STUDIES ON CONTAINERISED PRODUCTION SYSTEM FOR SALAD COCCINIA (*Coccinia grandis* L.)

Thesis submitted in partial fulfilment of the requirements for the degree of

Master of Science (Horticulture)

to the Tamil Nadu Agricultural University, Coimbatore.

By

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1999

CERTIFICATE

This is to certify that the thesis entitled **"STUDIES ON CONTAINERISED PRODUCTION SYSTEM FOR SALAD COCCINIA (*Coccinia grandis L.*)"** submitted in part fulfilment of the requirement for the degree of **MASTER OF SCIENCE (HORTICULTURE)** to the Tamil Nadu Agricultural University, Coimbatore, is a record of *bona fide* research work carried out by **Ms.K.R.Vijayalatha** under my supervision and guidance and that no part of this thesis has been submitted for the award of any other degree, diploma, fellowship or other similar titles and that the work has not been published in part or full in any scientific or popular journal or magazine.

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K.R.VIJAYALATHA

Abstract

ABSTRACT

STUDIES ON CONTAINERISED PRODUCTION SYSTEM FOR SALAD COCCINIA (*Coccinia grandis* L.)

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Investigation on containerised production system for salad coccinia (*Coccinia grandis* L.) was undertaken to standardize the media for container growing, frequency of irrigation and requirement of fertilizers that are amenable for homestead gardens. Container studies were conducted during 1998-99 in factorial completely randomized design at Department of Olericulture, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore.

The results revealed that the performance of Coimbatore local (V_1), FYM medium (M_1), 25 per cent higher level of recommended fertilizer dose (L_2) and daily irrigation (F_1) were found to be superior to Bhubaneshwar local, other two media, other level of fertilizers and weekly irrigation respectively.

The FYM medium (M_1), 25 per cent higher level of recommended fertilizer dose (L_2) (5.7:12.15:5.7 g N, P, K per plant respectively) and daily irrigation (F_1) improved the yield components like vine length, number of branches, number of fruits, weight of fruits per vine in the variety Coimbatore local (V_1). Earliness *viz.*, Days to 1st flowering and days to first harvest was noticed in FYM medium (M_1) with 25 per cent higher level of fertilizers (L_2) and weekly irrigation (F_2) in the variety Coimbatore local (V_1).

The quality traits *viz.*, ascorbic acid and reducing sugar were found to be increased in the variety Bhubaneshwar local (V_2), FYM medium (M_1) and weekly irrigation (F_2). The 25 per cent higher fertilizer dose (L_2) improved the ascorbic acid content, acidity and TSS. Acidity and TSS were more in Coimbatore local variety (V_1). Shelf life of fruits of Bhubaneshwar local (V_2), control (L_0), weekly irrigation (F_2) and FYM medium (M_1) was extended. Seed to flesh ratio was low for the variety Coimbatore local.

The physiological parameters like SLW, harvest index, partitioning efficiency and fruit dry matter content were considerably improved by 25 per cent higher fertilizer dose (L_2), weekly irrigation (F_2) and FYM medium (M_1) in the Coimbatore local variety.

The N, P and K content and uptake in shoot and fruit were increased in 25 per cent higher fertilizer dose (L_2) (5.7: 12.15: 5.7 g N, P, K per plant respectively) with daily irrigation (F_1) in FYM medium (M_1) followed by coirpith medium (M_3).

Thus the study clearly indicated that application of FYM and 25 per cent higher dose of fertilizers can maximize the yield of tender coccinia fruits in the variety Coimbatore local.

CONTENTS

CHAPTER NO.	TITLE	PAGE NO.
I.	INTRODUCTION	01
II.	REVIEW OF LITERATURE	03
III.	MATERIALS AND METHODS	26
IV.	EXPERIMENTAL RESULTS	36
V.	DISCUSSION	106
VI.	SUMMARY	120
	REFERENCES	124
	APPENDICES	

LIST OF TABLES

TABLE NO.	TITLE	PAGE NO.
1.	Effect of variety, potting media, fertilizer, irrigation on plant morphological traits Coccinia	37
2.	Effect of treatments on plant morphological traits in container grown Coccinia	38
3.	Effect of variety, potting media, fertilizer and irrigation on earliness in Coccinia	42
4.	Influence of treatments on earliness in container grown Coccinia	43
5.	Effect of variety, potting media, fertilizer and irrigation on fruit morphological characters in Coccinia	54
6.	Influence of treatments on fruit morphology in container grown Coccinia	55
7.	Effect of variety, potting media, fertilizer and irrigation on yield attributes in Coccinia	57
8.	Effect of treatments on yield attributes in container traits in container grown Coccinia	58
9A.	Effect of variety, fertilizer dose, media and their interactions on yield per vine	48
9B.	Effect of fertilizer, variety and irrigation on yield per vine	49
9C.	Effect of irrigation, variety and media on yield per vine	50
9D.	Effect of fertilizer, irrigation and media on yield per vine	51
10.	Effect of variety, potting media, fertilizer and irrigation on plant ascorbic acid in Coccinia	62
11.	Influence of treatments on ascorbic acid and acidity in container grown Coccinia	63

TABLE NO.	TITLE	PAGE NO.
12.	Effect of variety, potting media, fertilizer and irrigation on fruit quality in Coccinia	65
13.	Influence of treatments on fruit quality in container grown Coccinia	66
14.	Effect of variety, potting media, fertilizer and irrigation on post harvest loss in weight in Coccinia	68
15.	Influence of treatments on fruit, post harvest loss in weight in container grown Coccinia	69
16.	Effect of variety, potting media, fertilizer and irrigation on shelf life and seed to flesh ratio in Coccinia	71
17.	Influence of treatments on shelf life and seed to flesh ratio in container grown Coccinia	72
18.	Effect of variety, potting media, fertilizer and irrigation on physiological parameters in Coccinia	74
19.	Influence of treatments on physiological parameters in container grown Coccinia	75
20.	Effect of variety, potting media, fertilizer and irrigation on harvest index and fruit dry matter in Coccinia	78
21.	Influence of treatments on harvest index and fruit dry matter in container grown Coccinia	79
22.	Effect of variety, potting media, fertilizer and irrigation on partitioning efficiency in Coccinia	81
23.	Effect of treatments on partitioning efficiency in container grown Coccinia	82
24.	Effect of variety, potting media, fertilizer and irrigation on shoot N, P and K content in Coccinia	84
25.	Effect of treatments on shoot N, P and K content in container grown Coccinia	85

TABLE NO.	TITLE	PAGE NO.
26.	Effect of variety, potting media, fertilizer and irrigation on fruit N, P and K content in Coccinia	88
27.	Effect of treatments on fruit N, P and K content in container grown Coccinia	89
28.	Effect of variety, potting media, fertilizer and irrigation on N, P and K uptake in Coccinia	92
29.	Effect of treatments on N, P and K uptake in container grown Coccinia	93
30.	Effect of variety, potting media, fertilizer and irrigation on N, P and K content in post harvest soil Coccinia	96
31.	Effect of treatments on N, P and K content in residual soil in container grown Coccinia	97
32.	Inter correlation among yield contributing characters and yield	100
33.	Organoleptic evaluation for salad Coccinia	102

LIST OF FIGURES

Fig. No.	Title	Page. No.
1.	Effect of variety, potting media, fertilizer and irrigation frequency on primary branches in container grown Coccinia.	40
2.	Effect of variety, potting media, fertilizer and irrigation frequency on secondary branches in container grown Coccinia.	41
3.	Effect of variety, potting media, fertilizer and irrigation frequency on days to 1st flowering in container grown Coccinia.	44
4.	Effect of variety, potting media, fertilizer and irrigation frequency on fruit weight in container grown Coccinia.	49
5.	Effect of variety, potting media, fertilizer and irrigation frequency on fruit number per vine in container grown Coccinia.	60
6.	Effect of variety, potting media, fertilizer and irrigation frequency on yield per vine in container grown Coccinia.	46

LIST OF PLATES

Plate.No.	Title	Page. No.
1.	View of container grown Coccinia.	104
2.	Comparison of different levels of fertilizer- L_0 , L_1 and L_2.	104
3.	Early flowering and fruiting – treatment T_7 ($V_1L_2F_2M_1$)	104
4.	High yielding treatments T_7 and T_{25}.	104
5	Comparison of fruit characters – V_1 & V_2	105
6.	Comparison of fruit characters – M_1, M_2 & M_3	105
7.	Comparison of fruit characters – L_0, L_1 & L_3	105
8.	Fruit characters of different media – M_1, M_2 & M_3.	105
9.	Best medium (M_1 and M_3) for V_1 variety	105
10.	Best medium (M_1 and M_3) for V_2 variety	105

Introduction

CHAPTER I

INTRODUCTION

IVY gourd (*Coccinia grandis*) is a dioecious Asian vegetable belonging to the family Cucurbitaceae. It is widely distributed throughout China, Malaysia, C. America and Africa. It is found both in wild and cultivated states in the plains of India. The tender fruits are highly nutritive with 1.2 g protein, 0.1 g fat, 0.5 g minerals, 1.6 g fibre, 3.1 g carbohydrate, 40.0 mg calcium, 30.0 mg phosphorus, 1.4 mg iron, 10.07 mg thiamine, 0.08 mg riboflavin, 0.07 mg niacin, 15.0 mg ascorbic acid, 1.56 mg carotene and 93.5 g water per 100 g. Besides culinary uses, its use in siddha and ayurvedic systems to cure diabetics is well known. Further it is considered as a body slimming agent and reduces cholesterol in human system.

Coccinia has been cultivated in small pockets, mostly in natural fences and also as a nature sown crop from which fruits are collected and sold in the market. The preference for coccinia as a salad vegetable by the urban consumer is the order to the day. The dietary habit of the urban consumer is at the transition from traditional to health conscious diet pattern and salad has found its place irrespective of the age group, young and old in the family and time of the day when food is consumed.

Coccinia as salad vegetable thus fits in the diet pattern and demand is increasingly high as it is the only salad vegetable that can be made available throughout the year.

Coccinia cultivation is to be augmented in field scale in the near future. In the meantime, coccinia can be considered for cultivation in homesteads, in the kitchen garden, roof garden and as a container grown single plant, so as to maintain a steady supply a fresh salad coccinia to the inmates of the house.

Hence a study has been contemplated with the following objectives to standardize the containerised production system for coccinia.

1. To standardize the media for containerised production system for salad coccinia.
2. To standardize the nutrient management for container grown salad coccinia.
3. To standardize the frequency of irrigation for container grown salad coccinia.

Review of literature

CHAPTER II

REVIEW OF LITERATURE

Perennial cucumber (***Coccinia grandis*** L.) is a valued nutritive vegetable crop of tropical Asia. It is yet to be exploited extensively as a salad crop through out the world. Hardly any varietal improvement has been done in this crop. Considerable work has been done on sex mechanism and only few studies have been conducted on manurial requirement of ivy gourd. Coccinia is well adopted to the warm and wet tropics.

Literature on the different media, nutrition, management on growth, yield and quality of Coccinia, cucumber and certain other crops are reviewed as below.

2.1. MEDIA

Cucumber cultivars Iwa, Serana, Sandro and Parbro grown in containers of 2:1 pine bark: sphagnum peat substrate gave early yield from 4.34 to 7.86 kg/m^2 compared to strawbales. Greater nutrition and water economy was obtained with containers (Bartkowski, 1985).

Abou-Hadid *et al.* (1995) reported on the performance of soilless media on green house production of cucumber. Among the media tested, peat based mixtures gave better results than soil control. Also it confirmed the possibility of re-circulating the drained solution for cucumber grown under protected cultivation.

Abou-El-Hassan *et al.* (1993) studied the nutrient uptake of cucumber cv. Fatia grown on local substrates. Rice straw covered with sand gave the highest yield of fresh and dry weight and total N, P, K accumulation in vegetative parts and fruits. Total dry matter content and total N, P, K accumulation in vegetative parts increased with plant age till 120 days from planting and then declined.

El-Beltagy *et al.* (1992) observed the interaction between rooting media and fertilizer for cucumber crops of cv. Corona F_1 grown in green house in different combinations of peat, sand and vermiculite.

Stofella and Graetz (1996) revealed that total tomato yield, marketable yield were higher with larger mean fruit size (g) in plots amended with sugarcane filter cake compost than control.

Raviv (1998) stated the effects of compost on soil plant system. It was found to improve soil texture, enhanced nutrient cycling and suppress soil borne pathogens. Roe *et al.* (1997) observed that plots amended with compost in cucumber gave higher marketable yield.

2.1.1. Farm yard manure

The bulky organic manure such as FYM compost help in maintaining the soil productivity. They increased organic carbon and humus content, CEC and WHC. The organic sources also increase the efficiency of chemical fertilizers.

2.1.1.1. Growth and yield

Lima *et al.* (1984) evaluated the use of different organic matter for commercial cucumber production of cv. Aodai Nazare. The treatment imposed with FYM at 20 t/ha gave an yield of 18.5 t/ha however chicken manure was profitable.

Kwalflewski (1984) reported that in cucumber cv. Wisconsin SMR-18, FYM at 20-60 t/ha supplemented along with NPK increased marketable yield by 16.9 per cent. A study on manurial requirement of ivy gourd was conducted by Sachan and Chundawat (1985). They reported N application at 45 kg/ha in the form of castor cake or FYM at the time of fruiting will increase the yield.

Annanurova *et al.* (1992) studied the effects of fertilizer on fruit quality of tomato. To the basic NPK recommendation (220:160:150 kg/ha), addition of FYM at 30 t/ha increased the mean weight of fruits and yield by 161.8 per cent than other treatments. Nirmala (1996) studied the effects of organic farming in cucumber and found that yield and yield components were increased with FYM at 20 t/ha along with biofertilizers.

2.1.1.2. Nutrient uptake

As a result of organic matter decomposition in the native soil, P uptake increased and also due to high P content (1.18 per cent) in FYM (Prabhakar *et al.*, 1972). Patil *et al.* (1993) emphasized FYM to be most effective and incorporation of FYM increased the available N, P_2O_5 contents.

Das and Banerjee (1994) determined the uptake of nutrients in potato. The manurial treatment 50 t FYM + 60 kg N/ha left more residual nutrients to absorb higher quantities of N, P, K. Bagavathiammal and Muthiah (1995) revealed that P uptake was highest with 100 kg K + FYM.

2.1.1.3. Quality

Yoshida *et al.* (1984) indicated the differences between the levels of reducing sugar, organic acid and vitamin C in Saturn tomatoes produced organically and inorganically though vitamin C was highest with organic fertilizers. Leclere *et al.* (1990) pointed that high level of mineral fertilization can reduce the vitamin content in leaf salad vegetable.

2.1.2. Flyash

Incorporation of flyash greatly increased the plant available water capacity of the substrate. Flyash can be a substitute for peat as it has the potential to replace the water holding capacity several times its own volume of peat.

2.1.2.1. Growth and yield

Wong and Wong (1990) studied the effect of flyash on yield of ***Brassica parachinensis*** and ***B. chinensis***. Application of 12 per cent flyash increased soil pH and soil FC. The yield was highest from 3 per cent flyash application for ***B.chinensis*** while 12 per cent flyash application gave higher yield in ***B. parachinensis***.

Kene *et al.* (1991) assessed the effects of application of flyash in soil. Addition till 10 per cent had beneficial effects on growth and yield performance of sunflower cv. Morden.

Narwal *et al.* (1992) observed increase in dry matter yield of oat plants with no added P but decreased dry weight in plants which were given P. Uptake of P increased with increasing P rate at all concentrations of flyash. Soil carbon increased by 20 per cent flyash and concluded, 2.5 per cent flyash as safe level.

Gupta *et al.* (1996) reported that grain yield of wheat increased upto 90 mg P and increased with 2.5 per cent flyash but decreased at higher rates. Soil organic carbon increased with rate of flyash. Lalk *et al.* (1996) stated that at higher levels of 16 per cent flyash growth is reduced.

Tomato cv. Pusa Ruby plants grown in pots containing the ash soil mixture showed luxuriant growth with bigger and greener leaves than in soil only. Plant growth, yield, leaf carotenoid and chlorophyll concentration were mostly enhanced in treatments with 40-80 per cent flyash being optimal at 50-60 per cent however yield was reduced at 100 per cent. The response of N was found to be antagonistic. The yield was improved at 40 per cent incorporation (Khan and Khan, 1996).

Scotti *et al.* (1996) reported the effect of flyash application on the yield, production and chemical composition of pot grown chicory. The results showed that the

addition of 3 per cent ashes gave a significant increase in yield and Mg content compared to the traditional growing.

2.1.2.2. Nutrient uptake

Menzies and Aitken (1996) found that addition of 10 per cent flyash as a component of potting substrate in tomato increased nutrient availability and led to significant increase in yield.

2.1.2.3. Quality

Lalk *et al.* (1996) studied the effect of flyash on growth and nutrition of soybean. The highest dry matter yield of soybean (14.78 g/plot) was obtained in treatment receiving 16 per cent flyash.

2.1.3. Coirpith

Incorporation of coirpith improves soil physical conditions *viz.*, improved aeration, WHC, supplements more plant nutrition.

2.1.3.1. Growth and yield

Ahmed (1993) studied the influence of composted coirpith on growth and yield of tomato in cv. Pusa Ruby. The incorporation of coirpith at 5-20 t/ha improved the soil bulk density, moisture retention capacity compared with FYM at 10 t/ha. However fruit yield was higher with FYM (190.01 t/ha) than coirpith (16.97 t/ha).

Thilagavathy and Mathan (1996) reported that grain yield was highest in plots receiving composted coirpith (3.82 t). Bhaskar and Saravanan (1997) in their trial conducted with coirpith in different proportions with soil as a substrate for growing tomatoes and cowpeas. The potting media of 75:25 coirpith to soil ratio recorded high yield (110 g/pot) followed by 50 per cent coir (90.3 g/pot) in cowpea. In tomato also higher yield was obtained with 25 per cent coir (65 per cent g/pot) followed by 50 per cent coir (506 g/pot).

Veeraputhiran and Joseph (1997) reported that incorporation of coirpith increased length of vine by 10.0, number of leaves/vine by 11.5, leaf area by 10.6, LAI by 24.2 than control. Number of fruits/plant increased by 13 per cent and yield by 27 per cent.

2.1.3.2. Nutrient uptake

Composted coirpith had more N, P, K than that of raw coirpith 1.06, 0.06 and 1.2 per cent respectively as suggested by Pushpa and Vasudevan (1994). Bagavathiammal and Muthiah (1995) revealed that uptake of N and K was highest with 100 kg K + composted coirpith. Thilagavathy and Mathan (1996) noticed that uptake of N, P, K, Ca, Mg were highest in rice plots treated with composted coirpith than control.

2.2. INORGANIC FERTILIZERS

2.2.1. Effect of NPK

Jamal and Ghouse (1975) determined physiobiochemical differences in two varieties of ***Coccinia cordifolia***. Allahabad variety had higher contents of P_2O_5 and K_2O,

soluble and insoluble carbohydrates, proteins and phenolic compounds than Aligarh variety. However Aligarh had higher nitrogen content.

Orphanos and Papadopoulous (1980) conducted a trial growing tomatoes in direct soil and pots. The fertilizer requirement of pot grown plants producing 7 kg tomatoes was 17 g N, 4 g P and 10 g K/plant. Plants grown in pots had 18 per cent lower yield than grown directly in soil.

A field experiment to study the effects of soil application of various levels of NPK on nutritional composition of tomato showed that a combination of 200 kg N/ha, 100 kg P_2O_5/ha and 100 kg K_2O)/ha gave higher protein (95.2 per cent), total sugars (11.9 per cent), reducing sugars (10.4 per cent), non-reducing (26.7 per cent), ascorbic acid (80.6 per cent), phosphorus, potassium, iron and calcium compared to control (Bagal *et al.*, 1989).

Al-sahaf and Al-khafagi (1990) reported that an increase of NPK concentration increased vegetative growth, dry matter production, leaf nutrient contents and yield. Highest plant height, number of branches, total leaf surface area, dry matter, fruit weight and yield were obtained with 300 per cent NPK treatment.

Yadav *et al.* (1993) recorded the response of pointed gourd variety BP-2 and BP-3 to varying levels of N, P, K. The results indicated that increasing levels of NPK increased

yield contributing characters. Application of 120 kg N, 80 kg P, 80 kg k/ha produced maximum yield of pointed gourd (120.68 q/ha).

2.2.2. EFFECT OF NITROGEN

2.2.2.1. GROWTH AND YIELD

Brantley (1958) observed that N at 100 lb/acre increased the total yield and fruit size in watermelon. Wagoner (1958) stated that cucumber yield was increased by applying N at 10 lb/acre. Dhesi *et al.* (1966) obtained the highest fruit yield in bitter gourd at 56 kg N/ha. Bishop *et al.* (1969) pointed out that N at 100 kg/ha was beneficial for pickling cucumber. Randhwa and Singh (1970) reported that an increasing level of N increased the dry matter content in muskmelon.

Manrdanove *et al.* (1971) found that root weight of squash melon was increased with low rate of N. However plant height was reduced. Application of K at 90 lb/acre was found to increase vine length, leaf area, total dry matter production and higher fruit yield of 10 t/acre in pickling cucumber (Mc Collem and Miller, 1971).

