RESPONSE OF PRUNING AND APPLICATION OF MICRONUTRIENT ON GROWTH AND YIELD OF SWEET PEPPER (*Capsicum annuum* L.) cv. RAJA

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DISSERTATION

Submitted to

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani in partial fulfillment of the requirements for the Degree of

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(Horticulture)

IN

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2020

CANDIDATE'S DECLARATION

I hereby declare that the dissertation

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For a degree of any

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CERTIFICATE – I

This is to certify that the dissertation entitled **"RESPONSE OF PRUNING AND APPLICATION OF MICRONUTRIENT ON GROWTH AND YIELD OF SWEET PEPPER (*Capsicum annuum* L.) cv. RAJA"** submitted by **Miss. PATIL SHROTIKA DATTATRAY, REG. No. 2018HT/16M** to the Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (Horticulture)** in the subject of **VEGETABLE SCIENCE** is record of original and bonafide research work carried out by her under my guidance and supervision. It is of sufficiently high standard to warrant its presentation for the award of the said degree.

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CERTIFICATE – II

This is to certify that the dissertation entitled **"RESPONSE OF PRUNING AND APPLICATION OF MICRONUTRIENT ON GROWTH AND YIELD OF SWEET PEPPER (*Capsicum annuum* L.) cv. RAJA"** submitted by **MISS. PATIL SHROTIKA DATTATRAY, REG. No. 2018HT/16M** to the Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (Horticulture)** in the subject of **VEGETABLE SCIENCE** has been approved by the student's advisory committee after viva-voce examination in collaboration with the external examiner.

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"Everyone has inside of him or her, a piece of good news. The good news is that you don't know how great you can be!"

- Dr.Abdul Kalam

Achievement is of no mean, without the sense of gratefulness and recognition of this is the beginning of wisdom.

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Date: -30/09/2020 *Shrotika Patil*

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ABBREVIATIONS

/	-	Per
@	-	At the rate of
&	-	And
^0C	-	Degree Celsius
B:C ratio	-	Benefit Cost Ratio
CD	-	Critical difference
Cm	-	Centimeter
Cv	-	Cultivar
DAS	-	Days After Sowing
DAT	-	Days After Transplanting
et.al.	-	Et alia
Fig.	-	Figure
FYM	-	Farm Yard Manure
G	-	Gram
Gl	-	Gram per liter
m^2	-	Square meter
Ha	-	Hectare
i.e.	-	That is
IU	-	International Units
Kg	-	Kilogram
Kg plant	-	Kilogram per plants
Kg ha	-	Kilogram per hectare
M	-	Meter
Mm	-	Milli meter
mg g	-	Milli per gram
MT	-	Metric tonnes
Cm^2	-	Centimeter square
mg 100 g	-	Milligram pee hundred gram
Mg	-	Milligram
FAO	-	Food and Agricultural Organization
No.	-	Number
Plant	-	Per plant
Pp	-	Page number
Q	-	Quintal
q ha	-	Quintal per hectares
var.	-	Variety
viz.,	-	Namely

Introduction

CHAPTER - I

INTRODUCTION

Capsicum (*Capsicum annuum*) belongs to the genus Capsicum and family Solanaceae which is grown in several part of the world and is believed to be native of Tropical South America (Shoemaker and Teskey, 1995). The domesticated pepper could be broadly classified into sweet and hot types based on their levels of pungency.Capsicum consists of 20–27 species, five of which are domesticated: *C. C.baccatum, C. chinense, C. frutescens, and C. pubescens. Capsicum (Capsicum annuum* L. var. grossum Sendt; 2n =24) also known as Bell pepper or Sweet pepper or Green pepper or Shimla mirch. Originate from Central and South America. They differ from common hot peppers in size and shape of the fruits, capsaicin content and usage. Capsicum is one of the popular solanaceous vegetable crops grown throughout India in open as well as protected environments. Brazil is a major center of diversity of the genus Capsicum is one of the most important vegetable crops grown extensively throughout the world especially in the temperate countries. China is the major producer of capsicum and contributes 36 per cent of the worlds cultivated area with a production of 15.03 million tones. India contributes average annual production of 327 thousand tonnes from an area 46 thousand with productivity of 7108.70 kg per hectare (Anonymous 2018).

