60 DAS and Navlakha (3.03 cm) at 90 DAS.

The number of branches per plant in different varieties of cluster bean was found to be significant at 30, 60 and 90 days after sowing. The variety Varun produced the highest number of branches per plant (0.67) at 30 DAS, (1.40) at 60 DAS and (2.33) at 90 DAS, whereas the lowest number of branches per plant produced by variety Nylon 55 (1.22) at 90 DAS.

Number of leaves per plant varied significantly at various stages of growth among the different varieties of cluster bean. The variety Varun produced maximum number of leaves per plant (52.12), whereas the

minimum number of leaves per plant were recorded in variety Nylon 55 (28.60) at 90 days after sowing.

In respect of leaf area, variety Varun recorded the highest leaf area (53.38 $cm^2$), which was superior over all varieties, whereas it was lowest in variety Malav 51 (50.81 $cm^2$).

## 6.2 Yield and yield contributing characters

The number of days required for flower initiation were ranged between 25.73 days to 33.93 days. The early flower initiation was recorded in variety Malav 51 (25.73 days), whereas variety Selection Sarika (33.93 days) required maximum number of days for flower initiation followed by Pusa Navbahar (32.27 days).

In relation to days required for 50 per cent flowering, variety Malav 51 required minimum number of days for 50 per cent flowering (31.43 days), whereas cluster bean variety Pusa Navbahar (39.67 days) and Varun (40.67 days) required maximum number of days for 50 per cent flowering.

In relation to days required for first picking of green pods, significantly less minimum number of days for first picking of green pods recorded in variety Varun (38.87 days) as compared to Pusa Navbahar (42.60 days), whereas maximum number of days for first picking of green pods were recorded in variety Ankur Rani (47.67 days).

Number of green pods per plant were varied significantly among the different varieties of cluster bean variety Varun produced highest number of green pods per plant (71.43); whereas the lowest number of green pods per plant recorded in variety Ankur Rani (37.40).

The variety Varun recorded maximum length of pods (12.59 cm) and the variety Ankur Rani recorded minimum length of pods (7.09 cm) followed by Nylon 55 (8.05 cm), Selection Sarika (8.48 cm) and Pusa Navbahar (8.83 cm).

The highest width of pods was observed in variety Varun (0.96 cm) followed by Malav 51 (0.86 cm) and lowest width of pod was recorded in variety Navlakha (0.66 cm).

The highest weight of pod was observed in variety Varun (2.67 g) followed by Malav 51 (2.50 g) and the lowest weight of pod was recorded in variety Navlakha (1.69 g).

Green pod yield was significantly varied among the different varieties of cluster bean. The variety Varun recorded highest and superior green pod yield per plant (182.97 g), green pod yield per plot (9.44 kg) and yield per hectare (87.50 q) followed by Malav 51 and Jyoti 51 and stood second and third for producing maximum green pod yield per plant, yield per plot and yield per hectare, respectively. While, variety Ankur Rani recorded significantly lowest green pod yield per plant (82.28 g), yield per plot (4.59 kg) and yield per hectare (42.55 q).

The variety Varun recorded highest crop duration (107.07 days) followed by Malav 51 (106.80 days), Pusa Navbahar (103.73 days) and Jyoti 51 (100.86 days). The lowest crop duration was recorded in variety Selection Sarika (92.87 days).

## CONCLUSIONS

The present investigation was undertaken to evaluate the cluster bean varieties for growth and yield under agro climatic conditions of Marathwada region. From the present investigation it can be concluded that all the ten varieties of cluster bean showed significant variation in respect of growth, yield and yield parameters.

From overall performance of different varieties of cluster bean under study, variety Varun found to be best and superior variety for its cultivation in the agro climatic conditions of Marathwada region.

Varieties Malav 51 and Jyoti 51 also found promising by producing maximum number of pods per plant (68.70 and 66.47), maximum pod length (11.13 and 9.33 cm), pod width (0.86 and 0.84 cm), pod weight (2.50 and 2.46 g) and green pod yield per plant (167.17 and 164.25 g), yield per plot (8.75 and 8.22 kg) and yield per hectare (81.02 and 76.16 q) under Marathwada conditions, respectively.

### Future line of work

The further investigation needs to conduct for confirmation of the promising varieties for Marathwada region. Cluster been varieties Varun, Malav 51 and Jyoti 51 were found promising under Marathwada conditions and hence it can be useful for further crop improvement programme.