Highest yield of fruits (11.28 kg/plant) with 110 kg N/ha was recorded as against 10.18 kg with 165 kg N in muskmelon (Jassal *et al.*, 1972). In pointed gourd, 80 kg N/ha increased the yield upto 85 per cent (Dubey and Pandey, 1973).

The continuous liquid fertilization to cucumber, tomato and lettuce of very high, high, moderate nutrient requirement showed that the crops could be grown with lower soil N and K contents than usual as reported by Hauer (1973).

Wu *et al.* (1974) studied the effect of nitrogen from ammonium and nitrate source on growth. Plants grown with NH_4-N exhibited fewer leaves, shorter stems, lower fresh and dry weight than those grown with N as NO_3.

Kmiecik (1976) recorded a significant yield increase in plots receiving N at 120 kg/ha in cucumber. Patil and Bhosale (1976) noticed highest number and weight of fruits at 75 kg N/ha in watermelon. In watermelon var. Sugar Baby, application of 75 and 100 kg N/ha gave significantly more yield of fruits (22.104 and 23.357 t/ha respectively (Bhosale *et al.*, 1978).

Cantiliffe and Omran (1978) revealed that application of N at 133 kg/ha significantly increased the number of leaves/plant in cucumber. El-Beheidi *et al.* (1978) stated that fairly high rate of N at 60 kg/ha was needed for satisfactory growth and seed yield in cucumber.

El-Aidy and Moustafa (1978) observed that more number of leaves, better branching and highest yield of fruits (3.4 kg/m2) when cucumber plants were supplied with mixed fertilizer (1:1:2) in cucumber.

Schenk *et al.* (1979) reported that shoot yield was much reduced in plants treated with NH_3 dissolved in the nutrient solution. Randhawa *et al.* (1981) recorded an increased number of fruits/vine, average weight/fruit and total marketable yield at 75 kg N/ha in muskmelon.

In tinda, increasing levels of N significantly increased vine length, stem diameter, more number of leaves/plant. Application of 120 kg N significantly increased the diameter and weight of fruits (Singh *et al.*, 1982).

Alan (1984) reported maximum fruit yield in cucumber with supply of 300 ppm of N. Raychaudhury *et al.* (1984) conducted a trial with ***C. vulgaris*** var. fistulosess cv. Green Round. They found that the response to N was greatest and plants receiving the standard N rate (1.71 g/15 cm pot) produced highest number of flowers and fruits (11/plants).

Das *et al.* (1987) found increased total yield in pointed gourd at 90 kg N. Cerda and Martinez (1988) noticed that addition of N enhanced the development of root and shoot dry weight in cucumber. Sanchez Conde (1988) found that the courgette plants (***C. pepo***) had increased growth of aerial parts with increasing N applied as NH_4NO_3.

Wu *et al.* (1988) in their experiment with rice found that leaf area and chlorophyll content increased while those of cucumber decreased sharply when supplemented with increasing NH_4-N concentration (1-20 mmol/l). The NH_4-N ratio in leaves of cucumber was affected due to decreased activities of Glutamine synthase and Glutamine dehydrogenase.

Du *et al.* (1989) reported that NH_4. N can be used upto 50% of total N for cucumbers in sand culture as NH_4-N increased leaf area, shoot length, number of flowers but had no effect on yield.

Kim and Lee (1989) found that NPK fertilizer in cucumber increased the stem length. However, application of hyponex as nutrient source increased the growth and contact of some mineral elements. Al-sahaf and Al-khafagi (1990) recorded more number of fruits/plants (13.52) and early yield (435.51 g/plant) by application of N at 300% in cucumber.

Maximum leaf girth in cucumber was due to the application of nutrient solution containing higher concentration of ammonium di-hydrogen phosphate (Masuda *et al.*, 1990). Montagu and Goh (1990) studied the effect of organic and inorganic fertilizer on yield and quality of tomato cv. Potentate. Fruit yield was significantly correlated with leaf N concentration but not with fruit N concentration. Along with N fertilization at 600 kg N/ha ,compost increased fruit yield by 40 per cent.

Sharaf *et al.* (1990) found that increase in N concentration increased plant height, leaf number, fresh and dry weight of plants by supply of N to soilless culture. Kulbir Singh *et al.* (1991) studied the effect of N and spacing on growth, yield and quality of pumpkin. They found that combination of 80 kg N/ha and 3m x 6 cm spacing were the best for maximum fruit yield.

Zhang *et al.* (1991) studied the effect of nitrogen on growth and development of cucumber cv. Lin Za No.1. Yield was improved by increasing proportion of NH_4 upto 50 per cent applied to media containing mixture of sand, vermiculite and peat. According to Adams *et al.* (1992) higher dose of liquid N increased plant height and dry weight.

Yingjajaval and Markmoon (1993) noticed that application of N (200 per cent) increased the vegetative growth and 40-50 per cent increase in marketable fruit yield in cucumber. John, M. Swaider *et al.* (1994) recorded highest yield of 15.5 t/ha in pumpkin by application of N at 11kg/ha through drip irrigation.

Nawab Ali *et al.* (1995) reported the response of bitter gourd to different levels of N. The highest yield of 24.9 t/ha was recorded with 80 kg N and the individual fruit weight was higher (155.26g) while fruit set (34.49) was greater at 120 kg N.

Lamrani *et al.* (1996) reported the influence of N, P, K as NH_4NO_3, H_3PO_4, K_2SO_4 respectively on the pigmentation of cucumber leaves. The concentration of chlorophyll a, chlorophyll b and carotenes increased with increasing rate of N while higher P rate decreased it and K increased the concentration of chlorophyll a only. Shousenyan *et al.* (1996) in his studies showed that reproductive growth was best when NH_4 N was 25 per cent or 50 per cent of the total N.

Park Hyesun *et al.* (1997) studied the effect of form and concentration of nitrogen. Seedlings grown with NH_4 showed poor growth. However, total N content was

high in plants grown in NH_4 solution. Higher the N concentration in nutrient solution, higher the leaf N.

2.2.2.2. Nutrient uptake

Wu *et al.* (1974) studied the effect of N from ammonium and nitrate sources on growth of cucumbers. The No_3-N increased the uptake of NH_4-N. Schenk *et al.* (1979) reported that K concentration was reduced in plants treated with NH_3 dissolved in the nutrient solution.

Prohaszea *et al.* (1988) reported the factors influencing the nutrient supply of cucumbers where the soil nutrient content was higher but leaf nutrient level was poor. The reason attributed to it is high Na and Cl content and partly due to soil reaction.

Yanishevsku and Krishchenko (1988) in their investigation found greater difference in composition of plant parts. Between the plants given NO_3-N and NH_4-N in hydroponics. The use of NO_3-N resulted in higher concentration of Ca, Mg, Na, Mo while NH_4-N resulted in hour N, S, P, U, Fe and Zn contents.

Alan (1989) studied the effect of nitrogen nutrition in cucumber. Significant decrease in dry weight of fruit, leaves and roots was recorded when N was applied as NH_4^+. The N content of fruit, leaves stems, roots and P content of leaves, fruits, stem and roots increased when 50 per cent of N was applied as NH_4. NH_4 source decreased the K, Ca and Mg contents of all tissues.

Du *et al.* (1989) reported that NH_4-N can be used upto 50 per cent of total N for cucumbers in sand culture as increasing levels of NH_4-N decreased the levels of N, P, soluble sugar in leaves and decreased K, Ca, Mg, Mo.

2.2.2.3. Quality

Ammonium toxicity appears to affect the carbohydrate metabolism in plants. Toxic quantities of applied NH_3 increased the levels of uridine diphospho glucose in leaves and the uridine compound containing sugar as sugar derivatives (Matsumoto *et al.* 1969).

Sagdullaev and Umarouve (1975) reported that application of 100 kg N/ha improved quality like TSS in melons. According to Buczek and Burzynskii (1979), protein content and dry weight increment of plants grown for 10 days with NH_4-N were significant over the plants grown with NH_3-N or NH_4NO_3. Cucumber preferred NO_3 although they could utilize ammoniacal N also.

Randhawa *et al.* (1981) indicated that increased level of N increased TSS and vitamin C in muskmelon. In the trial conducted with cucumber cv. TSKhA-2u grown in soil and hydroponically, highest yield of good quality cucumber in soil (11.5 fruits /3 kg container) was obtained from plants receiving NH4-NO3. In hydroponically grown plants, the yield (8 fruits/container), cucumber quality were highest from the plants receiving KNO_3 + $NaNO_3$ as reported by Krishchenko (1981).

Yadav and Mangal (1984) found that addition of 40 kg N/ha improved pulp thickness TSS and ascorbic acid. Das *et al.* (1987) recorded that increasing level of N upto 80 kg/ha improved the protein (14.28 per cent) and vitamin C (12.9 mg/100g) contents in cucumber.

Valenzuela *et al.* (1990) noticed maximum carbohydrates and chlorophyll a, b with highest amount of N in cucumber. Pansare *et al.*. (1994) reported in tomato cv. Pusa Ruby that highest yield was obtained with 3:1:3 NPK while TSS was highest with 3:1:2 ratio.

Yommi *et al.* (1995) found that increased NPK application had no effect in fruit quality or shelf life in tomato cv. Bonanza when N was applied as ammonium nitrate. Pandey *et al.*. (1998) conducted a trial in tomato to study the effect of N, P on quality of tomato fruits. Its dry weight and radial diameter of fruit increased significantly by increasing levels of N upto 120 kg/ha. Thickness of rind, TSS, equatorial diameter of the fruit was not affected.

2.2.3. Effect of Phosphorus

2.2.3.1. Growth and yield

Everett *et al.* (1967) noticed increase in yield with P application upto 105 lb/acre on fine sandy soil in water melon.

El-Beheidi *et al.* (1978) reported that 22.5 to 37.5 kg P/acre promoted plant growth, advanced flowering, increased weight of fruits and total yield in cucumber.

Deswal and Patil (1984) recorded increased percentage of flesh (62.14 per cent) and TSS (10.01 per cent) at highest level of P_2O_5. In musk melon, high level of P_2O_5 increased the number of fruits and TSS content (Prabhakar *et al.*, 1985).

Das *et al.* (1987) pointed out in pointed gourd that increasing levels of P_2O_5 increased growth. Stoliarov and Fanina (1989) found that P at 90 kg/ha increased fruit yield of cucumber upto 30 t/ha.

Al-sahaf and Al-khafagi (1990) revealed, an increase of P concentration in Cooper's nutrient solution produced higher yield of fruits/plant in cucumber. Fruit yield was increased with P application at 40 kg/ha in pointed gourd (Rajesh kumar *et al.* 1990).

El-Hassan (1991) observed that application of P at 7.6 to 15.2 kg/ha gave maximum fruit yield than control in cucumber. Yingajajaval and Markmoon (1993) found that P fertilization twice a week to cucumber increased yield by 40.5 per cent.

According to Yalcin and Topcvoglu (1994), suggested application of P as triple super PO_4 to potted cucumber cv.Maram increased plant dry weight and yield/plant.

Lamrani *et al.* (1996) reported on the influence of N, P, K as NH_4NO_3, H_3PO_4, K_2SO_4 respectively on the pigmentation of cucumber leaves. The concentration of chlorophyll a, chlorophyll b and carotenes increased with increasing rate of N while higher P rate decreased it and K increased the concentration of chlorophyll a only.

2.2.3.2. Uptake and tissue content

According to Yalcin and Topcvoglu (1994) application of P at 150 ppm/plot as triple super PO_4 increased P, N, K, Ca, Mg content.

2.2.3.3 Fruit quality

Pandey *et al.* (1998) conducted a trial in tomato to study the effect of N, P, on quality of tomato fruits. While per cent acidity and ascorbic acid increased with increasing level of P, thickness of rind, TSS, equatorial diameter of fruit were not affected.

2.2.4. Potassium

2.2.4.1. Growth and yield

Paterson and Smith (1958) found that increase in K application till 100 lb/acre increased fruit yield in watermelon. Lachovev (1968) recorded a marked increase in fruit yield of squash with 100 kg K/ha.

Application of K at 80 lb/acre was found to increase vine length, leaf area, total dry matter production and higher fruits yield (10 t/acre) in pickling cucumber (Mc Collem and Miller, 1971). El-Aidy and Moustafa (1978) reported an increased vegetative growth and fruit yield in cucumber with 350 kg/ha application of mixed fertilizer (1:1:2).

In watermelon cv. Sugar baby, application of 75 and 100 kg K_2O/ha gave significantly more yield of fruits, 22.35 t/ha (Bhosale *et al.*, 1978).

Manuca (1989) noticed higher rate of K_2O improved vine growth and increased fruit yield by 10-40 per cent in cucumber. Kubo *et al.* (1991) pointed out in cucumber a significant increase in length and girth of fruit due to split application of K at 150 kg/ha.

Yingjajaval and Markmoon (1993) observed that application of K 50 per cent higher than the recommended dose increased the yield by 31 per cent in cucumber cv. Puang.

John M. Swaider *et al.* (1994) found increased vegetative growth and total marketable pumpkin fruits when fertigated with N at 112 kg and K at 224 kg/ha in combination.

Lamrani *et al.* (1996) reported that application of K_2SO_4 increased the concentration of chlorophyll a without altering the concentration of chlorophyll b and carotenes.

Bastelaere (1998) revealed greatest crop weight and better crop quality in lettuce plant treated with patent potassium and ammonium nitrate at 3.5-8 kg/acre each.

2.2.4.2. Nutrient uptake

El-Hassan (1991) recorded increased K content in fruits and leaves of cucumber with K application at 50 kg/ha. John M. Swaider *et al.* (1994) reported that leaf K content in cucumber increased with high K fertigation.

Zhuhongxun *et al.* (1996) showed that uptake increased upto fruit development stage and then declined. High yield was obtained with K at 180 kg/hm^2.

2.2.4.3. Quality

Bradley (1957) revealed that increasing rates of K fertilization resulted in increase upto 40 per cent in titrable acidity level and citric acid content of tomato.

Trudel and Ozbun (1970) found low K nutrition to be directly related to low acidity. Picha and Hall (1982) noticed increase in reducing sugar, dry weight and pH with increasing application of K upto 744 kg/ha in tomato.

Sanchez Conde (1988) reported that courgette plants (*C. pepo*) had increased fruit vitamin content when K was applied as K_2SO_4. Al-sahaf and Alkhafagi (1990) indicated K application at higher level increased the leaf area and leaf content.

The uptake of nutrients with reference to K was high due to additional application of K to cucumber (Alan and Kovanci, 1991). Increased potassium application increased the chemical constituents of tomato fruits, *viz.*, ascorbic acid, acidity while TSS, reducing and non-reducing sugar were found to be more upto 80 kg K_2O/ha and reduced at higher levels. Maximum yield was recorded at 120 kg K_2O/ha (Verma *et al.* 1991).

Adams *et al.* (1992) recorded that liquid feed of K at 250 kg/ha improved K content of leaves. Maximum (61.68 per cent) first grade fruit can be obtained if

cucumbers were supplied with enough quality of K fertilizers. John M. Swaider *et al.* (1994) reported that leaf K content in cucumber increased with high K fertigation.

2.3. IRRIGATION

The crop needs regular supply of water for optimum yield. Excessive supply of water at maturity will reduce the storage life of the fruit.

2.3.1. Growth and yield

Souza and Souza (1998) studied the effect of frequency of application of N and K by trickle irrigation in melon. Commercial yield of 21.69 t/ha were obtained with irrigation frequencies of 2 days and application of N at 90 kg/ha and 100 kg K/ha.

2.3.2. Nutrient uptake

Orphanos and Papadopoulous (1980) conducted a trial growing tomatoes in direct soil and pots. Lower yield of pot grown plants was attributed to water stress since there was no response to increased application of N, P, K. Malik and Kumar (1998) found that there was adequate nutrient availability when fertilizers were given with drip.

2.3.3. Quality

Tuzel and Tuzel (1994) recorded increased yield with increasing irrigation rates but decreased TSS and reduce dry matter content of fruits. The reason attributed is increasing irrigation rate favoured moisture content of fruit which may have created dilution effect on TA content in tomato.

Titulaer (1996) studied on fertigation of gherkins, total nutrient requirement was 220:280 kg N: 100-160 kg P_2O_5 : 380-450 kg K_2O /ha which was met with 60 kg kristalon Blaumarke (19:6:20:3 N:P:K:Mg/ha/week during early growth and 100 kg applied/ha/week during fruit production.

Malik and Kumar (1998) noticed more yield, fruit size, TSS content through fertigation by means of drip. Souza and Souza (1998) reported in melon, more TSS content of fruit with highest irrigation frequency than control.

2.4. PHYSIOLOGICAL ASPECTS

Nath and Subramanyam (1971) observed that Coccinia fruits can be stored at room temperature for a week.

The cucumber cv. Dolzhik grown under different irrigation and fertilizer treatments gave maximum content of chlorophyll a, b (3.17, 3.27 mg/dm^2) at 60 t FYM+NPK at 90:90:120 kg/ha as stated by Zabara (1984).

Kanellis *et al.* (1986) observed that commercial maturity of cucumber fruits was attained 10-11 days after anthesis and these matured fruits had 20-30 days shelf life and good colour retention while chlorophyll content decreased with fruit age.

Kumar and Rao (1991) revealed an increase in dry matter production, P uptake and seed yield with increase in N and P rate. P application did not affect dry matter partitioning in soybean.

Cucumber cv. Corona grown in 8 litre containers of perlite had significant correlation between root weight, shoot weight, leaf area and fruit yield (Bohnie, 1992). NeSmith (1992) recorded a significant linear correlation between leaf area and the product between leaf length and width.

Bhatnagar and Sharma (1994) studied the maturity stage in bottle gourd cv. Pusa Summer Prolific Long. Fruits were edible, tender and green from 12.24 days after anthesis. Ascorbic acid increased at intermediate stage of fruit development and decreased there after. Reddy *et al.* (1995) found that SLW decreased with increase in LAI. There was positive correlation between SLW and assimilation rate.

2.5. BIOCHEMICAL PROPERTIES OF COCCINIA

In reducing the blood glucose level, 95 per cent ethanolic extract of whole plant of Coccinia was more active compared to that of root extract (Mukherjee *et al.*, 1988). Roy and Dutta (1989) revealed that fruit decoction of Coccinia significantly reduced the blood glucose level when administered to rabbits.

Aga and Badada (1997) reported the nutritional and antinutritional characteristics of ***Coccinia abyssinica***. The protein, starch, total sugars, reducing sugars, retinol and riboflavin contents were higher in peeled (3.9 g, 20.4 g, 4.0 g, 53.3 µg, 0.08 mg respectively) than whole plant samples. It was concluded that it had a good nutritive value.

Materials and methods

CHAPTER III

MATERIALS AND METHODS

Studies on container production system for salad Coccinia (***Coccinia grandis*** L.) were carried out during 1998-99 at Department of Olericulture, Horticultural College and Research Institute, TNAU, Coimbatore.

The materials and analytical methods adopted for the study are presented in this chapter.

3.1. MATERIALS

Two lines of Coccinia (***Coccinia grandis*** L.), Coimbatore local and Bhubaneshwar line were chosen for the study from the germplasm maintained at Department of Olericulture, Horticultural College and Research Institute, TNAU, Coimbatore.

3.2. METHODS

Container studies were conducted to assess the suitable media and nutrient requirements for salad Coccinia. The design followed was completely randomized block design with 36 treatments with three replications. The trial was conducted from August'98 to March 1999.

3.2.1. Details of the experiment

Cuttings of 15 cm length with 2-3 nodes at pencil thickness from both the Coimbatore local (V_1) and Bhubaneshwar line (V_2) had been selected and planted in

polybags containing soil and sand (1:1). Thirty day old rooted cuttings were transplanted to containers filled with three different media.

M_1 : Soil + Sand + FYM

M_2 : Soil + Sand + Flyash

M_3 : Soil + Sand + Composted coirpith.

The frequency of watering was done at daily interval (F_1) and weekly interval (F_2). The fertiliser dose recommended for the crop is 20:40:20 kg N, P_2O_5, K_2O respectively (Anonymous, 1974). Liquid grade of fertlizers as ammonium nitrate, orthophosphoric acid, potassium nitrate were applied at 0.5 per cent concentration. The recommended dose (L_1) treated plant received 4.5:9.72:4.5 g NH_4NO_3, H_3PO_4, KNO_3 per plant respectively and 25 per cent higher than recommended dose (L_2) treated plants received 5.7:12.5:5.7 g NH_4NO_3, H_3PO_4, KNO_3 per plant respectively. They were applied in split doses.

3.2.2. Treatments

The total number of treatments were thirty six as indicated below. The total number of plants per treatment was 10.