Vegetables play a major role in daily human diet since they are most important and cheapest source of natural protective foods. Sweet pepper is one of the most favoured of chilli and widely used universal spices, named as wonder species. It is extensively cultivated in hills of Himachal Pradesh, Uttar Pradesh, Jammu and Kashmir, Andhra Pradesh and Nilgiri hills during summer months. As an autumn crop, it extends up to winter months in Karnataka, Maharashtra, Tamil Nadu, Bihar, West Bengal, Uttar Pradesh and Madhya Pradesh. Bell pepper/capsicum is one of the highly remunerative vegetables cultivated in most part of the world especially in temperate regions of central and South America and European countries, tropical and subtropical regions of Asian continent. In the world, area and production of bell pepper is merged with that of hot pepper (chilli pepper). Hence, the exact statistics related to bell pepper/chilli as whole is given. Capsicum attained a status of high value low volume crop in India in recent years and occupies a place of pride among

vegetables in Indian cuisine, because of its delicacy and pleasant flavour coupled with rich content of ascorbic acid along with other vitamins and minerals.

The family solanaceae is an important for horticulture because there are several commercial vegetable crops like sweet pepper, Tomato, Brinjal ,Potato etc. which are cultivated extensively; further the members of the solanaceae kind are characterized by the fact that they contain vitamin c which is an important constituent of a balanced human diet. Of the various vegetables grown in India, Sweet pepper (*Capsicum annuum*) is a high value low volume winter season cash crop and fetches higher price during early winter or late winter as off- season crops. The fresh fruit consumed as salad or cooked as vegetables is rich in antioxidants vitamin A and vitamin C which protects human body from oxidative damages that may lead to heart disease, cancer and ageing. It also finds place in preparations like pizza stuffing's and burger with growing popularity of fast food. The high market price is attributed to the heavy demand from the urban consumers.

There is a good demand for export too. Concentrations of vitamin C is ranged from 63 to 243 (mg 100 g-1) depending on fruit colour (Howard *et al*., 1994). In a survey on content of vitamin C in fruits and vegetables, bell peppers represented the highest fourth out of 42 choices (Frank et al., 2001). A 100 g of edible portion of pepper provides 24 Kcal of energy, 1.3 g of protein, 4.3 g of carbohydrates and 0.3 g of fat (Zende, 2008). One hundred gram of edible portion of capsicum provides 24 k Cal of energy, 1.3 g protein, 4.3 g carbohydrates and 0.3 g fat. Also, it is one of the valuable medicinal plants in pharmaceutical industries, owing to high amounts of health promoting substances, particularly antioxidant, capsaicin and capsanthin (Aminifard et al., 2012).The crop is highly sensitive to environmental stresses particularly temperature. Micronutrient plays vital roles in the growth and development of plants, due to their stimulatory and catalytic on metabolic processes and ultimately on flower yield and quality.

The fruits of sweet pepper are harvested either at green mature stage or at colouring stage and are a very good source of vitamin A and C and other nutrients having great demand in big cities and other urban areas of the country. One medium green bell pepper can provide up to 8% of the recommended daily allowance of Vitamin A, 180% of Vitamin C, 2% of calcium and 2% of iron. Sweet pepper contributes substantially to our diet, it is a good source of vitamins A, C (More than that obtained from tomato), E, B1, B2, and D. A phenolic compound called capsaicin

is responsible for the pungency in peppers. Pepper is grown as an annual crop due to its sensitivity to frost and is actually herbaceous perennial and will survive and yield for several years in tropical climates. According to Norman the growing of sweet pepper in West Africa is confined to urban centres but recently large scale or commercial productions has been undertaken under irrigation in the rural areas. It is very valuenerable to frost and grows poorly at temperatures between 5 and 15°C.