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Appendix

## APPENDIX-I : Weekly weather data of *kharif* season for the year 2008 at Parbhani

| MW | *Dates* | RF (mm) | Rainy days | Temp °C | | Humidity % | | EVP (mm) | BSS (Hrs.) | W.S. (kmph) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Max. | Min. | AM | PM | | | |
| **22** | 28-03 June | 2.2 | 0 | 39.0 | 24.7 | 61 | 29 | 10.5 | 9.7 | 5.8 |
| **23** | 04-10 June | 68.8 | 2 | 37.1 | 22.6 | 71 | 37 | 7.0 | 7.5 | 7.2 |
| **24** | 11-17 June | 50.8 | 1 | 36.2 | 22.7 | 75 | 42 | 7.2 | 10.0 | 6.3 |
| **25** | 18-24 June | 52.4 | 3 | 34.2 | 21.9 | 82 | 56 | 4.3 | 7.0 | 8.0 |
| **26** | 25-01 July | 72.4 | 4 | 31.9 | 20.9 | 86 | 61 | 2.9 | 2.8 | 7.8 |
| **27** | 02-08 July | 14.8 | 2 | 31.7 | 21.0 | 80 | 60 | 4.9 | 6.0 | 9.3 |
| **28** | 09-15 July | 0.0 | 0 | 32.1 | 20.8 | 76 | 53 | 4.8 | 3.5 | 6.5 |
| **29** | 16-22 July | 17.8 | 1 | 33.3 | 21.3 | 79 | 53 | 5.0 | 6.2 | 4.7 |
| **30** | 23-29 July | 108.8 | 4 | 32.2 | 19.6 | 85 | 64 | 3.8 | 6.4 | 4.1 |
| **31** | 30-05 Aug | 2.2 | 0 | 31.4 | 20.2 | 82 | 64 | 4.4 | 6.0 | 4.4 |
| **32** | 06-12 Aug | 15.4 | 2 | 30.9 | 18.9 | 83 | 65 | 4.5 | 5.4 | 6.8 |
| **33** | 13-19 Aug | 2.5 | 0 | 31.4 | 19.3 | 84 | 59 | 4.5 | 4.2 | 5.4 |
| **34** | 20-26 Aug | 72.6 | 4 | 31.8 | 19.8 | 85 | 58 | 4.9 | 7.2 | 4.6 |
| **35** | 27-02 Sept | 165.7 | 4 | 31.2 | 20.4 | 94 | 68 | 4.1 | 5.9 | 3.3 |
| **36** | 03-09 Sep | 24.2 | 1 | 31.1 | 20.9 | 83 | 62 | 4.5 | 6.2 | 3.8 |
| **37** | 10-16 Sep | 25.5 | 3 | 32.3 | 20.4 | 88 | 62 | 4.4 | 8.0 | 3.7 |
| **38** | 17-23 Sep | 105.6 | 6 | 30.5 | 17.5 | 93 | 72 | 3.6 | 4.0 | 4.1 |
| **39** | 24-30 Sep | 20.2 | 2 | 31.8 | 20.3 | 86 | 62 | 3.9 | 8.3 | 3.1 |
| **40** | 01-07 Oct. | 0.0 | 0 | 32.6 | 18.4 | 79 | 44 | 5.5 | 9.1 | 4.3 |
| **41** | 08-14 Oct. | 0.0 | 0 | 33.5 | 15.3 | 77 | 44 | 5.8 | 9.7 | 2.6 |
| **42** | 15-21 Oct. | 0.0 | 0 | 33.1 | 13.8 | 75 | 33 | 4.4 | 10.0 | 2.7 |
| **43** | 22-28 Oct. | 0.0 | 0 | 32.3 | 10.4 | 76 | 38 | 4.6 | 10.4 | 5.1 |

# STUDIES ON VARIETAL PERFORMANCE OF CLUSTER BEAN (*Cyamopsis tetragonoloba* (L.) Taub.) UNDER MARATHWADA CONDITION


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## THESIS ABSTRACT


The present investigation was undertaken to evaluate the cluster bean varieties for growth and yield under agro climatic conditions of Marathwada region. From the present investigation it can be concluded that all the ten varieties of cluster bean showed significant variation in respect of growth, yield and yield parameters.

From overall performance of different varieties of cluster bean under study, variety Varun found to be best and superior variety for its cultivation in the agro climatic conditions of Marathwada region. Varieties Malav 51 and Jyoti 51 also found promising by producing maximum number of pods per plant (68.70 and 66.47), maximum pod length (11.13 and 9.33 cm), pod width (0.86 and 0.84 cm), pod weight (2.50 and 2.46 g) and green pod yield per plant (167.17 and 164.25 g), yield per plot (8.75 and 8.22 kg) and yield per hectare (81.02 and 76.16 q) under Marathwada conditions, respectively.