$V_1L_0F_1M_1$ (T_1)	$V_1L_0F_2M_1$ (T_{19})
$V_1L_0F_1M_2$ (T_2)	$V_1L_0F_2M_2$ (T_{20})
$V_1L_0F_1M_3$ (T_3)	$V_1L_0F_2M_3$ (T_{21})
$V_1L_1F_1M_1$ (T_4)	$V_1L_1F_2M_1$ (T_{22})
$V_1L_1F_1M_2$ (T_5)	$V_1L_1F_2M_2$ (T_{23})
$V_1L_1F_1M_3$ (T_6)	$V_1L_1F_2M_3$ (T_{24})

$V_1L_2F_1M_1$ (T_7)	$V_1L_2F_2M_1$ (T_{25})
$V_1L_2F_1M_2$ (T_8)	$V_1L_2F_2M_2$ (T_{26})
$V_1L_2F_1M_3$ (T_9)	$V_1L_2F_2M_3$ (T_{27})
$V_2L_0F_1M_1$ (T_{10})	$V_2L_0F_2M_1$ (T_{28})
$V_2L_0F_1M_2$ (T_{11})	$V_2L_0F_2M_2$ (T_{29})
$V_2L_0F_1M_3$ (T_{12})	$V_2L_0F_2M_3$ (T_{30})
$V_2L_1F_1M_1$ (T_{13})	$V_2L_1F_2M_1$ (T_{31})
$V_2L_1F_1M_2$ (T_{14})	$V_2L_1F_2M_2$ (T_{32})
$V_2L_1F_1M_3$ (T_{15})	$V_2L_1F_2M_3$ (T_{33})
$V_2L_2F_1M_1$ (T_{16})	$V_2L_2F_2M_1$ (T_{34})
$V_2L_2F_1M_2$ (T_{17})	$V_2L_2F_2M_2$ (T_{35})
$V_2L_2F_1M_3$ (T_{18})	$V_2L_2F_2M_3$ (T_{36})

The plant protection measures were taken up to control the infestation of mealy bugs and aphids at fortnight intervals.

3.3. OBSERVATIONS

Five randomly selected plants in each treatment per replication were tagged for recording the observations on plant characters and the mean values were subjected to statistical scrutiny.

3.3.1. BIOMETRICAL CHARACTERS

3.3.1.1. Vine length

The length of the vine was recorded from the sprouting node to the vine tip at harvest and expressed in centimetres.

3.3.1.2. Number of branches/vine

The branches arising from the main stem were counted as primary branches and branches arising from primary were counted as secondary branches and the mean expressed in numbers.

3.3.1.3. Days to first flowering

The number of days taken for the appearance of 50 per cent flowering from date of planting was recorded and expressed as number of days.

3.3.1.4. Days to first harvest

The number of days taken for first harvest of fruits at optimum vegetable maturity stage were counted from date of planting and expressed as number of days.

3.3.1.5. Number of fruits per vine

The number of fruits produced by the vine was counted and expressed as number per vine.

3.3.1.6. Fruit length

The length of fruits at optimum maturity to use as salad was measured from the fruit stalk end to the tip in randomly selected fruits and mean values expressed in centimetres.

3.3.1.7. Fruit girth

The girth of fruits at optimum maturity to use as salad was measured from centre of fruits randomly selected and mean values expressed in centimetres.

3.3.1.8. Fruit weight

All the fruits were weighed and mean values were recorded as average fruit weight and expressed in grams.

3.3.1.9. Yield per vine

All fruits harvested per treatment were weighed and the fruit yield was expressed as g/vine.

3.3.1.10. Seed flesh ratio

The ratio of seed weight to flesh weight is measured as seed flesh ratio.

3.3.1.11. Keeping quality at ambient temperature

The number of days taken for initiation of ripening from harvest at optimum maturity salad stage is shelf life and expressed as number of days. The physiological loss in weight was recorded on 4^{th} and 7^{th} day and expressed as per cent.

3.3.2. PHYSIOLOGICAL PARAMETERS

3.3.2.1. Specific leaf weight (SLW)

SLW was worked out by using the formula suggested by Pearce *et al.* (1968) and was expressed in grams per square centimetre.

$$SLW = \frac{\text{Leaf dry weight per plant}}{\text{Leaf area per plant}}$$

3.3.2.2. Specific leaf area

SLA was measured using the formula given by Kvet *et al.* (1971) and expressed in square centimetre per gram.

$$SLA = \frac{\text{Leaf area}}{\text{Leaf dry weight}}$$

3.3.2.3. Dry matter production (DMP)

The dry matter content of the fruit was recorded at last harvest. The fruits from vines were harvested and dried in hot air oven at 60°± 2°C and removed after 24 hrs. The dry matter expressed as percentage.

3.3.2.4. Harvest index

The harvest index was calculated adopting the following formula.

$$HI = \frac{\text{Economical Yield}}{\text{Biological Yield}} \times 100$$

3.3.2.5. Partitioning coefficient

Partitioning coefficient was calculated from yield per plant and dry matter product after harvest (Synder and Carlson, 1984)

$$PC = \frac{\text{Yield / Plant}}{\text{DMP}}$$

3.3.3. BIOCHEMICAL PARAMETERS

3.3.3.1. Ascorbic acid

The ascorbic acid content of fruit pulp was estimated by titrimetric method using 2,6 dichlorophenol indophenol dye (Aberg, 1958) and expressed as milligrams per 100 grams of dry weight.

3.3.3.2. Tritable acidity

Titrable acidity was estimated as per the method described by A.O.A.C. (1975). Ten gram of fruit sample were macerated and volume was made upto 100 ml. From that 10ml of fruit juice was taken in conical flask and 2 drops of phenolphthalein indicator was added and these were titrated against 0.1 N KOH till permanent pink colour was obtained. The results were expressed in terms of citric acid per 100 gram of dry weight.

3.3.3.3. Reducing sugar

Reducing sugar was estimated as per the method of Somogyi, 1952. Ethanol extract was prepared by grinding 100 mg fruit tissue in 80 per cent warm ethanol. This was centrifuged and supernatant was collected. From 0.2 ml of ethanol extract, the alcohol was evaporated by keeping it in water bath.

Residues were dissolved in 2 ml of water to which 1ml of alkaline copper tartarate reagent was added. Again they were boiled in water bath for 10 min. After cooling, 1 ml of arsenomolybdate reagent was added, to it 6 ml of water was added and mixed well. The absorbance was measured after 10 min at 620 nm. From the standard graph the

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3.3.5.2. Phosphorus

Phosphorus content of plant sample was estimated by triple acid extract (Jackson, 1967) using calorimeter. The uptake was worked out by multiplying P content (per cent) by DMP of that treatment and expressed in kg ha^{-1}.

3.3.5.3. Potassium

The K content of the sample was estimated by triple acid extract method using flame photometer (Jackson, 1973) and expressed in per cent. The uptake of K was expressed in kg ha^{-1}.

3.3.6. SOIL SAMPLE ANALYSIS

Soil samples were collected from containers before sowing and at last harvest. The samples were shade dried, powdered and sieved through 2 mm sieve and used for analysis.

3.3.6.1. Available Nitrogen

The available nitrogen in the soil sample was estimated by alkaline potassium permanganate method (Subbiah and Asija, 1956).

3.3.6.2. Available Phosphorus

The available phosphorus in soil was estimated calorimetrically by employing the method of Olsen *et al.*, 1954.

3.3.6.3. Available Potassium

The available potassium in soil was estimated after extraction with neutral ammonium acetate. (Stanford and English, 1949).

3.3.7. STATISTICAL ANALYSIS

The experimental data were statistically analysed by adopting the procedure described by Panse and Sukhatme (1957).

Results

CHAPTER IV

EXPERIMENTAL RESULTS

Studies on container production system for Coccinia was conducted at Department of Olericulture, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore during the year 1998-1999 and the observations recorded were analysed statistically. The mean data pertaining to the biometrical characteristics, quality parameters, physiological parameters and the results relating to the chemical analysis of plant and soil samples are furnished below.

4.1. BIOMETRICAL CHARACTERS

4.1.1. Vine length

The variety Coimbatore local (V_1) recorded significantly higher vine length of 154.26 cm compared to Bhubaneshwar local (120.09 cm). The mean values of different fertilizer doses indicate highest significant vine length (164.08 cm) for 25 per cent higher recommended dose followed by recommended dose (140.07 cm) compared to that of the control (107.37 cm). Daily irrigation had a significant effect in increasing the vine length by 9.44 cm compared to weekly irrigation. Among the media, FYM, coirpith and fly ash recorded the values of 159.53 cm, 136.49 cm and 115.50 cm respectively and FYM being significant (Table 1).

Among the treatment combinations T_7 ($V_1L_2F_1M_1$) recorded significantly higher value, 208.60 cm followed by T_{25} ($V_1L_2F_2M_1$) of 196.80 cm and the lowest was T_{29} ($V_2L_0F_2M_2$) with a value of 66.27 cm followed by T_{11} ($V_2L_0F_1M_2$) of 75.57 cm (Table 2).

Table.1. Effect of variety,potting media,fertilizer and irrigation on plant morphological traits in Coccinia.

Main factors	Vine length (cm)	Primary branches	Secondary branches
V1	154.26	3.23	9.72
V2	120.09	2.84	9.94
L0	107.37	2.52	8.32
L1	140.07	3.03	10.51
L2	164.08	3.55	10.67
F1	141.90	2.92	9.82
F2	132.45	3.15	9.84
M1	159.53	3.99	12.34
M2	115.50	2.34	8.06
M3	136.49	2.77	9.09
	SE(d)	SE(d)	SE(d)
V	0.60	0.07	0.08
L	0.74	0.08	0.10
F	0.60	0.07	0.08
M	0.74	0.08	0.10
	CD(0.05)	CD(0.05)	CD(0.05)
V	1.21	0.14	0.16
L	1.48	0.17	0.19
F	1.21	0.14	0.16
M	1.48	0.17	0.19
	CD(0.01)	CD(0.01)	CD(0.01)
V	1.60	0.18	0.21
L	1.96	0.23	0.27
F	1.60	0.18	0.21
M	1.96	0.23	0.27

Table.2. Effect of treatments on plant morphological traits in container grown Coccinia.

Treatments	Vine length (cm)	Primary branches	Secondary branches
T1	152.33	3.27	11.00
T2	104.10	2.07	6.40
T3	134.57	2.13	7.33
T4	183.90	4.67	14.33
T5	133.97	2.00	8.20
T6	164.13	2.20	9.40
T7	208.60	5.33	14.13
T8	158.93	2.07	8.00
T9	185.27	3.00	8.73
T10	110.00	2.73	10.27
T11	75.57	2.20	7.20
T12	87.53	2.47	7.93
T13	143.90	3.47	11.80
T14	114.27	2.00	9.20
T15	130.17	2.67	10.40
T16	181.20	4.40	12.67
T17	132.58	2.87	9.07
T18	153.10	3.00	10.73
T19	157.87	3.53	11.20
T20	103.03	2.47	6.07
T21	118.90	2.87	7.20
T22	175.23	4.73	13.67
T23	122.03	2.53	8.00
T24	155.43	3.40	9.27
T25	196.80	5.13	14.07
T26	148.60	3.13	8.53
T27	172.97	3.60	9.47
T28	100.80	2.53	10.47
T29	66.27	2.00	7.27
T30	77.43	2.00	7.47
T31	134.37	3.93	11.80
T32	103.17	2.07	9.27
T33	120.27	2.73	10.73
T34	169.37	4.20	12.67
T35	123.47	2.67	9.53
T36	138.13	3.20	10.40
SE(d)	2.57	0.30	0.34
CD(0.05)	5.13	0.60	0.67
CD(0.01)	6.81	0.80	0.89

4.1.2. Primary branches per vine

The differences between the treatment for the number of primary branches per vine were significant. The variety (V_1) Coimbatore local recorded the highest number of primary branches (3.23) than V_2 (2.84). The (L_2) 25 per cent higher recommended dose recorded highest number (3.55) than L_1 (3.03) and L_0 (2.52). Weekly irrigation (F_2) was found to record the highest (3.15) than F_1 (2.92). The medium with FYM (M_1) recorded highest number of primary branches (3.99) than M_2 (2.34) and M_3 (2.77) (Table 1).

The mean values of the number of primary branches varied from 2.00 to 5.13. Among the interactions lowest number of branches (2.00) were recorded in T_5 ($V_1L_1F_1M_2$), T_{14} ($V_2L_1F_1M_2$), T_{29} ($V_2L_0F_2M_2$), T_{30} ($V_2L_0F_2M_3$) and highly significant value was recorded in T_7 ($V_1L_2F_1M_1$) with 5.33 followed by T_{25} ($V_1L_2F_2M_1$) (Table 2 and Fig. 1).

4.1.3. Number of secondary branches per vine

The number of secondary branches varied significantly between the varieties with V_2 Bhubaneshwar local recording highest (9.94) than V_1 (9.72). Variation was found between the fertilizer doses with L_2 dose having more number of secondary branches (10.67) followed by L_1 (10.51). There was slight variation noticed among the irrigation treatments with F_2 recording 9.84 secondary branches per vine than F_1 (9.82). There was significant variation between the media with FYM recording highest (12.34) and least with fly ash (8.06) (Table 1).

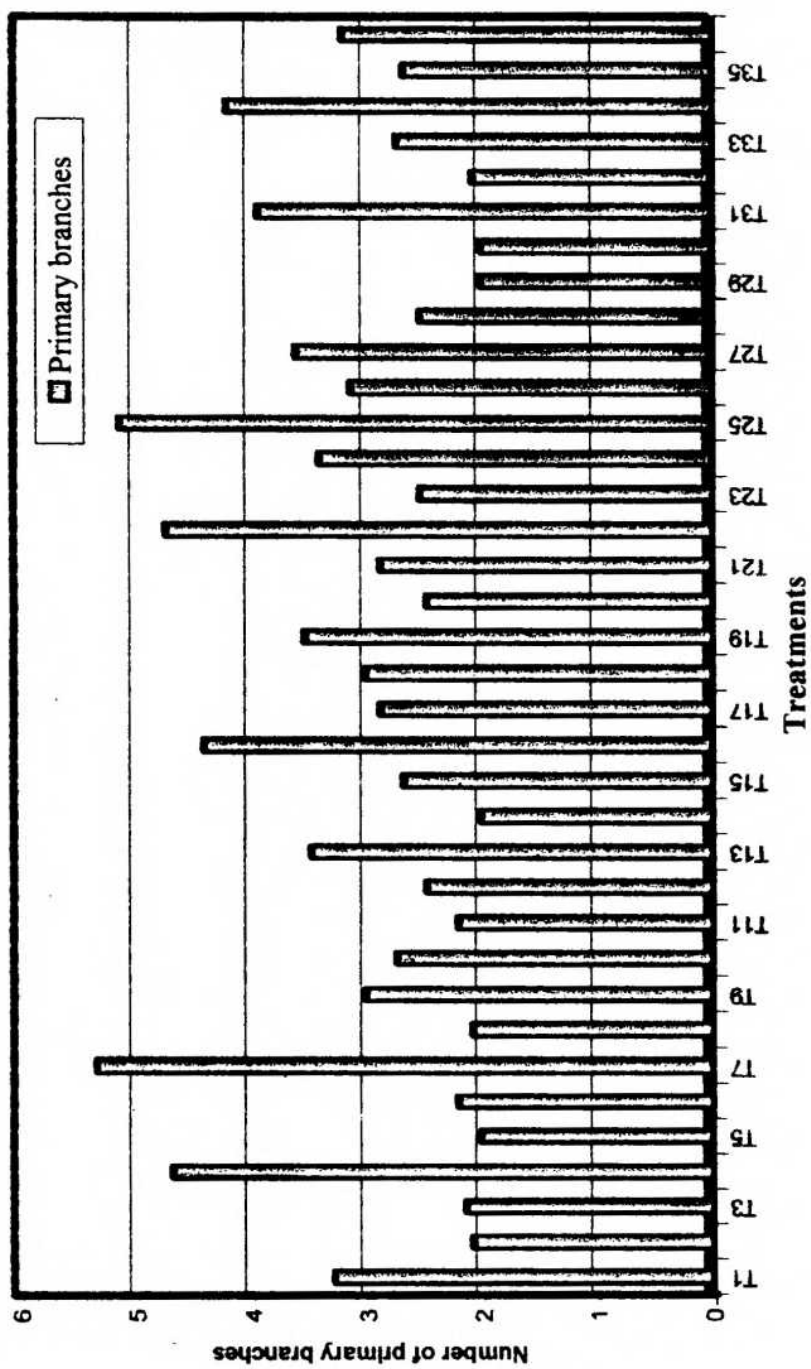


Fig.1. Effect of variety,potting media,fertilizer and irrigation frequency on number of primary branches in container grown Coccinia

Table.3. Effect of variety,potting media,fertilizer and irrigation on earliness in Coccinia.

Main factors	Days to 1st flowering	Days to 1st harvest
V1	50.16	62.43
V2	55.94	68.62
L0	59.86	72.69
L1	50.55	63.28
L2	48.74	60.60
F1	59.41	71.60
F2	46.69	59.45
M1	49.16	61.54
M2	56.54	69.20
M3	53.44	65.84
	SE(d)	SE(d)
V	0.20	0.28
L	0.24	0.35
F	0.20	0.28
M	0.24	0.35
	CD(0.05)	CD(0.05)
V	0.40	0.57
L	0.49	0.69
F	0.40	0.56
M	0.49	0.69
	CD(0.01)	CD(0.01)
V	0.53	0.75
L	0.65	0.91
F	0.53	0.75
M	0.65	0.92

Table.4. Influence of treatments on earliness in container grown Coccinia.

Treatments	Days to first flowering	Days to first harvest
T1	61.40	73.07
T2	64.73	78.27
T3	63.07	75.87
T4	52.67	65.40
T5	58.33	69.87
T6	54.67	67.00
T7	47.53	57.47
T8	57.87	68.73
T9	55.33	66.00
T10	66.40	79.20
T11	78.47	91.40
T12	73.73	86.07
T13	54.27	66.73
T14	60.27	73.47
T15	57.80	69.73
T16	50.40	62.73
T17	58.40	70.93
T18	54.07	66.60
T19	46.67	60.00
T20	49.60	63.07
T21	48.67	61.07
T22	38.07	50.67
T23	44.40	58.00
T24	40.67	53.27
T25	34.07	47.07
T26	44.33	55.67
T27	40.87	53.20
T28	53.20	66.53
T29	56.67	69.67
T30	55.67	68.13
T31	45.40	57.40
T32	52.13	65.80
T33	47.93	61.83
T34	39.87	52.20
T35	53.33	65.53
T36	48.87	61.07
SE(d)	0.84	1.20
CD(0.05)	1.69	2.39
CD(0.01)	2.24	3.18

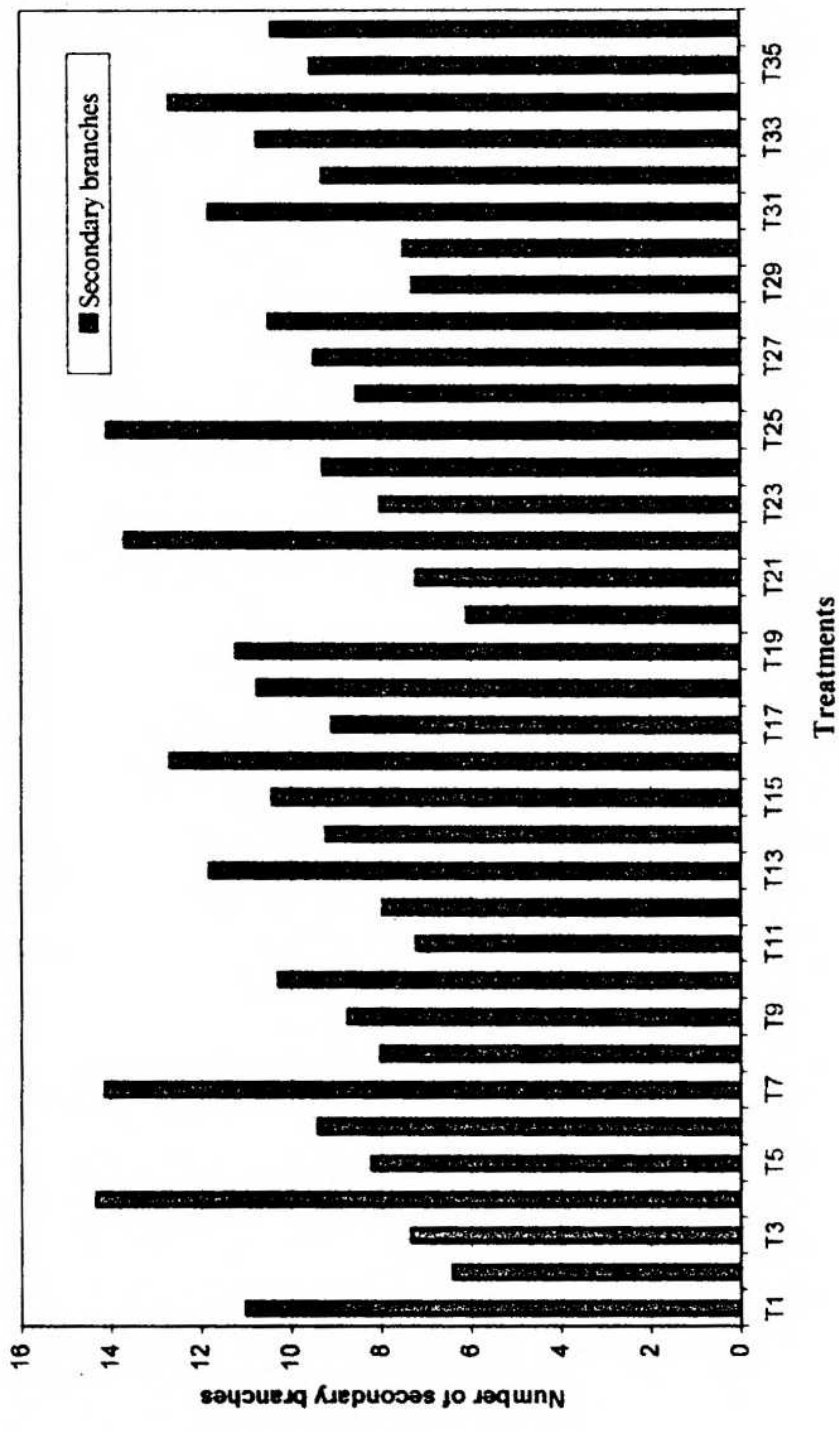


Fig.2. Effect of variety, potting media,fertilizer and irrigation frequency on number of secondary branches in container grown Coccinia.