The optimum temperature range for sweet pepper growth is 20 to 25°C. Low humidity and high temperatures results in poor fruit set due to dropping of flower buds, flowers and small fruits caused by their abscission because of their excessive transpiration, also night temperatures below 15.6°C and above 32.2°C prevent fruit set. Flower production is significantly increased when the night temperatures during the growing season is between 12-21°C and fruits also develops sun scalds when grown in the dry season in the open field. There are several factors that influence the growth and yield of pepper, some of which include temperature, relative humidity, day length, photoperiod etc. Along with other factors which affect the per unit area production like nutrition, cultivar, growing system and soil fertility, plant density has its significance. Greenhouses increase crop yields by as much as four to ten times as plants grown under open field conditions; the quality of the product is normally higher than open field and the dependency on chemicals is drastically reduced. The main reasons for increased yields lie in the nature of the growing environment as well as the genetics of some greenhouse varieties. Cultivation in the open field also tend to be much easier and less costly hence production of fresh vegetables by numerous people in this system of production.

Pepper plants have a branching habit; therefore, fruit development is controlled by restricting the branching pattern to 1, 2, 3 and 4 main branches. The reasons for pruning bell pepper under greenhouse conditions are to train plant to grow upright in order to facilitate light penetration all over the leaf canopy, improve fruit set and obtain early fruit ripening and high yield of large sized fruits (Jovicich *et al*., 2004; Zende, 2008). Moreover, pruning is effective in improving air circulation which reduces relative humidity and limits the spread of diseases (Esiyok et al., 1994). Pruning methods vary with different branching habits of Capsicum cvs. and under different plant densities (Dasgan and Abak, 2003; Maniutiu et al., 2010). The prime objective of the pruning practice is obtaining proper balance between fruit number and fruit size by improved canopy management. Due to the heavy vegetative growth

and fruit load on the coloured pepper plants (Shaw and Cantliffe, 2002), shoot pruning is important factor in proper utilization of production area (Maniutiu et al., 2010).Pruning of the capsicum plants to two stem, three or four stem not only facilitate easy training operation but also permit closer planting, early ripening of fruits and ultimately higher yields of larger sized fruits (Dasgan and Kazim 2003). Due to the heavy vegetative growth and fruit load on the colored pepper plants shoot pruning proves to be one of the important factor in proper utilization of production area. Micronutrient fertilizers are one of the outstanding sources of nutrient that effect on growth and development of sweet pepper. Use the low value for medium responsive crops and the high rate for high responsive crops the micro-nutrients are required in the minute quantities by the plants, but each of these play a specific role in the physiology of the plants. Therefore, it is essential to adopt a strategy of nutrients management in vegetable production by using judicious combination of macro and micro-nutrients. The present study was undertaken with the following objectives:

- To increase the number of fruit and fruit weight of sweet pepper.
- To identify the days of pruning in shade net of sweet pepper.

Review of Literature

CHAPTER- II

REVIEW OF LITERATURE

Capsicum is important vegetable crop. Now days, world facing major problem of climate change. Due to this climate change, ecological balances have been broken down, which ultimately leads to abrupt climatic conditions. And because of such undesirable change in climate, production of agricultural produce is greatly hampered.

The present investigation entitiled "Response of pruning and application of micronutrient on growth and yield of sweet pepper (*Capsicum annuum*)." Was conducted during Kharif season 2019 at Department of Horticulture V.N.M.K.V, Parbhani.

The literatures avalilable on effect of different micronutrient and pruning and their interaction on various parameter of capsicum is presents under subheading as listed viz, growth, flowering, fruit yield and quality paramters.

2.1 Effect of Pruning:

2.1.1 Pruning on growth

Magdalena *et al.,* (2008a) studied that pruning methods were applied: pruning to one shoot with leaving on every node 2 fruit sets and 1, 2 or 3 leaves, and pruning to two shoots with leaving on every node 1 fruit set and 1, 2 or 3 leaves. With the introduction of a greater number of leaves and fruit sets on eggplant shoots irradiation in plant profile was reduced.