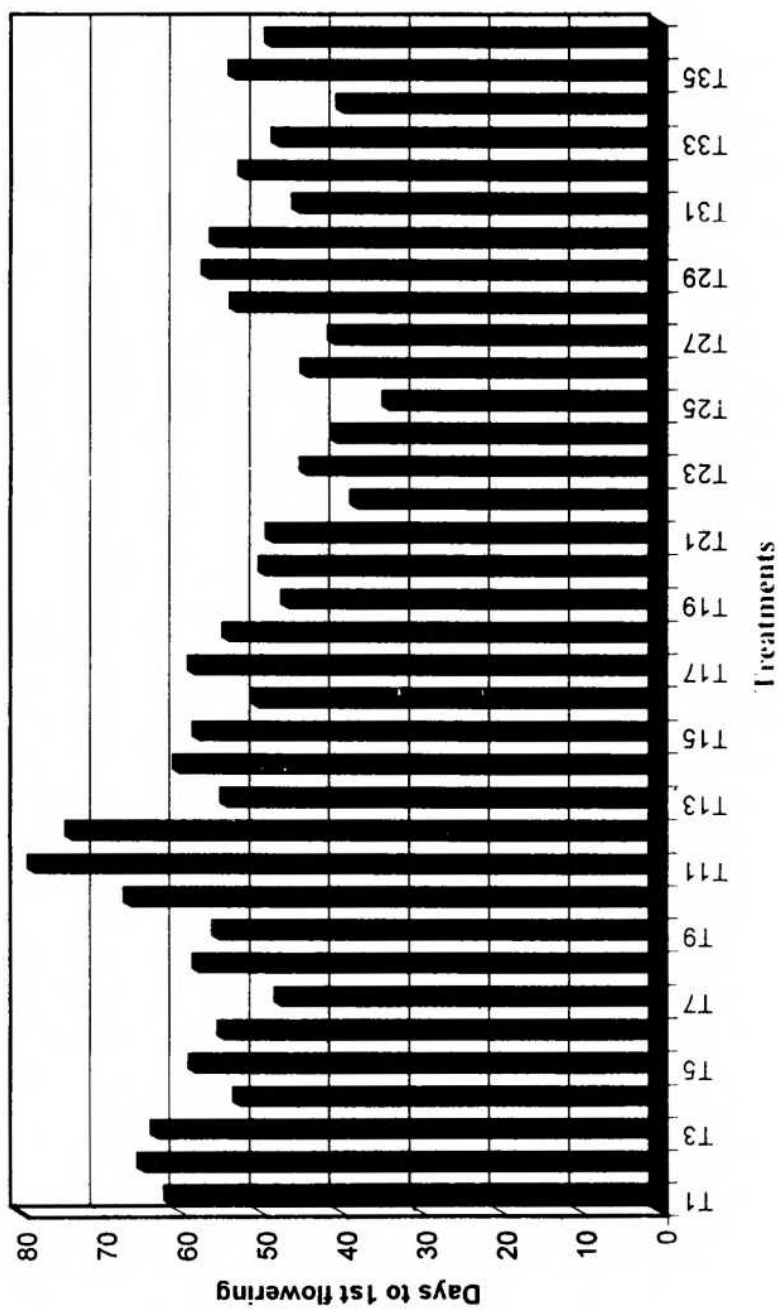


Fig.3. Effect of variety,potting media,fertilizer and irrigation frequency on days to 1st flowering in container grown Coccinia

Among the interactions, the mean values varied from 6.07 to 14.33. Significant number of secondary branches was observed for T_4 (14.33) followed by T_7 (14.13) while treatment T_{20} recorded lowest number of 6.07 followed by T_2 (6.40) (Table 2 and Fig. 2).

4.1.4. Days to first flowering

The vines of variety (V_1) produced significantly early flowering i.e. within 50.16 days compared to V_2 (55.94). Flower appearance of L_2 was significantly early (48.74) while control took longer time of 59.86 days. Delayed flowering was noticed in weekly irrigated F_1(59.41) than F_2 (46.69). The earliest flower appearance was found in the medium with FYM M_1 (49.16) while fly ash (M_2) medium delayed flowering (56.54) (Table 3) and FYM being significant.

Days to first flower appearance varied significantly between the treatments. The mean values ranged from 34.07 to 78.47 days. The vine of treatment T_{25} recorded the earliest appearance of flower (34.07 days) followed by T_{22} which took 38.07 days. While it was delayed at T_{11}, T_{12}, T_2 treatments (78.47, 73.73, 67.43 days respectively) (Table 4 and Fig. 3).

4.1.5. Days to first harvest

The stage of maturity for salad coccinia was accounted from days to first harvest. The variety V_1 Coimbatore local reached early maturity of 62.43 days significantly superior to V_2 (68.62 days). The control pots L_0 took longer time to reach maturity stage of 72.69 days while L_2 was significantly early to maturity (60.60 days) (Table 3).

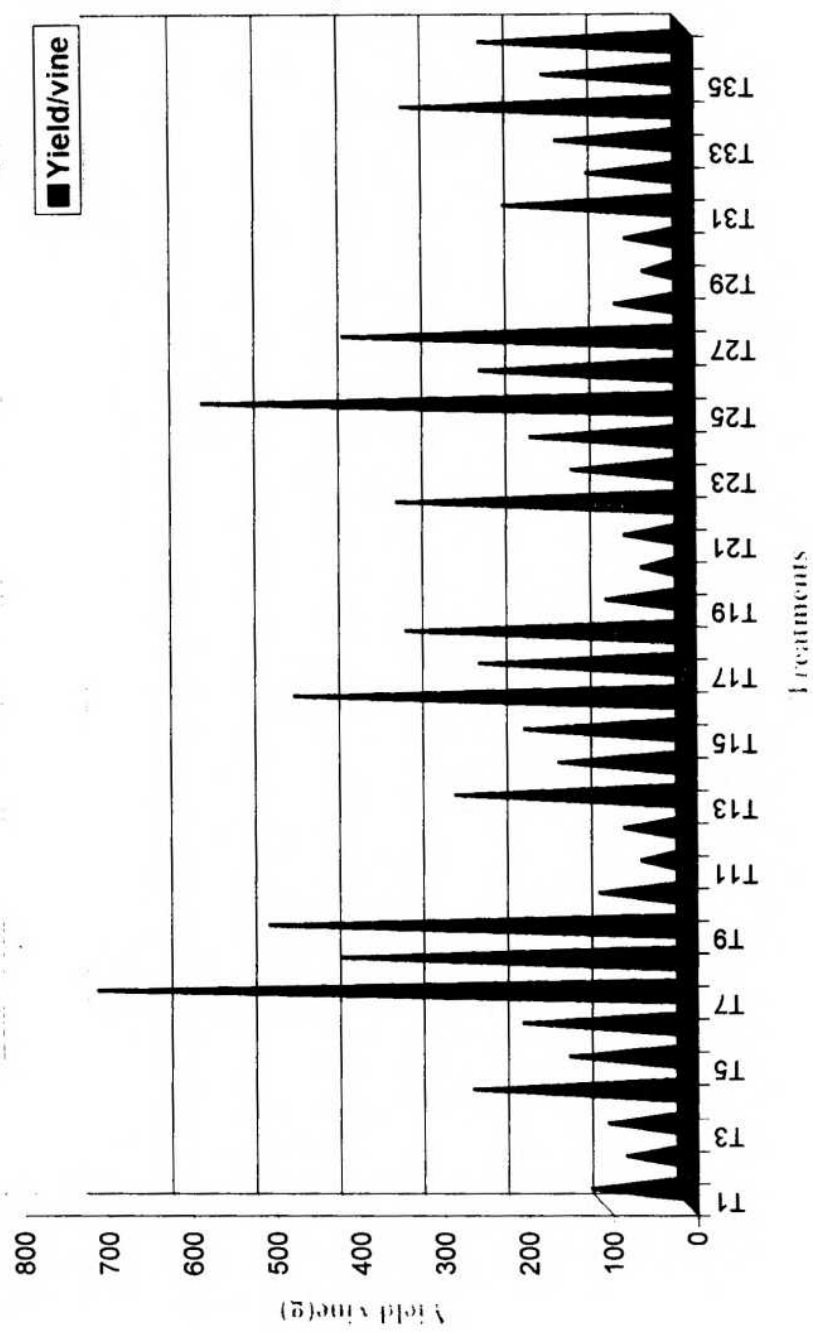


Fig.6. Effect of variety,potting media,fertilizer and irrigation on yield/vine in container grown Coccinia

Weekly irrigation F_2 recorded earliest significant maturity 59.45 days compared to F_1 (71.60 days). Among the different media employed FYM (M_1) produced earlier fruits within 61.54 days while fly ash (M_3) extended the days to 65.84.

There existed significant differences between the treatment interactions. The vine of treatment T_{25} was early to harvest (47.07 days) followed by T_{22} (50.67 days) and T_{34} (52.20 days). The treatment T_{11} was late to maturity (91.40 days) followed by T_{12} (86.07 days) (Table 4).

4.1.6. Yield per vine

Fruit yield per vine was significant between the varieties. The yield was more in variety V_1 (254.44 g/vine) than V_2 (184.62 g/vine). The L_2 dose recorded significantly higher fruit yield of 385.10 g/vine while control recorded only 77.54 g/vine. Among the media significantly higher yield was registered in FYM (M_1) with 296.49 g/vine while fly ash M_2 recorded lowest yield (152.80 g/vine) (Table7).

The mean data of yield per vine for interactions have indicated that values varied from 48.77 g/vine to 700.21 g/vine. The vine of treatments T_7 produced significant yield of 700.21 g/vine followed by T_{25} (574.17 g/vine). The vines of T_{29}, T_{20}, T_{11} treatments recorded lowest yield (48.77, 52.05 and 53.37 g/vine) and are on par followed by T_{30}, T_2, T_{12} (69.89, 72.24, 73.50 g/vine) which are on par. The other treatmental differences were significant statistically (Table 8 and Fig. 6).

Table .9A. Effect of variety, fertilizer dose ,media and their interactions on yield per vine.

Variety	Fertilizer	Media			Mean (VL)
		M1	M2	M3	
V1	L0	107.73	62.14	82.67	84.18
	L1	348.79	136.93	189.28	224.99
	L2	687.32	326.77	451.80	488.29
Mean (VM)		381.28	175.28	241.25	
V2	L0	92.93	50.92	72.20	72.01
	L1	245.08	133.18	172.46	183.57
	L2	400.61	206.83	287.42	298.29
Mean (VM)		246.20	130.30	177.36	
SE(d)		CD(0.05)		CD(0.01)	
VM	1.07	VM	2.13	VM	2.83
VL	1.06	VL	2.13	VL	2.83
VLM	1.85	VLM	3.69	VLM	4.90

Table.9B. Effect of fertilizer, variety and irrigation on yield per vine.

Irrigation	Variety	Fertilizer		
		L0	L1	L2
F1	V1	95.50	229.10	568.92
	V2	76.96	206.26	348.89
Mean(FL)		86.23	217.68	458.49
F2	V1	72.87	220.90	408.34
	V2	67.07	160.89	248.59
Mean(FL)		69.97	190.89	328.42
	SE(d)	CD(0.01)	CD(0.01)	
LF	1.07	3.01	2.83	
VLF	1.51	2.13	4.00	

Table.9C. Effect of irrigation , variety and media on yield per vine.

Fertilizer	Irrigation	Media		
		M1	M2	M3
L0	F1	112.21	62.66	83.82
	F2	88.45	50.41	71.05
Mean		100.33	56.53	77.44
L1	F1	314.44	145.34	193.26
	F2	279.42	124.77	168.48
Mean		296.93	135.06	180.87
L2	F1	633.11	327.90	414.47
	F2	484.82	205.70	324.75
Mean		543.96	266.80	369.61
	SE(d)	CD(0.05)	CD(0.01)	
LM	1.31	2.61	3.47	
LFM	1.85	3.69	4.90	

Table.9D. Effect of fertiliser, irrigation and media on yield per vine.

Irrigation	variety	Media			Mean
		M1	M2	M3	
F1	**V1**	425.15	207.12	261.24	297.84
	V2	281.35	150.14	199.79	210.43
Mean		353.25	178.63	230.52	
F2	**V1**	337.40	143.44	221.26	234.03
	V2	211.05	110.48	154.93	158.82
Mean(FM)		274.23	126.96	188.09	
	SE(d)	**CD(0.05)**	CD(0.01)		
VF	0.87	2.13	2.31		
FM	1.07	3.01	2.83		
VFM	1.51	2.31	4.00		

VxLxM Interaction

For the variety V_1, highest yield per vine was recorded in 25 per cent higher recommended dose (L_2) invariably of all media. Among the media FYM (M_1) produced significant highest yield of 687.32 g/vine followed by coirpith (451.80 g/vine) and flyash (326.77 g/vine) (Table 9A).

For the variety V_2 also similar results have been obtained. In L_2 dose media M_1 registered significant highest yield of 400.61 g/vine followed by M_3 and M_2 (287.42 g/vine and 206.83 g/vine respectively) (Table 9A).

FxVXL Interaction

In daily irrigation F_1, more yield per vine was noticed in 25 per cent higher recommended dose (L_2). The variety V_1 recorded significant yield (568.92 g/vine) than V_2 (348.89 g/vine)(Table 9B).

In weekly irrigation F_2, V_1 produced significant yield of 408.34 g/vine than V_2 (248.51 g/vine) treated with 25 per cent higher recommended dose (L_2) followed by L_1 (Table 9B).

FxVxM Interaction

Among the media, FYM (M_1) recorded significant highest yield in variety V_1 (425.15 and 337.40 g/vine) than V_2 in both daily and weekly irrigated (F_1 and F_2) respectively. (Table 9C).

LxFxM Interaction

In case of control(L_o), the daily irrigated F_1 produced more yield in all the media compared to F_2. Of the media, FYM recorded significant yield of 112.21 g/vine.

In case of recommended dose of fertilizer (L_1) the daily irrigation (F_1) coupled with FYM medium registered significant higher yield of 314.44 g/vine than F_2 (279.42 g/vine) (Table 9D).

In case of 25 per cent higher recommended dose (L_2) the FYM (M_1) media along with F_1 produced highly significant yield 633.11 g/vine than F_2 (454.82 g/vine) compared to other media (Table 9D).

4.1.7. Fruit length

Of the varieties, V_1 produced significantly lengthier fruits of 7.99 cm on than V_2 (7.57 cm). Higher fertilizer dose (L_2) recorded significant fruit length (8.48 cm) followed by L_1 and L_0 (7.80 cm and 7.08 cm). There was significant variation in the frequency of irrigation where F_2 produced shorter fruits (7.61 cm) than F_1 (7.96 cm). With different media, FYM (M_1) registered significantly lengthier fruits of 8.46 cm followed by M_3 (7.70 cm) and M_2 (7.21 cm) (Table 5).

In the interactions, vine of treatments T_7 and T_{25} produced lengthiest fruits of 9.53 cm each, followed by T_{16} producing 9.23 cm fruits. The shorter fruits were found in the treatments T_{11}, T_{20}, T_{29} (6.53,6.60,6.30 cm respectively) and are on par. There was significant differences among the other treatments (Table 6).

Table.5. Effect of variety,potting media,fertilizer and irrigation on fruit morphological characters in Coccinia.

Main factors	Fruit length (cm)	Fruit girth (cm)
V1	7.99	7.21
V2	7.57	6.22
L0	7.08	5.83
L1	7.80	6.70
L2	8.48	7.62
F1	7.96	7.07
F2	7.61	6.36
M1	8.46	7.61
M2	7.21	5.91
M3	7.70	6.82
	SE(d)	SE(d)
V	0.03	0.05
L	0.04	0.06
F	0.03	0.05
M	0.04	0.06
	CD(0.05)	CD(0.05)
V	0.06	0.10
L	0.08	0.12
F	0.65	0.10
M	0.08	0.12
	CD(0.01)	CD(0.01)
V	0.08	0.13
L	0.11	0.16
F	0.09	0.14
M	0.11	0.17

Table.6. Influence of treatments on fruit morphology in container grown Coccinia.

Treatments	Fruit length (cm)	Fruit girth (cm)
T1	8.20	7.33
T2	6.90	6.27
T3	7.53	6.77
T4	8.83	8.43
T5	7.63	8.86
T6	8.27	7.73
T7	9.53	8.76
T8	7.93	7.30
T9	8.60	8.07
T10	7.60	6.73
T11	6.53	4.87
T12	7.00	5.60
T13	8.37	7.87
T14	7.10	5.23
T15	7.63	6.23
T16	9.23	8.80
T17	7.97	6.80
T18	8.37	7.53
T19	7.37	6.43
T20	6.60	5.43
T21	6.77	5.74
T22	8.73	8.00
T23	7.37	6.10
T24	7.87	6.87
T25	9.53	8.83
T26	7.80	6.67
T27	8.50	8.10
T28	7.43	5.73
T29	6.30	4.37
T30	6.67	4.60
T31	7.87	6.57
T32	6.80	4.97
T33	7.13	5.53
T34	8.77	7.83
T35	7.53	6.07
T36	8.03	6.63
SE(d)	0.13	0.21
CD(0.05)	0.27	0.43
CD(0.01)	0.36	0.57

4.1.8. Fruit girth

The vine of the treatment V_1 had significantly larger fruits (7.21 cm) than V_2 (6.22 cm). The L_2 dose produced larger fruits of 7.62 cm followed by L_1 and L_0 (6.70 and 5.83 cm respectively). Daily watering F_1 recorded larger fruits of 7.07 cm than F_2 (6.36 cm). The FYM medium (M_1) was found to produce large fruits (7.61 cm) than M_3 and M_2 (6.82 and 5.91 cm respectively) (Table 5).

Among the treatment interactions, vines of the treatment T_4, T_5, T_7, T_{16}, T_{25} produced larger fruits (8.43, 8.86, 8.76, 8.80, 8.83 cm respectively) and were on par. Lower fruit girth was registered in the treatments T_{11}, T_{29}, T_{30}, T_{32} (4.87, 4.37, 4.60, 4.97 cm respectively) (Table 6).

4.1.9. Fruit weight

There existed significant differences in the weight of fruits per vine. The variety V_1 registered heavier fruits of 14.92 g than V_2 (11.32 g). The L_2 dose was noticed to produce more fruit weight of 18.61 g than L_1, L_0 (11.73 and 9.02 g respectively). Daily irrigation F_1 produced heavier fruits of 13.98 g than F_2 (12.26 g). The flyash medium (M_2) recorded lower fruit weight of 11.43 g while FYM (M_1) medium recorded highest fruit weight of 15.06 g (Table 7).

The mean values of the weight of the fruits per vine varied from 7.12 to 27.94 g. The treatment T_7 registered highly significant fruit weight (27.94 g) followed by T_9

Table.7. Effect of variety,potting media,fertilizer and irrigation on yield attributes in Coccinia.

Main factors	Number of fruits/vine	Average fruit weight (g)	Yield/vine (g)
V1	15.29	14.92	254.44
V2	14.41	11.32	184.62
L0	8.74	9.02	77.54
L1	15.53	11.73	195.95
L2	20.29	18.61	385.10
F1	15.32	13.98	242.63
F2	14.39	12.26	196.43
M1	18.34	15.06	296.49
M2	12.13	11.43	152.80
M3	14.09	12.86	209.30
	SE(d)	SE(d)	SE(d)
V	0.29	0.11	0.62
L	0.35	0.13	0.76
F	0.29	0.11	0.62
M	0.35	0.13	0.76
	CD(0.05)	CD(0.05)	CD(0.05)
V	0.58	0.22	1.23
L	0.71	0.27	1.51
F	0.58	0.22	1.23
M	0.71	0.27	1.51
	CD(0.01)	CD(0.01)	CD(0.01)
V	0.77	0.29	1.63
L	0.94	0.36	2.00
F	0.77	0.29	1.63
M	0.94	0.36	2.00

Table.8. Effect of treatments on yield attributes in container grown Coccinia.

Treatments	Number of fruits per plant	Average fruit weight (g)	Yield/vine (g)
T1	11.93	11.61	114.40
T2	7.40	9.35	72.24
T3	8.63	10.64	93.14
T4	20.10	15.69	253.82
T5	10.43	10.48	139.21
T6	10.53	11.85	194.21
T7	25.30	27.94	700.21
T8	21.07	22.00	409.92
T9	19.60	24.25	496.37
T10	12.47	9.96	103.31
T11	6.27	7.12	53.37
T12	8.24	8.43	73.50
T13	19.40	13.63	274.47
T14	13.90	9.67	151.47
T15	16.57	11.09	192.31
T16	22.93	18.49	465.76
T17	19.27	13.50	245.88
T18	21.63	15.91	332.56
T19	9.40	9.83	94.36
T20	6.63	7.85	52.05
T21	8.37	8.91	72.20
T22	23.30	14.67	343.69
T23	14.37	14.67	134.66
T24	15.77	14.67	184.34
T25	25.10	23.25	574.17
T26	16.43	16.99	243.62
T27	20.90	20.54	407.23
T28	10.58	9.13	82.54
T29	7.33	7.17	48.77
T30	7.67	8.25	69.89
T31	17.33	12.49	215.16
T32	11.53	8.89	114.89
T33	13.07	9.66	152.61
T34	22.23	14.07	335.46
T35	10.90	13.58	167.78
T36	18.13	12.76	242.28
SE(d)	1.23	0.47	2.61
CD(0.05)	2.45	0.94	5.22
CD(0.01)	3.25	1.25	6.93

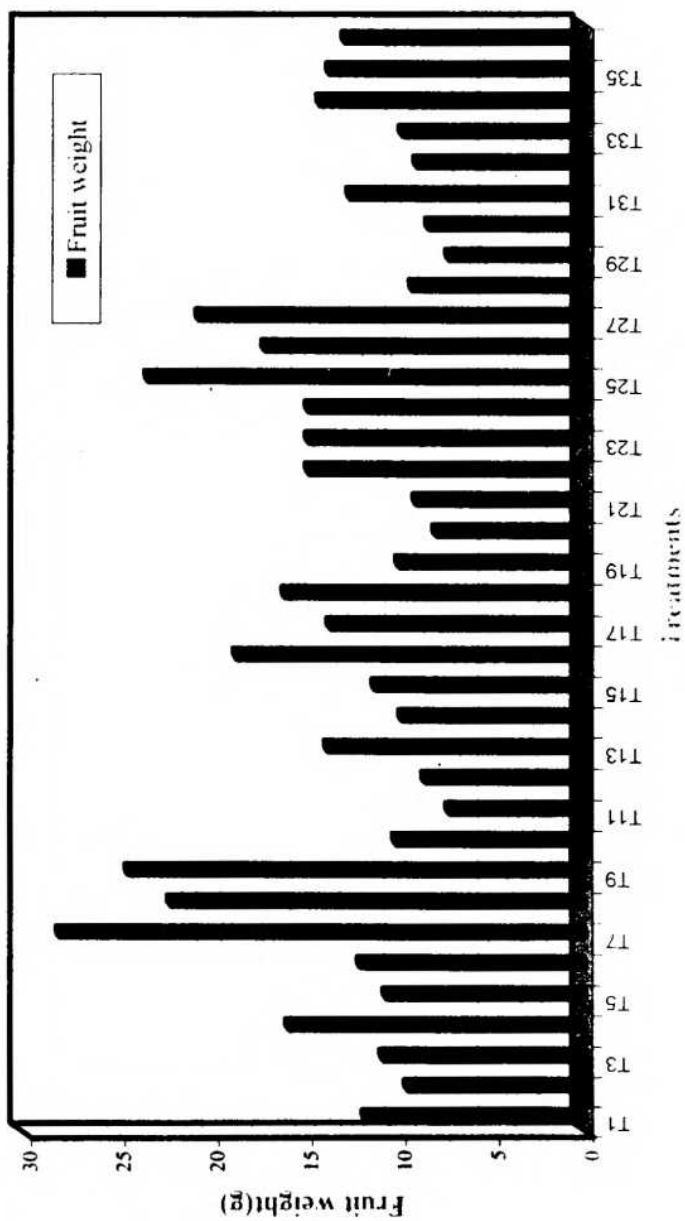
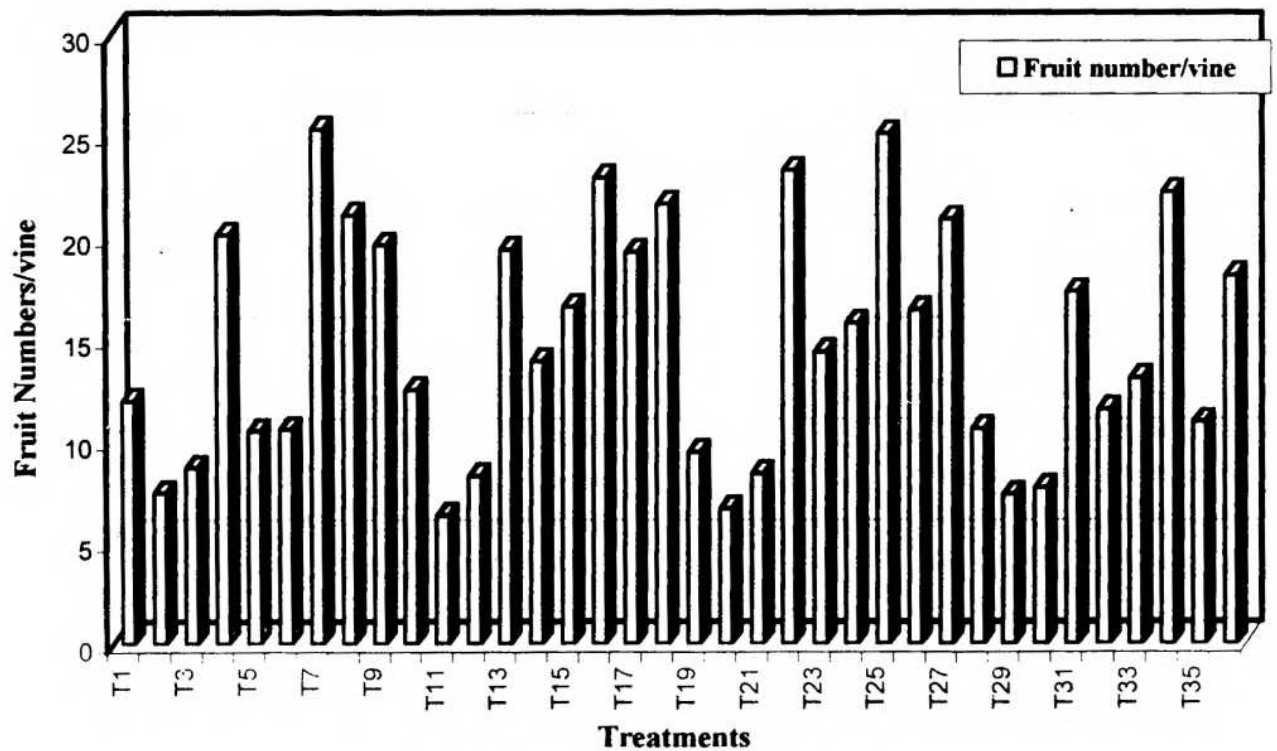


Fig.4.Effect of variety, potting media,fertilizer and irrigation frequency on Fruit weight in container grown Coccinia

Fig.5.Effect of variety, potting media,fertilizer and irrigation frequency on fruit number/vine in container grown Coccinia



(24.25 g), whereas T_{11}, T_{20}, T_{29} produced lower fruit weight (7.12, 7.85, 7.17 g respectively) (Table 8 and Fig. 4).

4.1.10. Number of fruits

The number of fruits per vine was significant,in the variety V_1 (15.29) than V_2 (14.41). The L_2 dose also recorded significant number of fruits (20.29) followed by L_1 and L_0 (15.53 and 8.74 respectively). Daily irrigation F_1 produced significant number of fruits (15.32) than F_2 (14.39).

The medium with FYM (M_1) registered highly significant fruit number (18.34) than M_3 (14.09) (Table 7).

The yield in terms of number of fruits per vine varied from 6.27 to 25.30. The vines had more number of fruits under T_7 (25.30) and is on par with other treatments T_{16}, T_{22}, T_{25} (22.93, 23.30, 25.10 respectively) compared to least number of fruits under T_2, T_3, T_{11}, T_{12}, T_{20}, T_{21}, T_{29}, T_{30} (7.40, 8.63, 6.27, 8.24, 6.63, 8.37, 7.33, 7.67 respectively) and are on par (Table 8 and Fig. 5).

4.2. QUALITY PARAMETERS OF THE FRUIT

4.2.1. Ascorbic acid

Ascorbic acid content of the fruits varied significantly between the varieties with V_2 recording more ascorbic acid content of 14.75 mg $100g^{-1}$. The vines of L_2 dose produced highly significant ascorbic acid content (17.70 mg $100g^{-1}$). Weekly irrigation F_2 recorded significant ascorbic acid content of 14.90 mg $100g^{-1}$. The FYM media (M_1)

Table.10. Effect of variety,potting media,fertilizer and irrigation on ascorbic acid and acidity in Coccinia.

Main factors	Ascorbic acid (%)	Acidity (%)
V1	13.78	0.18
V2	14.75	0.14
L0	10.69	0.16
L1	14.40	0.13
L2	17.70	0.20
F1	13.62	0.17
F2	14.90	0.15
M1	14.59	0.16
M2	14.10	0.16
M3	14.10	0.16
	SE(d)	SE(d)
V	0.05	0.01
L	0.06	0.002
F	0.05	0.001
M	0.06	0.002
	CD(0.05)	CD(0.05)
V	0.09	0.003
L	0.11	0.004
F	0.09	0.003
M	0.11	0.004
	CD(0.01)	CD(0.01)
V	0.12	0.004
L	0.14	0.006
F	0.12	0.004
M	0.14	0.006

Table.11. Influence of treatments on ascorbic acid and acidity in container grown Coccinia.

Treatments	Ascorbic acid (%)*	Acidity (%)
T1	9.66	0.19
T2	9.26	0.19
T3	9.13	0.18
T4	13.85	0.17
T5	13.31	0.16
T6	13.82	0.16
T7	16.77	0.23
T8	16.28	0.24
T9	16.52	0.23
T10	10.58	0.13
T11	10.45	0.16
T12	10.25	0.13
T13	14.31	0.12
T14	13.79	0.12
T15	13.67	0.11
T16	17.83	0.17
T17	17.87	0.19
T18	17.86	0.17
T19	10.95	0.17
T20	10.65	0.17
T21	10.62	0.17
T22	14.56	0.14
T23	14.69	0.15
T24	13.99	0.14
T25	18.17	0.20
T26	17.77	0.18
T27	17.96	0.19
T28	12.41	0.12
T29	11.95	0.11
T30	12.36	0.13
T31	16.19	0.11
T32	15.36	0.11
T33	15.26	0.11
T34	19.78	0.18
T35	17.77	0.18
T36	17.77	0.19
SE(d)	0.19	0.01
CD(0.05)	0.38	0.01
CD(0.01)	0.51	0.02

* On fresh weight basis

recorded significant ascorbic acid (14.59 mg $100g^{-1}$) while the other two media M_2 and M_3 are on par. (14.10 mg $100g^{-1}$ each)(Table 10).

There was significant differences between the treatment interactions. The mean values ranged from 9.13 to 19.78 mg $100g^{-1}$. The vines harvested from the treatment T_{34} recorded more ascorbic acid content of 19.78 mg $100g^{-1}$ followed by T_{25} (18.17 mg $100g^{-1}$). The treatments T_3, T_2 produced lower ascorbic acid contents of 9.13 and 9.26 mg $100g^{-1}$ (Table 11).

4.2.2. Acidity

The fruits of variety V_1 registered significantly higher acidity (0.18) than V_2 (0.14). The L_2 dose accounted for significantly higher acidity (0.20) compared to L_0 (0.16) and L_1 (0.13). Daily irrigated (F_1) produced fruits of more acidity (0.17) than F_2 (0.15). There was no significant difference between the media. The fruits produced in all the media had 0.16 acidity (Table 10).

The results of the treatment interactions have indicated that much significant differences did not exist in acid content of fruits. The fruits harvested from treatments T_7, T_8, T_9 (0.23. 0.24, 0.23 respectively) had higher acidity while lower acidity was noticed in the treatments T_{15}, T_{29}, T_{31}, T_{32}, T_{33} that had 0.11 acidity each (Table 11).

4.2.3. Reducing sugar

Reducing sugar of the fruits exhibited significant difference between the variety, fertilizer, irrigation and media. The variety V_2 recorded higher reducing sugar

Table.12. Effect of variety,potting media,fertilizer and irrigation on fruit quality in Coccinia.

Main factors	Reducing sugars (%)	TSS (brix)
V1	1.88	3.76
V2	2.04	3.09
L0	1.82	2.78
L1	2.14	3.44
L2	1.91	4.06
F1	1.92	3.04
F2	2.00	3.81
M1	2.04	3.86
M2	1.99	3.14
M3	1.85	3.28
	SE(d)	SE(d)
V	0.01	0.11
L	0.01	0.13
F	0.01	0.11
M	0.01	0.14
	CD(0.05)	CD(0.05)
V	0.02	0.22
L	0.02	0.27
F	0.02	0.22
M	0.03	0.27
	CD(0.01)	CD(0.01)
V	0.03	0.29
L	0.04	0.37
F	0.03	0.30
M	0.04	0.37

Table.13. Influence of treatments on fruit quality in container grown Coccinia.

Treatments	Reducing sugars* (%)	TSS (Brix)
T1	1.75	3.00
T2	1.71	2.00
T3	1.71	2.33
T4	2.14	4.67
T5	2.11	3.33
T6	1.97	4.00
T7	1.84	4.33
T8	1.79	4.33
T9	1.79	3.00
T10	1.85	2.33
T11	1.79	2.00
T12	1.59	2.33
T13	2.28	2.67
T14	2.25	2.33
T15	2.05	2.00
T16	1.96	3.33
T17	1.97	3.67
T18	1.95	3.00
T19	1.95	4.00
T20	1.88	3.33
T21	1.87	4.00
T22	2.33	4.67
T23	2.19	3.33
T24	1.06	4.33
T25	1.97	5.33
T26	1.90	3.67
T27	1.89	4.00
T28	1.96	3.33
T29	1.92	2.33
T30	1.92	2.33
T31	2.46	3.67
T32	2.42	3.00
T33	2.41	3.33
T34	1.96	5.00
T35	1.97	4.33
T36	1.95	4.67
SE(d)	0.04	0.47
CD(0.05)	0.09	0.95
CD(0.01)	0.12	1.26

* On fresh weight basis

2.04 mg $100g^{-1}$. The L_1 dose produced fruits of more reducing sugar (2.14 mg $100g^{-1}$). Weekly irrigation (F_2) registered more reducing sugar 2.00 mg $100g^{-1}$. Of the media, FYM (M_1) produced fruits of higher reducing sugar (2.04 mg $100g^{-1}$) followed by M_2 (1.99 mg $100g^{-1}$) (Table 12).

The mean values of the interactions ranged from 1.06 to 2.46 mg $100g^{-1}$. The vines under the treatment T_{31}, T_{32}, T_{33} recorded more reducing sugar (2.46, 2.42, 2.41 mg $100g^{-1}$ respectively) and are on par whereas treatment T_{24} recorded lowest reducing sugar (1.06 mg $100g^{-1}$) (Table 13).

4.2.4. TSS content

There existed significant differences in the treatments. The TSS content of the variety V_1 was higher (3.76° brix) than V_2 (3.09° brix). The L_2 dose registered more TSS content of 4.06° brix compared to L_1 and L_0 (3.44° and 2.78° brix). Weekly irrigation F_2 recorded higher TSS content of 3.81° brix. Among the media, FYM (M_1) had higher TSS of 3.86° brix while other two media M_2 and M_3 were on par (3.14° and 3.28° brix respectively) (Table 12).

There was not much significant differences in the TSS content of the fruits between the interactions. The vines of the treatment T_4, T_{22}, T_{25}, T_{32}, T_{36} were on par producing TSS content of 4.67, 4.67, 5.33, 3.00, 4.67° brix respectively. While treatments T_2, T_{11}, T_{15} recorded lowest TSS content of 2.00° brix (Table 13).

Table.14. Effect of variety,potting media,fertilizer and irrigation on post harvest loss in weight in Coccinia.

Main factors	PLW 4th day	PLW 7th day
V1	5.38	9.56
V2	2.94	6.11
L0	3.58	6.97
L1	4.43	8.01
L2	4.48	8.53
F1	4.25	7.84
F2	4.07	7.83
M1	4.07	7.81
M2	4.28	7.90
M3	4.14	7.79
	SE(d)	SE(d)
V	0.03	0.02
L	0.03	0.03
F	0.03	0.02
M	0.03	0.03
	CD(0.05)	CD(0.05)
V	0.06	0.04
L	0.07	0.05
F	0.06	0.04
M	0.07	0.05
	CD(0.01)	CD(0.01)
V	0.07	0.05
L	0.09	0.07
F	0.07	0.05
M	0.09	0.07

Table.15. Influence of treatments on fruit, post harvest loss in weight in container grown Coccinia.

Treatments	Post harvest loss in weight 4th day(%)	Post harvest loss in weight 7th day(%)
T1	4.61	9.18
T2	5.33	8.97
T3	4.59	9.10
T4	5.51	9.56
T5	5.75	9.57
T6	5.78	9.49
T7	5.96	10.17
T8	6.02	9.96
T9	6.00	10.11
T10	2.33	4.63
T11	2.53	5.36
T12	2.37	4.59
T13	3.09	6.49
T14	3.19	6.51
T15	3.22	6.46
T16	3.43	6.96
T17	3.34	7.07
T18	3.49	6.99
T19	4.72	9.17
T20	5.23	9.96
T21	4.52	9.13
T22	5.47	9.54
T23	5.86	9.56
T24	5.48	9.49
T25	5.30	10.05
T26	5.33	9.98
T27	5.45	10.09
T28	2.12	4.60
T29	2.39	5.31
T30	2.29	4.59
T31	3.24	6.49
T32	3.19	6.51
T33	3.22	6.45
T34	3.07	6.93
T35	3.23	7.04
T36	3.13	7.03
SE(d)	0.18	0.09
CD(0.05)	0.23	0.17
CD(0.01)	0.31	0.23

4.2.5. Physiological loss in weight (4th day)

The physiological loss in weight of the fruits accounts for the shelf life of the fruits. The variety V_2 recorded lower physiological loss in weight (2.94 per cent) and was significant. The control L_0 dose had less physiological loss in weight (3.58 per cent) while L_2 recorded more loss (4.48 per cent). Weekly irrigation F_2 was found to have low physiological loss in weight (4.07 per cent). The media FYM (M_1) had significantly lower physiological loss in weight (4.07 per cent) followed by coirpith media (4.14 per cent) (Table 14).

Among the interactions, the fruits of the treatment T_{28}, T_{30} recorded lower physiological loss in weight (2.12, 2.29 per cent respectively) and are on par. While T_9, T_8 treatments recorded more physiological loss in weight of 6.00 and 6.02 per cent respectively accounting for less shelf life (Table 15).

4.2.6. Physiological loss in weight (7th day)

There was significant physiological loss in weight for the variety V_2 (6.11 per cent) on the 7th day compared to V_1 (9.56 per cent). The control fruits exhibited significantly lower physiological loss in weight (6.97 per cent) followed by L_1 (8.01 per cent). There was not much significant difference with the irrigation frequency as F_1 and F_2 recorded 7.84 per cent and 7.83 per cent respectively. The physiological loss in weight on the 7th day for the coirpith medium was significantly less 7.79 per cent followed by (M_1) FYM medium (7.81 per cent) (Table 14).

Table.16. Effect of variety,potting media,fertilizer and irrigation on shelf life and seed to flesh ratio in Coccinia.

Main factors	Days to initiation of ripening	Seed to flesh ratio
V1	7.33	0.15
V2	10.82	0.20
L0	8.80	0.21
L1	9.54	0.17
L2	8.88	0.16
F1	9.03	0.18
F2	9.12	0.18
M1	9.03	0.18
M2	9.01	0.18
M3	9.19	0.18
	SE(d)	SE(d)
V	0.06	0.001
L	0.07	0.001
F	0.06	0.001
M	0.07	0.001
	CD(0.05)	CD(0.05)
V	0.11	0.002
L	0.14	0.003
F	0.11	0.002
M	0.14	0.003
	CD(0.01)	CD(0.01)
V	0.15	0.003
L	0.18	0.004
F	0.15	0.003
M	0.18	0.004

Table.17. Influence of treatments on shelf life and seed to flesh ratio in container grown Coccinia.

Treatments	Days to initiation of ripening	Seed to flesh ratio
T1	7.07	0.18
T2	7.33	0.17
T3	7.49	0.19
T4	7.20	0.15
T5	7.33	0.13
T6	7.27	0.15
T7	7.73	0.13
T8	7.67	0.13
T9	7.60	0.14
T10	10.53	0.23
T11	10.40	0.24
T12	10.50	0.23
T13	11.60	0.23
T14	11.40	0.18
T15	11.73	0.18
T16	10.07	0.21
T17	9.87	0.18
T18	9.73	0.18
T19	7.00	0.19
T20	7.00	0.18
T21	7.27	0.18
T22	7.40	0.15
T23	7.20	0.13
T24	7.27	0.14
T25	7.20	0.13
T26	7.60	0.14
T27	7.33	0.17
T28	10.33	0.23
T29	10.20	0.24
T30	10.60	0.24
T31	11.73	0.21
T32	11.80	0.19
T33	12.60	0.12
T34	10.50	0.18
T35	10.33	0.18
T36	10.87	0.18
SE(d)	0.24	0.01
CD(0.05)	0.48	0.01
CD(0.01)	0.64	0.02

The mean values for the physiological loss in weight ranged from 4.59 to 10.17 per cent. The fruits of the treatment T_7, T_9 exhibited more physiological loss in weight (10.17 and 10.11 per cent) and are on par. The treatments T_{12}, T_{30} recorded minimum physiological loss in weight (4.59 per cent each) and were on par (Table 15).

4.2.7. Days to initiation of ripening

The results of days to initiation of ripening reveal the shelf life or keeping quality of fruits. The variety V_2 fruits showed later ripening (10.82 days) than V_1 (7.33 days). The L_1 dose exhibited late ripening phase (9.54 days) while control (L_0) dose showed quicker ripening (8.80 days). Weekly irrigation (F_2) extended the ripening phase till 9.12 days while daily irrigation (F_1) fruits started ripening by 9 03 days. Among the media, coirpith recorded late ripening by 9.19 days while M_2 and M_1 media recorded ripening of fruits by 9.01 and 9.03 days (Table 16).

Among the interactions, the fruits of the treatments, T_{32}, T_{33} recorded more shelf life as initiation of ripening was extended (11.80 and 12.60 days respectively). Whereas ripening was early in the treatments T_{19}, T_{20} (7.00 days each). The mean values of the treatment ranged from 7.00 to 12.60 days (Table 17).

4.2.8. Seed to flesh ratio

Comparing the varieties, V_1 exhibited low seed to flesh ratio (0.15) than V_2 (0.20). The L_2 dose recorded 0.16 seed to flesh ratio followed by L_1 (0.17). There was no

Table.18. Effect of variety,potting media,fertilizer and irrigation on Physiological parameters in Coccinia.

Main factors	SLW mg/cm^2	SLA cm^2/mg
V1	4.09	0.32
V2	3.39	0.36
L0	3.48	0.39
L1	3.71	0.33
L2	4.03	0.30
F1	3.75	0.34
F2	7.74	0.34
M1	4.17	0.24
M2	3.18	0.45
M3	3.88	0.33
	SE(d)	SE(d)
V	0.001	0.0003
L	0.002	0.0004
F	0.001	0.0003
M	0.002	0.0004
	CD(0.05)	CD(0.05)
V	0.004	0.0006
L	0.004	0.0007
F	0.004	0.0006
M	0.004	0.0007
	CD(0.01)	CD(0.01)
V	0.005	0.0008
L	0.006	0.0010
F	0.005	0.0008
M	0.006	0.0010

Table.19. Influence of treatments on physiological parameters in container grown Coccinia.

Treatments	Specific leaf weight (SLW) mg/cm^2	Specific leaf area (SLA) cm^2/mg
T1	4.27	0.24
T2	3.26	0.51
T3	3.76	0.28
T4	4.71	0.21
T5	3.40	0.37
T6	3.92	0.34
T7	5.30	0.19
T8	3.89	0.39
T9	4.40	0.29
T10	3.47	0.34
T11	2.65	0.57
T12	3.53	0.39
T13	3.61	0.24
T14	2.87	0.43
T15	3.80	0.36
T16	3.79	0.21
T17	3.01	0.40
T18	3.81	0.29
T19	4.16	0.24
T20	3.25	0.51
T21	3.75	0.29
T22	4.69	0.22
T23	3.39	0.38
T24	3.86	0.34
T25	5.25	0.19
T26	3.87	0.40
T27	4.48	0.29
T28	3.46	0.34
T29	2.67	0.57
T30	3.58	0.39
T31	3.58	0.25
T32	2.86	0.43
T33	3.80	0.38
T34	3.79	0.21
T35	3.00	0.40
T36	3.81	0.29
SE(d)	0.01	0.001
CD(0.05)	0.02	0.003
CD(0.01)	0.02	0.003

significant variation for irrigation (F_1 and F_2 recording 0.18) and media (M_1, M_2, M_3 recording 0.18) (Table 16).

There was not much variation between the interactions. The mean values ranged from 0.12 to 0.24. The treatments T_5, T_7, T_8, T_{23}, T_{25}, T_{34} recording a ratio of 0.13 except T_{33} (0.12) whereas T_{11}, T_{29}, T_{30} registered a ratio of 0.24. (Table 17).

4.3. PHYSIOLOGICAL PARAMETERS

4.3.1. Specific leaf weight

The specific leaf weight of variety V_1 was significantly greater (4.09 mg/ cm^2) than V_2 (3.39 mg/ cm^2). The L_2 dose produced significant specific leaf weight (4.03 mg/ cm^2). Weekly irrigation F_2 recorded significantly higher specific leaf weight of 7.74 mg cm^{-2} than F1 (3.75 mg cm^{-2}). Among the media, FYM (M_1) recorded significant SLW of 4.17 mg cm^{-2} followed by coirpith (3.88 mg cm^{-2}) (Table 18).

The mean values of interactions ranged from 2.65 to 5.30 mg cm^{-2}. The vines under the treatment T_7, T_{25} recorded higher specific leaf weight (5.30 and 5.25 mg cm^{-2}) whereas lower specific leaf weight was registered under the treatments T_{11} and T_{29} (2.65 and 2.67 mg cm^{-2} respectively) and are on par (Table 19).

4.3.2. Specific leaf area

The specific leaf area was significant in the variety V_2 (0.36 cm^2 mg^{-1}) than V_1 (0.32 cm^2 mg^{-1}). The control L_0 dose recorded higher SLA value of 0.39 cm^2 mg^{-1}

followed by L_1 (0.33 cm^2 mg^{-1}). There was no significant variation in the frequency of irrigation as F_1 and F_2 recorded 0.34 cm^2 mg^{-1} each. Significant SLA was registered in the M_2 media with flyash 0.45 cm^2 mg^{-1} followed by coirpith (0.33 cm^2 mg^{-1}) (Table 18).

The mean values of the SLA ranged from 0.19 to 0.57 cm^2 mg^{-1}. The vines of the treatments under T_{11}, T_{29} produced more SLA (0.57 cm^2 mg^{-1} each) whereas vines of treatment T_7, T_{25} recorded lowest SLA (0.19 cm^2 mg^{-1} each) (Table 19).

4.3.3. Harvest index

Significantly higher harvest index was noticed in the variety V_1 (46.28 per cent) than V_2 (40.44 per cent). The L_2 dose recorded more harvest index (51.28 per cent) followed by L_1 (42.90 per cent). There was slight variation in the frequency of irrigation with F_1 recording higher harvest index (43.59 per cent) than F_2 (43.13 per cent). The media with FYM (M_1) had significantly greater harvest index (44.99 per cent) (Table 20).

The mean values of the interaction treatments were significant and varied from 21.12 to 59.16 per cent. The highest harvest index was noticed with the treatment T_{22} (59.16 per cent) followed by T_4 (57.64 per cent) whereas least was recorded under the treatment T_{11} (21.12 per cent) followed by T_{32} (29.57 per cent) (Table 21).

4.3.4. Dry matter of the fruit

The dry matter content of the fruit was significant in the variety V_1 (7.26g) than V_2 (7.00g). Significant dry matter content of the fruit was noticed in L_2 dose of 8.58 g

Table.20. Effect of variety,potting media,fertilizer and irrigation on harvest index and fruit dry matter in Coccinia.

Main factors	Harvest index	Dry matter of the fruit
V1	46.28	7.26
V2	40.44	7.00
L0	35.91	5.82
L1	42.90	6.98
L2	51.28	8.58
F1	43.59	6.42
F2	43.13	7.84
M1	44.99	7.36
M2	42.87	6.99
M3	42.21	7.08
	SE(d)	SE(d)
V	0.39	0.04
L	0.48	0.05
F	0.39	0.04
M	0.48	0.05
	CD(0.05)	CD(0.05)
V	0.79	0.08
L	0.96	0.09
F	0.79	0.08
M	0.96	0.09
	CD(0.01)	CD(0.01)
V	1.05	0.10
L	1.28	0.12
F	1.05	0.10
M	1.28	0.12

Table.21. Influence of treatments on harvest index and fruit dry matter in container grown Coccinia.

Treatments	Harvest index (HI)	Fruit dry matter content (%)
T1	43.04	4.97
T2	39.32	5.08
T3	31.96	4.72
T4	57.64	6.95
T5	40.49	6.75
T6	45.98	6.68
T7	48.32	8.67
T8	54.44	8.19
T9	56.24	8.31
T10	32.35	4.74
T11	21.12	4.64
T12	29.04	4.74
T13	40.68	6.52
T14	41.18	6.24
T15	43.26	6.07
T16	54.96	7.25
T17	51.42	7.35
T18	53.17	7.62
T19	42.37	6.56
T20	41.46	6.25
T21	35.64	6.60
T22	59.16	8.02
T23	45.21	7.01
T24	44.06	7.44
T25	42.70	10.52
T26	52.04	9.15
T27	52.83	8.78
T28	31.32	7.25
T29	50.58	7.07
T30	32.67	7.25
T31	34.87	7.45
T32	29.57	7.21
T33	32.72	7.44
T34	52.48	9.44
T35	47.69	8.93
T36	48.96	8.80
SE(d)	1.67	0.16
CD(0.05)	3.34	0.32
CD(0.01)	4.43	0.43

followed by L_1 (6.98 g). Weekly irrigation F_2 produced significant dry matter content of 7.84 g than F_1 (6.42 g). The FYM medium (M_1) recorded significantly higher dry matter content of 7.36 g (Table 20).

Among the interactions, fruits of the treatment T_{25} recorded significantly higher dry matter content of 10.52 g followed by T_{34} (9.44 g) whereas fruits of the treatment T_{10}, T_{11}, T_{12} registered least dry matter content of 4.74, 4.64, 4.74 g respectively (Table 21).

4.3.5. Partitioning efficiency of root

The partitioning efficiency of root was significantly greater in variety V_2 (29.89), than V_1 (26.66). The control (L_0) recorded significantly higher partitioning efficiency of 38.59 followed by L_2 (24.00). Weekly irrigation (F_2) recorded significant partitioning efficiency 28.75 than F_1 (27.79). The medium with fly ash (M_2) registered higher partitioning efficiency (30.22) (Table 22).

The mean values of the interaction data on partitioning efficiency ranged from 17.71 to 62.12. Significant values was recorded under the treatments T_{29} (62.12) followed by T_{12} (49.06). Lower partitioning efficiency was noticed in T_{22} (17.71) followed by T_4 (19.04) (Table 23).

4.3.6. Partitioning efficiency of shoot

There were significant differences among the treatments. Greater partitioning efficiency of shoot was noticed in the variety V_2 (32.49) than V_1 (27.56). The L_1 dose had

Table.22. Effect of variety,potting media,fertilizer and irrigation on partitioning efficiency of Coccinia.

Main factors	Partitioning efficiency of root (%)	Partitioning efficiency of shoot (%)	Partitioning efficiency of fruit (%)
V1	26.66	27.56	44.61
V2	29.89	32.49	40.54
L0	38.59	31.59	34.07
L1	22.23	33.90	42.56
L2	24.00	24.59	51.10
F1	27.79	26.68	41.71
F2	28.75	30.37	43.44
M1	27.41	27.47	43.48
M2	30.22	30.72	43.11
M3	27.19	31.89	41.14
	SE(d)	SE(d)	SE(d)
V	0.09	0.15	0.59
L	0.11	0.18	0.72
F	0.09	0.15	0.59
M	0.11	0.18	0.72
	CD(0.05)	CD(0.05)	CD(0.05)
V	0.18	0.30	1.17
L	0.22	0.37	1.44
F	0.18	0.30	1.17
M	0.22	0.37	1.43
	CD(0.01)	CD(0.01)	CD(0.01)
V	0.24	0.40	1.55
L	0.29	0.49	1.90
F	0.24	0.40	1.55
M	0.29	0.49	1.90

Table.23. Effect of treatments on partitioning efficiency in container grown Coccinia.

Treatments	Root (%)	Shoot (%)	Fruit (%)
T1	37.01	23.55	39.19
T2	34.88	23.53	40.56
T3	30.30	40.17	28.36
T4	19.04	18.80	46.74
T5	21.16	35.91	42.58
T6	24.44	31.36	45.47
T7	24.35	28.55	46.75
T8	24.62	24.56	54.16
T9	21.79	21.89	52.80
T10	38.17	32.91	28.97
T11	39.27	37.43	20.43
T12	49.06	29.85	26.36
T13	23.96	37.14	38.63
T14	23.01	37.90	39.20
T15	21.24	39.13	40.19
T16	23.71	21.68	54.59
T17	23.23	23.81	53.15
T18	21.01	25.57	52.73
T19	34.99	23.90	40.35
T20	38.25	24.64	37.19
T21	27.83	42.57	29.60
T22	17.71	22.19	59.78
T23	22.74	30.85	45.48
T24	22.03	30.20	47.37
T25	27.74	26.92	42.64
T26	24.20	23.65	52.18
T27	26.75	22.33	51.82
T28	36.03	31.37	32.66
T29	62.12	36.79	52.15
T30	35.21	31.80	33.06
T31	23.98	39.45	37.09
T32	24.32	43.35	31.94
T33	23.07	40.50	36.23
T34	22.25	23.19	54.33
T35	24.89	26.25	48.32
T36	23.49	26.72	49.69
SE(d)	0.38	0.63	2.49
CD(0.05)	0.76	1.27	4.98
CD(0.01)	0.01	1.69	6.61

higher partitioning efficiency (33.90) followed by L_0 (31.59). Weekly irrigation (F_2) recorded more partitioning efficiency of 30.37 than F_1 (26.68). The coirpith medium (M_3) recorded greater partitioning efficiency of 31.89 followed by FYM (M_1) of 27.47 (Table 22).

Among the interaction, the mean values ranged from 18.80 to 43.35. The treatments T_4 registered lowest partitioning efficiency of 18.80 followed by 21.68 whereas greater partitioning efficiency was recorded under the treatments T_{32} (43.35) followed by T_{21} (42.57) (Table 23).

4.3.7. Partitioning efficiency of fruit

The partitioning efficiency of fruit was found to be significantly greater in variety V_1 (44.61) than V_2 (40.54). The L_2 dose exhibited significantly higher partitioning efficiency (51.10) followed by L_1 (42.56). Weekly irrigation F_2 showed more partitioning efficiency (43.44) than F_1 (41.71). Of the media, FYM (M_1) produced greater partitioning efficiency followed by M_2 (43.11) (Table 22).

The results of interaction showed significant variation between the treatments. The vines under T_{22} recorded significantly higher partitioning efficiency of fruit (59.78) followed by T_{16} (54.59). The lowest values were recorded under the treatments T_{11} (20.43) followed by T_{12} (26.36) (Table 23).

Table.24. Effect of variety,potting media,fertilizer and irrigation on shoot N,Pand K content in Coccinia.

Main factors	N content (%)	P content (%)	K content (%)
V1	3.94	0.66	3.92
V2	3.82	0.60	3.86
L0	2.39	0.45	2.42
L1	4.53	0.67	4.56
L2	4.72	0.77	4.69
F1	3.93	0.66	3.92
F2	3.82	0.59	3.86
M1	4.02	0.73	4.01
M2	3.75	0.52	3.75
M3	3.86	0.64	3.92
	SE(d)	SE(d)	SE(d)
V	0.01	0.01	0.02
L	0.01	0.01	0.01
F	0.01	0.01	0.01
M	0.01	0.01	0.02
	CD(0.05)	CD(0.05)	CD(0.05)
V	0.02	0.01	0.03
L	0.02	0.01	0.03
F	0.02	0.01	0.03
M	0.02	0.01	0.03
	CD(0.01)	CD(0.01)	CD(0.01)
V	0.02	0.01	0.04
L	0.03	0.01	0.04
F	0.02	0.01	0.04
M	0.03	0.01	0.04

Table.25. Effect of treatments on shoot N,P and K content in container grown Coccinia.

Treatments	N content (%)	P content (%)	K content (%)
T1	2.70	0.50	2.61
T2	2.27	0.41	2.23
T3	2.49	0.48	2.46
T4	4.73	0.89	4.70
T5	4.64	0.60	4.54
T6	4.75	0.80	4.81
T7	5.03	1.00	4.96
T8	4.75	0.76	4.70
T9	4.87	0.86	4.84
T10	2.48	0.49	2.58
T11	2.27	0.40	2.22
T12	2.37	0.49	2.45
T13	4.61	0.79	4.63
T14	4.33	0.49	4.36
T15	4.45	0.70	4.54
T16	4.87	0.90	4.79
T17	4.54	0.67	4.54
T18	4.66	0.76	4.61
T19	2.61	0.46	2.65
T20	2.18	0.37	2.15
T21	2.32	0.41	2.46
T22	4.61	0.79	4.49
T23	4.42	0.50	4.47
T24	4.49	0.70	4.53
T25	4.80	0.90	4.76
T26	4.55	0.66	4.55
T27	4.63	0.76	4.61
T28	2.43	0.49	2.46
T29	2.22	0.40	2.26
T30	2.32	0.48	2.54
T31	4.62	0.69	4.69
T32	4.32	0.46	4.38
T33	4.40	0.60	4.55
T34	4.81	0.82	4.75
T35	4.49	0.57	4.58
T36	4.61	0.66	4.62
SE(d)	0.04	0.02	0.06
CD(0.05)	0.08	0.04	0.12
CD(0.01)	0.11	0.05	0.15

4.4.NUTRIENT CONTENT OF PLANT SAMPLES

4.4.1. Nitrogen content of shoot at harvest

The nitrogen content of the shoot varied with the varieties, variety V_1 showing significantly higher nitrogen content (3.94 per cent) than V_2 (3.82 per cent). The L_2 dose had significant N content of 4.72 per cent followed by L_1 (4.53 per cent) and least in L_0 (2.39 per cent). Daily irrigation recorded significantly higher N content (3.93 per cent) than F_2 (3.82 per cent). The N content was greater in the medium containing FYM M_1 (4.02 per cent) being significant followed by M_3 (3.86 per cent) (Table 24).

The results have indicated significant differences between the treatments. The N content of shoot was higher in T_7 (5.03 per cent) and was significantly different from T_9, T_{16}, T_{25}, T_{34} (4.87, 4.87, 4.80, 4.81 per cent respectively) (Table 25).

4.4.2. Phosphorus content of shoot at harvest

The phosphorus content of shoot varied with the varieties with V_1 showing significantly higher P content (0.66 per cent) than V_2 (0.60 per cent). The L_2 dose recorded significantly higher P content of 0.77 per cent than L_1 and L_0 (0.67 and 0.45 per cent respectively). Weekly irrigation F_2 registered lower P content (0.59 per cent) while daily irrigation F_1 showed significant P content of 0.66 per cent. The media with FYM (M_1) was observed to have significantly higher P content (0.73 per cent) followed by coirpith (M_3) 0.64 per cent (Table 24).

The P level varied from 0.37 to 1.00 per cent in the treatments. The shoot harvested from T_7 treatment recorded significantly higher P content of 1.00 per cent

followed by T_{16} with 0.90 per cent and T_4 (0.89 per cent) which are on par. The least P content was noticed in T_{11}, T_{20} (0.40 and 0.37 per cent respectively) which are on par Table (25).

4.4.3. Potassium content of shoot at harvest

The potassium content of the shoot was significantly greater in V_1 variety (3.92 per cent) than V_2 (3.86 per cent). The L_2 dose showed significant K content (4.69 per cent) followed by L_1 (4.56 per cent). Daily irrigation F_1 (3.92 per cent) was found to be significant than F_2 (3.86 per cent). The media with FYM (M_1) showed significantly higher K content (4.01 per cent) followed by M_3 (3.92 per cent) (Table 24).

There was significant difference between the treatments. The mean values ranged from 2.15 to 4.96 per cent. The vines from treatment T_7 exhibited more K content of 4.96 per cent followed by T_6, T_9, T_{16}, T_{25} (4.81, 4.84, 4.79, 4.76 per cent respectively). The least K content was recorded in the treatments T_{20}, T_{11}, T_2 (2.15, 2.22, 2.23 per cent respectively (Table 25).

4.4.4. Nitrogen content of fruit at hravest

The nitrogen content of fruit was observed to be significantly high in case of variety V_1 (4.48 per cent) compared to V_2 (4.22 per cent). The L_2 dose showed significantly higher N content (5.31 per cent) followed by L_1 (4.73 per cent). Daily irrigation F_1 noticed significant N content of 4.49 per cent than F_2 (4.21 per cent). The

Table.26. Effect of variety,potting media,fertilizer and irrigation on fruit N,P and K content in Coccinia.

Main factors	N Content (%)	P Content (%)	K Content (%)
V1	4.48	1.61	4.56
V2	4.22	1.48	4.32
L0	3.01	1.10	3.02
L1	4.73	1.63	4.89
L2	5.31	1.89	5.40
F1	4.49	1.64	4.66
F2	4.21	1.45	4.23
M1	4.80	1.71	4.82
M2	4.06	1.31	4.12
M3	4.19	1.60	4.39
	SE(d)	SE(d)	SE(d)
V	0.01	0.04	0.01
L	0.01	0.05	0.01
F	0.01	0.04	0.01
M	0.01	0.05	0.01
	CD(0.05)	CD(0.05)	CD(0.05)
V	0.02	0.08	0.02
L	0.02	0.10	0.02
F	0.02	0.08	0.02
M	0.02	0.10	0.02
	CD(0.01)	CD(0.01)	CD(0.01)
V	0.02	0.11	0.02
L	0.03	0.14	0.03
F	0.02	0.11	0.02
M	0.03	0.14	0.03

Table.27. Effect of treatments on fruit N,P and K content in container grown Coccinia.

Treatments	N content (%)	P content (%)	K content (%)
T1	3.14	1.41	3.13
T2	3.02	0.87	3.05
T3	3.03	1.26	3.04
T4	5.77	1.92	5.84
T5	4.76	1.65	4.63
T6	4.90	1.84	5.61
T7	6.42	2.38	6.38
T8	5.45	1.85	5.77
T9	5.71	2.15	6.25
T10	3.05	1.19	3.07
T11	2.88	1.01	2.93
T12	2.97	1.40	2.95
T13	5.25	1.70	5.27
T14	4.24	1.43	4.37
T15	4.49	1.64	5.16
T16	5.94	2.18	5.87
T17	4.85	1.68	4.84
T18	4.92	1.99	5.63
T19	3.12	1.31	3.19
T20	3.02	0.79	2.94
T21	3.04	1.19	7.94
T22	5.26	1.82	5.42
T23	4.24	1.65	4.35
T24	4.49	1.84	4.44
T25	5.96	1.87	5.82
T26	4.88	1.41	4.83
T27	4.49	1.70	4.54
T28	3.04	1.13	3.17
T29	2.87	0.61	2.93
T30	2.96	1.09	2.95
T31	5.04	1.60	5.15
T32	4.04	1.26	4.22
T33	4.29	1.24	4.31
T34	5.64	2.05	5.47
T35	4.54	1.58	4.57
T36	4.92	1.89	4.87
SE(d)	0.03	0.18	0.04
CD(0.05)	0.07	0.35	0.07
CD(0.01)	0.10	0.47	0.10

medium with FYM (M_1) produced higher N content of 4.80 per cent and was significantly different from M_2 and M_3 media (Table 26).

The differences in the vine N content of the vines varied significantly among the treatments. The mean values varied from 2.87 to 6.42 per cent. Highest N content was observed in the treatment T_7 (6.42 per cent) followed by T_{16} and T_{25} (5.94 and 25.96 per cent respectively) which are on par while T_{11}, T_{29} was least with 2.88 and 2.87 per cent respectively also on par (Table 27).

4.4.5. Phosphorus content of fruit at harvest

The P content of the fruits varied significantly among the varieties with V_1 producing more P content of 1.61 per cent than V_2 (1.48 per cent). The L_2 dose was observed with more P content (1.89 per cent) followed by L_1 (1.63 per cent). Daily irrigation F_1 was noticed with higher P content of 1.64 per cent than F_2 (1.45 per cent). The medium with FYM (M_1) showed more P content (1.71 per cent) followed by M_3 (1.60 per cent) (Table 26).

The mean values of the P content of the fruit ranged from 0.61 to 2.38 per cent. The fruits of the vine under treatment T_7 exhibited significant P content (2.38 per cent) followed by T_{16} (2.18 per cent). Least P content in the fruits were noticed in the treatment T_{29} (0.61 per cent) followed by T_{20} (0.79 per cent) (Table 27).

4.4.6. Potassium content of fruit at harvest

There existed significant differences among the treatments among the varieties, higher K content of fruits at harvest was noticed in V_1 (4.56 per cent). The K content of the fruits were high in L_2 Dose (5.40 per cent) followed by L_1 (4.89 per cent). Daily irrigation F_1 showed more K content of 4.66 per cent than F_2 (4.23 per cent). The medium with FYM (M_1) recorded higher K content of 4.82 per cent and least K content in M_2 medium (4.12 per cent) (Table 26).

The mean values of the K content had significant variation among the treatments. Highest K content was recorded in the treatment T_7 (6.38 per cent) followed by T_4, T_{16} (5.84 and 5.87 per cent respectively) which are on par whereas it was least in the treatments T_{11}, T_{12}, T_{20}, T_{29}, T_{30} (2.93, 2.95, 2.94, 2.93, 2.95 per cent respectively) (Table 27).

4.5. NUTRIENT UPTAKE

4.5.1. Nitrogen uptake

The uptake of nitrogen varied significantly with varieties, V_1 showing more nutrient content (1.36 g/container). Highest significant N uptake was recorded under L_2 dose (1.97 g/container) while least uptake was noticed in L_0 dose (0.20 g/container). Daily irrigation F_1 recorded more N uptake (1.38 g/container) compared to F_2 (1.23 g/container). The medium with FYM (M_1) had significant higher N uptake (1.58 g/container) with least uptake in M_2 medium (1.04 g/container) (Table 28).

Table.28. Effect of variety,potting media,fertilizer and irrigation on N,P and K uptake of Coccinia.

Main factors	N uptake (g)	P uptake (g)	K uptake (g)
V1	1.36	0.82	1.74
V2	1.25	0.75	1.66
L0	0.20	0.05	0.42
L1	1.76	0.83	2.28
L2	1.97	1.46	2.41
F1	1.38	0.87	1.81
F2	1.23	0.69	1.60
M1	1.58	1.77	1.93
M2	1.04	0.47	1.49
M3	1.30	0.70	1.69
	SE(d)	SE(d)	SE(d)
V	0.02	0.07	0.01
L	0.02	0.09	0.01
F	0.02	0.07	0.01
M	0.02	0.09	0.01
	CD(0.05)	CD(0.05)	CD(0.05)
V	0.04	0.15	0.02
L	0.05	0.18	0.02
F	0.04	0.15	0.02
M	0.05	0.18	0.02
	CD(0.01)	CD(0.01)	CD(0.01)
V	0.05	0.19	0.02
L	0.07	0.24	0.03
F	0.05	0.19	0.02
M	0.07	0.24	0.03

Table.29. Effect of treatments on N,P and K uptake in container grown Coccinia.

Treatments	N uptake (g)	P uptake (g)	K uptake (g)
T1	0.28	0.07	0.59
T2	0.17	0.05	0.36
T3	0.21	0.06	0.51
T4	2.25	1.05	2.77
T5	1.55	0.45	1.94
T6	1.98	0.73	2.48
T7	2.60	2.55	2.84
T8	1.79	1.14	2.33
T9	2.11	1.72	2.63
T10	0.26	0.06	0.46
T11	0.14	0.05	0.36
T12	0.19	0.06	0.39
T13	2.34	2.49	2.56
T14	1.35	0.47	2.79
T15	1.76	0.68	2.23
T16	2.39	1.92	2.74
T17	1.61	0.81	2.07
T18	1.98	1.31	2.44
T19	0.23	0.06	0.52
T20	0.13	0.05	0.33
T21	0.19	0.05	0.38
T22	2.04	0.98	2.51
T23	1.39	0.44	1.84
T24	1.73	0.72	2.19
T25	2.23	2.11	2.65
T26	1.56	1.02	2.01
T27	2.02	1.52	2.45
T28	0.24	0.06	0.44
T29	0.13	0.04	0.32
T30	0.16	0.05	0.35
T31	1.98	0.99	2.49
T32	1.24	0.43	1.65
T33	1.49	0.54	1.92
T34	2.15	1.72	2.56
T35	1.39	0.67	1.84
T36	1.76	1.04	2.32
SE(d)	0.09	0.31	0.03
CD(0.05)	0.18	0.63	0.07
CD(0.01)	0.24	0.84	0.09

The results have indicated significant differences among the treatments. The uptake of N ranged from 0.13 to 2.60 g/container. The vines of the treatment T_7 recorded higher N uptake (2.60 g/container) followed by 2.39 g/container. The least uptake was noticed in T_2, T_3, T_{11}, T_{12}, T_{20}, T_{21}, T_{28}, T_{29}, T_{30} (0.17, 0.21, 0.14, 0.19, 0.13, 0.19, 0.24, 0.13, 0.16 g/container respectively) being on par (Table 29).

4.5.2. Phosphorus uptake

The P uptake did not vary much with V_1 variety recording higher P uptake (0.82 g/container) than V_2 (0.75 g/container). The highest P uptake was noticed in L_2 dose (1.46 g/container) with least uptake in control (L_0 dose) 0.05 g/container. Daily irrigation F_1 showed more P uptake (0.87 g/container) than F_2 (0.69 g/container). The M_1 medium (FYM) exhibited higher P uptake of 1.77 g/container with least uptake in flyash medium (M_2) (0.47 g/container) (Table 28).

The results have indicated less significant differences among the interactions. The P uptake of the vines was greater under the treatments T_7, T_{13}, T_{25} (2.55, 2.49, 2.11 g/container respectively). Whereas least uptake was noticed in T_1, T_2, T_3, T_{19}, T_{20}, T_{21}, T_{28}, T_{29}, T_{30} (0.07, 0.05, 0.06, 0.06, 0.05, 0.05, 0.06, 0.04, 0.05 g/container respectively) (Table 29).

4.5.3. Potassium uptake

The data on potassium uptake showed variation between the varieties with V_1 recording 1.74 g/container. The K uptake was highest in L_2 dose (2.41 g/container)

followed by L_1 (2.28 g/container). Daily irrigation F_1 recorded greater K uptake (1.81 g/container). The FYM medium M_1 was found to have higher K uptake (1.93 g/container) being significant (Table 28).

The mean values of K uptake ranged from 0.32 to 2.84 g/container. The vines of the treatments T_4, T_7, T_{16} are on par showing highest K uptake of 2.77, 2.84, 2.74 g/container respectively with least uptake noticed in T_2, T_{20}, T_{21}, T_{29} (0.36, 0.33, 0.38, 0.32 g/container respectively) (Table 29).

4.6. POST HARVEST SOIL NUTRIENT ANALYSIS

4.6.1. Available Nitrogen

The available N content in the post harvest soil was highest for the variety Bhubaneshwar local (1.37 g/container) . The recommended dose of fertilizers L_1 showed highest N content (1.63 g/container) followed by L_2 (1.36 g/container). Daily irrigation had higher available N (1.18 g/container) and FYM media exhibiting highest available N content of 1.47 g/container (Table 30).

Among the treatments, T_7 registered highest available N content (2.49 g/container) followed by T_{31} (2.26 g/container). The lowest available N was seen in control (0.06 g/container) (Table 31).

Table.30. Effect of variety,potting media,fertilizer and irrigation on N,P and K content in post harvest soil.

Main factors	Residual N (g)	Residual P (g)	Residual K (g)
V1	0.97	0.76	1.63
V2	1.37	0.53	1.55
L0	0.52	0.03	0.34
L1	1.63	0.71	2.15
L2	1.36	1.19	2.27
F1	1.18	0.69	1.67
F2	1.16	0.61	1.51
M1	1.47	1.05	1.80
M2	0.91	0.35	1.41
M3	1.12	0.54	1.56
	SE(d)	SE(d)	SE(d)
V	0.01	0.03	0.01
L	0.01	0.03	0.01
F	0.01	0.03	0.01
M	0.01	0.03	0.01
	CD(0.05)	CD(0.05)	CD(0.05)
V	0.01	0.05	0.01
L	0.01	0.06	0.02
F	0.01	0.05	0.01
M	0.01	0.06	0.02
	CD(0.01)	CD(0.01)	CD(0.01)
V	0.01	0.07	0.01
L	0.02	0.09	0.02
F	0.01	0.07	0.02
M	0.02	0.09	0.02

Table.31. Effect of treatments on N,P and K content in residual soil in container grown Coccinia.

Treatments	Residual N (g)	Residual P (g)	Residual K (g)
T1	0.23	0.03	0.55
T2	0.12	0.03	0.33
T3	0.18	0.03	0.49
T4	2.14	0.98	2.44
T5	1.45	0.37	1.88
T6	1.74	0.67	2.36
T7	2.49	2.31	2.76
T8	1.54	1.04	2.25
T9	2.02	1.30	2.34
T10	0.15	0.03	0.24
T11	0.06	0.04	0.25
T12	0.08	0.04	0.24
T13	1.76	1.85	2.42
T14	1.13	0.42	2.58
T15	1.16	0.42	2.13
T16	2.04	1.50	2.59
T17	1.29	0.33	1.96
T18	1.60	0.98	2.22
T19	0.20	0.03	0.48
T20	0.10	0.05	0.28
T21	0.15	0.02	0.34
T22	1.91	1.80	2.45
T23	1.22	0.37	1.75
T24	1.50	0.40	2.02
T25	0.19	1.97	2.45
T26	0.10	0.96	2.01
T27	0.17	1.30	2.21
T28	2.17	0.04	0.33
T29	1.26	0.03	0.25
T30	1.53	0.04	0.33
T31	2.26	0.75	2.44
T32	1.43	0.22	1.54
T33	1.80	0.32	1.84
T34	2.06	1.30	2.42
T35	1.24	0.33	1.80
T36	1.54	0.95	2.24
SE(d)	0.02	0.11	0.02
CD(0.05)	0.04	0.23	0.06
CD(0.01)	0.06	0.30	0.08

4.6.2. Available Phosphorus

The available P was greater in the soil of variety Coimbatore local (0.76 g/container). The higher fertilizer dose L2 recorded highest value for available P (11.19 g/container). Daily irrigation F_1 was found to register more available P (0.69 g/container) than F_2. The medium FYM was showing higher available P (1.05 g/container) (Table 30).

The mean values for available P ranged from 0.03 to 2.31 g/container. The highest value was recorded for the treatment T_7 (2.31 g/container) followed by T_{25}, T_{22}, T_{13} (1.97, 1.80, 1.85 g/container) respectively. The lower values recorded in the control treatment (Table 31).

4.6.3. Available Potassium

V_1 (Coimbatore local) variety recorded highest available K (1.63 g/container) in the soil. The L_2 dose showed more available K (2.27 g/container). Daily irrigation (F_1) exhibited high available K (1.67 g/container) than F_2. The FYM medium registered high available K (1.80 g/container) (Table 30).

Among the treatment mean values, available K was highest in the treatment T_7 (2.76 g/container) followed by T_{16} and T_{14} 12.59, 2.58 g/container respectively. Lowest was recorded in control treatments (Table 31).

4.7. CORRELATION STUDIES

4.7.1. Vine length

Vine length registered significant and positive association with primary branches, secondary branches, days to flowering, days to harvest, fruit weight, fruit number and yield per vine. This trait had positive non-significant association with fruit girth and negatively associated with fruit length (Table 32).

4.7.2. Primary branches

The results revealed a significant positive association with secondary branches, days to flowering, days to harvest, fruit weight, fruit number and yield per vine. Non-significant negative association was observed with fruit girth and non-significant positive association for fruit length (Table 32).

4.7.3. Secondary branches

The trait was found to be positively correlated with days to flowering, days to harvest, fruit number and yield/vine and was significant. Whereas fruit weight and fruit length were positively correlated but non-significant and fruit girth having non-significant negative correlation (Table 32).

4.7.4. Days to flowering

This character recorded significant positive association with days to harvest, fruit weight, fruit number and yield per vine. While fruit length and fruit girth were also positively associated but non-significant (Table 32).

Table.32. Inter correlation among yield contributing characters and yield

Characters	VL (1)	PB (2)	SB (3)	DTF (4)	DTH (5)	FL (6)	FGR (7)	FW (8)	FN (9)	YLD (10)
1	1.000	0.528**	0.476**	0.473**	0.456**	-0.301	0.299	0.329*	0.586**	0.781**
2		1.000	0.872**	0.351**	0.362*	0.273	-0.214	0.345*	0.786**	0.899**
3			1.000	0.345*	0.348*	0.261	-0.218	0.309	0.483**	0.892**
4				1.000	0.909**	0.327	0.326	0.427**	0.459**	0.750**
5					1.000	0.341*	0.321	0.419*	0.403*	0.759**
6						1.000	0.321	-0.334*	0.427**	-0.321*
7							1.000	0.429**	-0.378**	0.351*
8								1.000	-0.297	0.478**
9									1.000	0.861**
10										1.000

* Significant at 0.05% ** Significant at 0.01%

4.7.5. Days to harvest

The trait was found to be highly significant with yield per vine and positively being associated with fruit length, fruit weight, fruit number but non-significant positive association with fruit girth (Table 32).

4.7.6. Fruit length

Fruit length was positively associated with fruit number and significant. A significant negative correlation was observed with fruit weight and yield per vine. While fruit girth had non-significant positive association (Table 32).

4.7.7. Fruit girth

Significant positive correlation was observed with fruit weight and yield per vine but non-significant negative correlation with fruit number (Table 32).

4.7.8. Fruit weight

Fruit weight was highly correlated with yield per vine and non-significant negative association with fruit number (Table 32).

4.7.9. Fruit number

The trait had highly significant correlation with yield per vine (Table 32).

4.8. ORGANOLEPTIC EVALUATION

Eight samples of salad Coccinia from Bhuvaneswar local, Coimbatore local, Flyash, FYM, Coirpith media, control, recommended dose of fertilizers and 25 per cent higher than recommended fertilizer dose were subjected to organoleptic evaluation in

Table .33. Organoleptic evaluation for salad Coccinia.

Sample number	Colour and Appearance	Flavour	Texture	Taste	Over all acceptability	Mean acceptability
1	7.8	7.1	4.4	8.3	8.1	7.14
2	7.4	6.5	5.2	6.9	6.6	6.52
3	5.3	5.3	5.0	5.7	5.3	5.32
4	8.5	7.9	.8.3	6.5	7.5	7.74
5	5.2	7.4	6.2	6.1	7.0	6.38
6	5.8	7.3	8.3	8.1	8.2	7.54
7	6.2	5.3	5.2	5.6	5.8	5.62
8	8.1	5.3	5.2	5.3	5.4	5.86

KEY : 7-9 : HIGHLY ACCEPTABLE 5-7 : ACCEPTABLE

3-5 : MODERATELY ACCEPTABLE 1-3 : NOT ACCEPTABLE

SAMPLE
1 : Bhubaneshwar local
2 : Coimbatore local
3 : Fly ash media
4 : FYM media
5 : Coirpith media
6 : Control
7 : Recommended fertilizer dose
8 : 25 % higher than recommended fertilizer dose

which colour and appearance, flavour, texture, taste and overall acceptability were scored using nine point hedonic scale. All the samples were acceptable except Bhubaneshwar local, FYM medium and control which were highly acceptable as they scored higher marks for the above attributes compared to other samples (Table 33).

Plates

Plate 1. View of container grown Coccinia.

Plate 2. Comparison of different levels of fertilizer - L_0, L_1 and L_2.

Plate 3. Early flowering and fruiting - treatment T_7 ($V_1L_2F_2M_1$).

Plate 4. High yielding treatments T_7 and T_{25}.

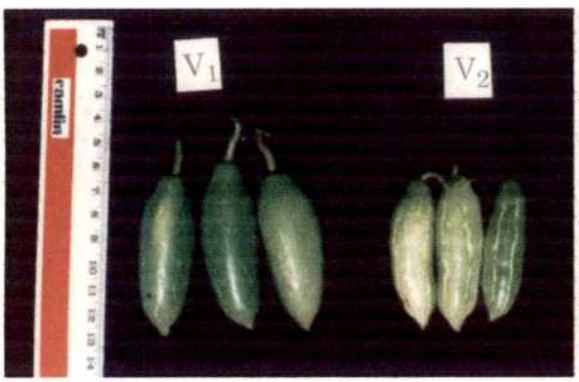


Plate 5 Comparison of fruit characters – V_1 & V_2

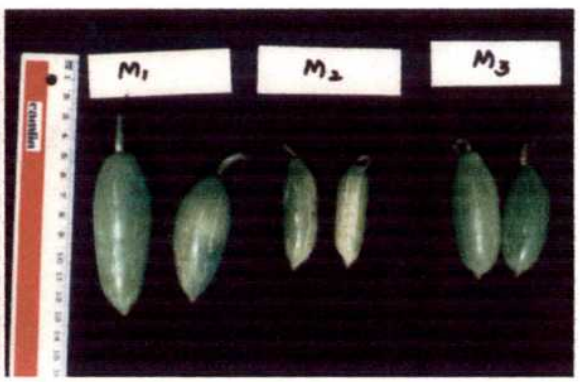


Plate 6. Comparison of fruit characters – M_1, M_2 & M_3.

Plate 7. Comparison of fruit characters – L_0, L_1 & L_3.

Plate 8. Fruit characters of different media – M_1, M_2 & M_3.

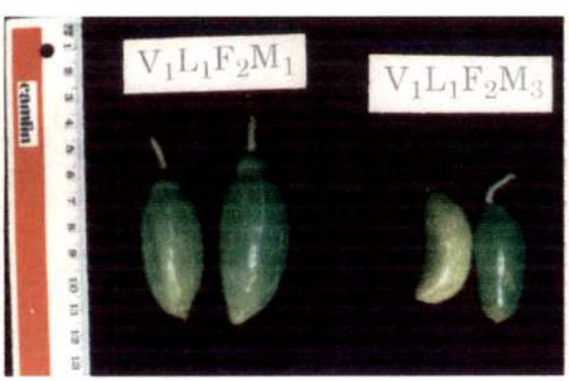


Plate 9. Best medium (M_1 and M_3) for V_1 variety.

Plate 10. Best medium (M_1 and M_3) for V_2 variety

Discussion

CHAPTER V

DISCUSSION

Coccinia (*Coccinia grandis* L.) is a minor but a highly nutritious vegetable grown in the tropics for its edible fruits. Coccinia is widely grown in the eastern, western and southern states of India (Nath, 1976). This semiperennial coccinia is yet to be exploited commercially as a salad crop. Pronounced effect of nutrition on yield and quality of cucurbitaceous crop has been investigated by many workers at different places. Application of fertilizers is one of the important factors to increase the yield and fruit quality. Hence the present investigation was undertaken to find out the optimum dose of fertilizers, frequency of irrigation and standardise the media for production in containers that can be utilised for homestead gardens.

5.1. BIOMETRICAL CHARACTERS

The plant architectural attributes recorded by the variety Coimbatore local was higher compared to that of the Bhubaneshwar local. This may be due to the adaptability of the variety. Plants grown in the medium containing FYM excelled the other two media for vine length, primary and secondary branches. This was followed by the composted coirpith medium. The favourable effect of coirpith might be due to its ability to retain relatively more soil moisture. Similar increased growth attributes by addition of such materials was reported by Cerne (1984) in pickling cucumbers and Asoegwn (1991) in pumpkin while incorporation of flyash as the potting substrate in media 2 resulted in yield reduction which may have been attributed to reduced aeration,

high substrate strength, high pH and possible toxicities of elements not determined. Of these factors, the effect of reduced aeration is considered to have the principal limitation to plant growth. Flyash, when incorporated at the rate of >20 per cent reduces the airfilled porosity by occupying voids in the coarse matrix which would otherwise have acted as drainage pores. For any potting substrate the airfilled porosity values should not exceed >10-15 per cent, the level considered necessary for maximum plant growth. This was in confirmity with Bunt (1974), Paul and Lee (1976) and similar findings being reported by Menzies and Aitken (1996) in tomato, petunia and boston fern.

Among the fertilizer dose, 25 per cent higher recommended fertilizer dose produced lengthiest vine and more primary, secondary branches. This might be due to the fact that application of nitrogen influences vegetative growth, flowering and yield. Increase in NPK level caused a significant enhancement in vine length while number of branches did not show much variation by the NPK level. The beneficial effect of Nitrogen on plant growth of the pumpkin crop has been reported earlier by Das and Swain (1977). It is thus evident that the nitrogen has growth promoting capability. Similar findings were registered by Singh *et al.* (1982) in tinda (***Citrullus fistulosus***), Bhella and Wilcox (1986) and Singh and Chhonkar (1986) in muskmelon, Karuthamani (1995) in pumpkin and Nirmala (1996) in cucumber.

Daily irrigation proved to be significant over weekly irrigation in production of maximum vine length, number of primary and secondary branches. This might be due to the fact that demand of water was more at the actively growing stage of the crop. This

was in line with the results of Veeraputhiran and Joseph (1997) in pickling melon (***Cucumis melo***). Thus in this study, T_7 followed by T_{25} were the treatments that recorded the above effects.

Earliness in terms of days to first flowering and first harvest was noticed in the variety Coimbatore local, medium containing FYM receiving 25 per cent higher recommended fertilizer dose compared to that of other treatments. Application of nitrogen highly influenced the number of days required for flowering. In this investigation, higher level of NPK induced early flowering and days to first harvest. Among the nutrients, phosphorus has been reported to act positively in imparting earliness while higher doses of N and K induces lateness. Thus treatments T_{25} followed by T_{22} were early to bloom.

5.1.1. Yield Parameters

The number of fruits per vine, average fruit weight per vine, fruit length, fruit girth are important yield contributing traits. The results revealed that number and weight of fruits were highest for the variety Coimbatore local compared to Bhubaneshwar local since Coimbatore local exhibits itself in its adapted environment. The 25 per cent higher recommended dose recorded increased number of fruits and fruit weight per vine. This was in line with Das and Swain (1977). This implied that there was more accumulation of carbohydrate and higher rate of metabolic activity and K nutrition which have led to increased yield per vine. Similar findings were reported in tomato (Smith *et al.*, 1961; Sundara Rao and Sinha, 1963) due to high N and K application. Similar observations

were noticed in pickling cucumber, (Manuca (1989), El-Hassan (1991) and Kubo *et al.* (1991). Increased P fertilization level increased the total number of fruit per plant which was in line with Rae Trimble and Richard Knowles (1995) in cucumber.

The medium with FYM followed by coirpith and daily irrigation registered highest values for fruit weight and fruit number. This might be due to the significant growth as a result of higher moisture availability to the plants. The better expression of yield attributes by addition of coirpith was also reported by Abou-El-Hassan *et al.* (1993) in cucumbers. Daily irrigation had beneficial effect in increasing fruit number and weight. Favourable effect of frequent irrigation on yield attributes have been reported by Singh and Singh (1978) in bottle gourd, round gourd and watermelon and Ortega and Kretchman, (1982) in pickling cucumbers. For this parameter, T_7 treatment recorded the best value.

Fruit length and girth were highest in the variety Coimbatore local and plants receiving 25 per cent higher recommended fertilizer dose with daily irrigation grown in the medium containing FYM. The treatments T_7 and T_{25} were found to be superior and pronounced effect of fruit girth was observed in fly ash medium.

The total yield increased significantly in the Coimbatore local variety receiving 25 per cent higher recommended fertilizer dose with media containing FYM, followed by coirpith that are daily irrigated. The yield increase was due to the number of fruits per plant and fruit weight. Pill *et al.* (1979) reported no yield decrease with NH_4-N nutrition

of plants grown in vermiculite and attributed to the buffering capacity of the medium. Deswal and Patil (1984) reported the highest yield with frequent irrigation in watermelon. Higher fruit yield might also be due to increase in leaf number, leaf area, accumulation of photo assimilates in the system. John M. Swaider *et al.* (1994) also observed an increase in number of pumpkin fruits due to higher dose of N and K application. The probable reasons for increase in fruit yield might be attributed to catalytic involvement of K in promoting vegetative growth, number and weight of fruits (Wilcox, 1964 and Praseeda and Sulladmath, 1979).

In general media containing higher NPK levels resulted in vigorous plants. Similar yield increase was recorded in tomato grown in coirpith medium which might be due to the increased nutrient availability, CEC, moisture retention and aeration (Savithiri and Hemeed Khan,1994.)

5.2. QUALITY PARAMETERS

The vital quality parameters were studied to assess the nutrient value of salad coccinia fruit for its ascorbic acid content, acidity, reducing sugar, TSS, shelf life and seed to flesh ratio.

The ascorbic acid content of the fruits was improved significantly in the media with FYM and 25 per cent higher recommended fertilizer dose and weekly irrigation. Ascorbic acid and acidity was improved by higher level of potassium application in tomato (Anand and Muthukrishnan, 1974). This was in line with the findings of Barooah

and Zaman Ahamed (1964). Increase in these contents might be due to the involvement of K in biosynthesis of protein and organic acids. Similar reports were given by Choudhary and De (1972) and Nechaeva (1974) who stated higher ascorbic acid content with increased N and P. The treatment T_{34} produced higher ascorbic acid.

Maximum TSS was observed in the variety Coimbatore local receiving 25 per cent higher recommended dose, weekly irrigation grown in the medium containing FYM (treatment T_{25}). Application of P and K is beneficial for getting sweet fruits of watermelon. Bradley and Flemming (1959) reported that per cent soluble solids was the only quality factor affected by fertilizer application. Berezhnova and Agzamova (1976) also reported that N,P and K increased, the fruit sugar content of watermelon. This was in line with Narayana and Rao (1980) in tomato. More utilization of N, P and K resulted in maximum TSS as well as healthy fruits at higher levels. The major possible reason might be nitrogen and other food material produced in the fruit and sufficient to maintain the growth and development of fruits in pointed gourd (Yadav *et al.*, 1993). Highest TSS value obtained with K application having favourable influence on photosynthesis, translocation and utilization of synthesized carbohydrate. These are in accordance with Tolkynabaev (1973), Locascio and Warren (1960). These findings are in close confirmity with the investigation of Davies and Winsor (1967). Das and Swain (1977) reported that application of N steadily increased the TSS content of fruit.

The acidity was higher in Coimbatore local variety receiving 25 per cent higher recommended fertilizer dose and daily irrigation. With higher NPK, acidity was

increased. Similar findings reported by Sharma and Mann (1971) in tomato. This was also in line with Anand and Muthukrishnan (1974), Winsor (1979) in tomato.

The reducing sugar was highest in Bhubaneshwar local receiving recommended dose of fertilizers, weekly irrigation and invariably in all the media. The reducing sugar decreased with higher level of K. This is possible due to the fact that K did not favour the formation and transfer to sugars in the plants at later stages of fruit maturity by influencing carbohydrate metabolism in accordance with Locasico and Warren (1960). Similar findings reported by Choudhary and De (1972), Matev (1974) and Nechaeva (1974).

The shelf life in terms of physiological loss in weight and days to initiation of ripening was poor in the variety Coimbatore local. This may be due to the bigger fruit size that aided in the increased area of exposure to evapotranspiration compared to Bhubaneshwar local. In control (L_0) and weekly irrigation (F_2) fruits exhibited lower physiological loss in weight and days to initiation of ripening. This might be due to smaller sized fruits and losses due to evaporation was low and more skin thickness in the medium containing fly ash exhibiting high PLW was high and quick ripening. This may be due to the influence of this medium towards alteration of pH of the fruit.

Seed to flesh ratio is one of the important fruit attribute deciding the fruit quality when consumed as a salad. The Coimbatore local that produced bigger sized fruits and

more flesh compared to seed. The fertilizer application increased the seed content and reduced the seed to flesh ratio compared to control.

5.3. PHYSIOLOGICAL ATTRIBUTES

Partitioning efficiency of the plant system as a whole has constant capacity in the production of photosynthates but its efficiency in the translocation of photosynthates among the source and sink decides the yield of fruits. In the present investigation the high yielding Coimbatore local had better efficiency to translocate the photosynthates towards sink compared to that of Bhubaneshwar local. Though the system capacity is constant it can be altered by nutrient application. This constant capacity may be increased by fertilizer application that will facilitate more allocation of assimilates to sink aiding in the increased yield. The daily irrigation will have more vegetative growth. It utilises the assimilates for vegetative growth instead of allocating more photosynthates towards fruit.

The harvest index was maximum for Coimbatore local variety with recommended dose of fertilizer receiving weekly irrigation grown in FYM medium. There was better partitioning of assimilates to various plant parts, better utilization of assimilates by the fruits has been observed in the present study as reflected by harvest index. Fruits get the maximum share of assimilates due to higher nutrient application. This was in accordance with the findings Premalakshmi (1997) in gherkins. In this study also higher harvest index was recorded for T_{22} which had higher partitioning efficiency for fruits.

There was considerable increase in dry matter production due to higher doses of N,P and K. The Coimbatore local variety grown in FYM medium receiving weekly irrigation and 25 per cent higher recommended fertilizer dose. The increase in dry matter production is an outcome of higher rate of growth characters like vine length, number of branches per vine, yield/vine besides higher accumulation of photo assimilates due to enhanced uptake of nutrients. These results are in conformity with the earlier findings of Randhawa and Singh (1970) in muskmelon and Premalakshmi (1997) in gherkins. In this investigation treatment T_{25} recorded highest value with increasing NPK levels. Similar findings given by Pandey *et al.* (1998) in tomato.

Specific leaf weight is helpful in understanding the translocating efficiency in context of source and sink size. SLW is high for high yielding treatments by and large present characteristics of easy assimilate partition compared to low yielders. This was in confirmity with the findings of Durgadevi (1981) in ragi.

Specific leaf area provides an estimate as to how the assimilors are used for leaf expansion.

5.4. NUTRIENT STATUS OF PLANT SAMPLES

The primary plant nutrients such as nitrogen, phosphorus and potassium play an important role in growth and development of plant and yield. Nitrogen is the key element enhancing cell division and cell elongation which results in vigorous vegetative growth while phosphorus induces root growth and reproductive system of the plant, while potassium improves the uptake of nitrogen and quality.

In the present study, the nitrogen content of shoot and fruit were highest in the treatment T_7 of Coimbatore local variety receiving 25 per cent extra recommended fertilizer dose with daily irrigation grown in FYM medium. This might have been influenced by higher level of K application. These findings are in line with Nirmala (1996) in cucumber and Premalakshmi (1997) in gherkins. Application of N fertilizers increased both N per cent and total N content of different plant parts. This was in agreement with Tayal *et al.* (1965).

The phosphorus content of shoot and fruit were highest in treatment T_7 vines that received 25 per cent higher recommended fertilizer dose. These results colloborate with the findings in cucumber by Nirmala (1996), in pumpkin by Karuthamani (1995) and in gherkins by Premalakshmi (1997).

The potassium content of shoot and fruit were highest in the treatment T_7 receiving higher NPK dose. Increased availability of K might be due to quicker transport of photoassimilates resulting in the increased yield. Similar results reported in onion (Thamburaj, 1991), in cucumber by Nirmala (1996) and Premalakshmi (1997).

5.4.1. Uptake of NPK

Higher uptake of NPK was observed in the treatment (T_7) receiving 25 per cent higher recommended fertilizer dose. The maximum N uptake was recorded in the vine of variety Coimbatore local with FYM medium irrigated daily receiving 25 per cent higher fertilizer dose. The results are in confirmity with that of Adams (1994) who observed

higher N uptake in cucumber due to higher application of N fertilizers. This might also be due to higher N content in case of shoot and fruit. These findings are in agreement with Nirmala (1996) in cucumber.

The P uptake was high in the treatment under 25 per cent extra recommended fertilizer dose which had higher level of N. This could be due to enhanced vegetative growth, higher N content in fruit and shoot and total yield. Similar results were reported by Karuthamani (1995) in pumpkin.

The higher level of N application had positive effect on uptake of K. The highest uptake was recorded in the vines of 25 per cent higher recommended fertilizer dose with daily irrigation containing FYM medium. In this investigation N and K had positive association that induced more production of photoassimilates and conversion to fruit yield. These agree with the results of Mc Collum and Miller (1971) and Adams (1994) in cucumber.

5.5. POST HARVEST SOIL NUTRIENT ANALYSIS

5.5.1. Available Nitrogen

Available nitrogen status of the media before the experiment was 0.497, 0.396, 0.426 g/container in M_1, M_2, M_3 media respectively. Soil available nitrogen status after the harvest was at a higher level in fertilizer applied treatments. Due to N application the soil built up of N status and uptake by the vine were higher. The depletion of soil N is also noticed in the treatments which received lower dose of N. This is in confirmity with

the results of Morachen and Subbiah (1972) in sorghum and Premalakshmi (1997) in gherkins. There could be possibilities of higher availability of N in soil which could have increased the available N status.

5.5.2. Available Phosphorus

The status of available P in the media initially was 0.098, 0.081, 0.091 g/container in M_1, M_2, M_3 media respectively. There was an increase in the available P in the soil after harvest which might be due to application of N and K in soil. Available P was more in treatments with higher doses of N. This might be due to reduction in soil pH and high dose of N. The opinion was in agreement with Biswas *et al.* (1977) and Premalakshmi (1997) in gherkins. This increase in post harvest soil could be the indication of the effect of residual fertilizer P. Since the removal of P by the crop was less when compared to addition of P, the residual effect could be expected.

5.5.3. Available Potassium

The available status of K in the media initially was 1.731, 1.601, 1.673 g/container as M_1, M_2, M_3 media respectively. The post harvest soil sample indicates higher status of available K. The available soil K was more due to application of K. Similar results were reported by Soundarajan and Palaniappan (1979) in red gram and Premalakshmi (1997) in gherkins.

5.6. CORRELATION STUDIES

The significant and positive association was established by vine length, primary branches, secondary branches, days to flowering, days to harvest with yield per vine. The yield increase might therefore be the consequence of improvement in different growth characters. These results are in confirmity with earlier findings by Konde *et al.* (1978) in onion, Nirmala (1996) in cucumber and Premlakshmi (1997) in gherkins.

5.7. ORGANOLEPTIC EVALUATION

Colour and appearance are the important visual attributes used to judge the over all quality and willing ness to accept coccinia as salad. Flavour is evaluated by the odour preference generated by stimulation of sensory cells. Texture constitutes the physical property and taste determines the acceptability of salad. The overall acceptability score for Bhubaneshwar local, FYM medium and control were higher.

From this investigation it was concluded that Coimbatore local yielded high but it had poor organoleptic quality though it contained low seed to flesh ratio. The recommended fertilizer dose had higher yield, further increased yield was noticed than control but organoleptic quality was good for control.

The growth and yield seemed to be superior when the plants are irrigated daily but produced fruits of less quality. The plants grown in container with FYM produced high yield, quality and organoleptic property.

So it can be concluded that Coimbatore local with FYM medium irrigated daily supplied with 25 per cent higher fertilizer dose in the liquid form is amenable for homestead production in containers.

Summary

CHAPTER VI

SUMMARY

Investigation of container production of Coccinia (***Coccinia grandis*** L.) was taken up to standardise the media for container growing, frequency of irrigation and requirement of fertilizers. The experiment was carried out at Department of Olericulture, Horticulture College Research Institute, Tamil Nadu Agricultural University, Coimbatore.

The variety Coimbatore local performed superiorly to Bhubaneshwar local in growth characteristics and yield. Among the three media, medium containing FYM facilitated better growth and development of plants and yield.

The 25 per cent higher level of recommended fertilizer dose and daily irrigation was significant compared to the recommended dose and control and weekly irrigation respectively in terms of growth and yield.

The yield attributing characters fruit weight, number of fruits per plant were higher in the variety Coimbatore local with 25 per cent higher fertilizer dose, in FYM medium and daily irrigation.

Earliness in terms of days to first flowering, days to first harvest was noticed in Coimbatore local and in the treatments with 25 per cent higher fertilizer dose receiving

weekly irrigation. Earliness was also noticed in the plants grown in medium containing FYM.

With regard to quality parameters high ascorbic acid content and reducing sugar was exhibited in the variety Bhubaneshwar local. The fruits from the plant grown in the container of FYM receiving weekly irrigation had highest ascorbic acid content. The 25 per cent higher fertilizer dose produced more ascorbic acid content and recommended dose produced more reducing sugar.

The variety Coimbatore local produced fruits of high acidity and TSS compared with that of Bhubaneshwar local. The 25 per cent higher fertilizer dose and daily irrigation produced maximum acidity and TSS. There was no significant variation found among the media in case of acidity while TSS was high in FYM medium.

Shelf life of the variety Bhubaneshwar local is superior to Coimbatore local. The control, weekly irrigation and medium containing FYM aided for the production of fruits with good shelf life. The seed to flesh ratio was low in the variety Coimbatore local in 25 per cent higher fertilizer dose. No significant difference was observed in irrigation frequency and media.

SLW and partitioning efficiency towards fruit were superior in the variety Coimbatore local, 25 per cent higher fertilizer dose, weekly irrigation and in FYM medium.

Fruit dry matter content and harvest index noticed in the variety Coimbatore local, plants supplemented with 25 per cent higher fertilizer dose and the medium FYM were highest.

The NPK uptake and its content in shoot and fruit were found to be greater in the variety Coimbatore local in the fertilizer dose of 5.70:12.15:5.70 g/plant and with daily irrigation. Among the media, FYM medium facilitated more NPK uptake and its content both in shoot and fruit followed by coirpith.

The residual N content and K content were highest in the media in which Bhubaneshwar local was grown but the residual phosphorus was high in medium in which Coimbatore local was grown. The residual N content was high in media supplemented with recommended fertilizer dose but for P and K it was high in 25 per cent higher fertilizer dose. In the media irrigated daily residual N and P were high and weekly irrigated media had high residual K. The FYM medium had more amount of residual N, P and K.

Organoleptic evaluation such as colour, appearance, flavour, texture, taste and overall acceptability were acceptable for all samples except Bhubaneshwar local, FYM medium and control which were highly acceptable.

The yield per vine had a positive significant association with number of primary and secondary branches, days to 1st flowering and days to 1st harvest, fruit girth, fruit weight and fruit number.

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Appendices

APPENDIX -1

Varieties and their source

Varieties	Source
Coimbatore local (V1)	HC&RI Coimbatore
Bhubaneswar (V2)	Bhubaneswar