Magdalena *et al.,* (2008b) reported that the best method of eggplant (*Solanum melongena* L.) pruning in greenhouse production. Plants were pruned to one or two shoots. In the case of two-shoot plants, The most effective fruit setting was observed in the intensely pruned plants. The greatest number of fruits was set at the lowest nodes Fruits of two-shoot plants with the second shoot led out from the sixth node and pruned to one shoot contained the greatest level of L-ascorbic acid.

Maniutiu *et al.,* (2010) conducted the experiment effectuated at the company SC Cristal Lux SRL from Balan commune, Salaj County, Romania, was to establish the best plant density and plant directing method for bell peppers cultivated in plastic tunnel. A density of 40000 plants/ha assured a significant yield increase comparative with 30000 plants/ha. Under the combined influenced of both factors the

best results have been obtained by variant III (40000 plants/ha, 2 shoots) and variant IV (40000 plants/ha, 3 shoots) for both the early and the total yield.

Maboko *et al*.,(2011) studied the effect of plant population, and fruit and stem pruning of hydroponically grown tomatoes in a 40% (black and white) shade-net structure at the ARC-Roodeplaat VOPI. Plant population of 3 plants/m2, resulted in significantly higher marketable yield of tomatoes, compared to 2.5 and 2 plants/m2. Results showed that tomato yield and quality can be effectively manipulated by plant population and stem pruning, while fruit pruning had only a limited effect.

Islam *et al.,* (2011) studied that growth and yield of sweet pepper as influenced by spacing. The plant spacing had significant variation in almost all the growth and yield components except pericarp thickness. The yield of fruits per hectare, cost of production and net return, 50×30cm spacing appeared to be recommendable for the cultivation of sweet pepper.

Hossein *et al.,* (2012) observed that the response of sweet pepper (Capsicum annum L.) to plant density and nitrogen fertilizer under field conditions. Nitrogen fertilizer was significantly affected on plant height, lateral stem number and leaf chlorophyll content. It was observed that fertilization with 50 kg N/ha resulted to the highest fruit volume and plant yield. There were significant differences between fruit volume and fruit weight by interaction between plant density and nitrogen treatments.

Singh Chandan *et al*., (2015) studied that the growth and flowering performance of one varieties of capsicum (Capsicum annum L.) Results showed that capsicum (Capsicum annum L.) yield and quality can be effectively manipulated by plant population and stem pruning, while fruit pruning had only a limited effect.

Pradeepkumar *et al*., (2016) conducted an experiment in two plants as a unit. The treatments significantly increased the vegetative growth and yield of phalsa' the maximum vegetative growth attributes like as shoot length(203.00cm), number of shoots per plant(103.33), number of leaves per shoot(27.00), intermodal length (6.66), yield attributes like number of fruits per node(14.33), number of fruiting node per shoot(16.00), fruit yield per plant(3.50 kg) and per hactare (58.30 q) were recorded with the spray of KCl @ 0.4 per cent with 50cm pruning intensity.

Adinde *et al*., (2016) studied that the effect of nipping on growth and

yield of green bell pepper (Capsicum annuum). The result showed that all the nipped green pepper plants performed better than the non-nipped plants (control). It can be concluded that nipping has a positive effect on growth and yield of green bell pepper. Nipping at 2 weeks after transplanting could therefore be recommended for improved yield of green bell pepper (Capsicum annuum).

Khoshkam *et al.,* (2016) observed that the pruning and planting density plays an important role in the growth and yield of greenhouse cucumber. In order to the effect of pruning and plant density on yield of cucumber conducted. In this study it was found that the highest performance and most desirable in pruning fruit quality was No. 3 with a density of 35,000 plants per.

Nakanishi *et al., (*2017) studied that the two production systems: greenhouse and open field and nine varieties of sweet pepper. California wonder (rank -8) was highly accepted by consumers compared to Caribbean Red (rank 4- moderate quality) in both greenhouse and open field conditions.

Ismeet Singh *et al.,* (2018) observed that the effect of the tested systems of pruning on vegetative, fruiting, yield and quality traits of capsicum varieties. The results showed that the two stem pruning treatment significantly affected the plant growth and flowering characteristics in terms of plant height (194.75cm), number of days to first flower (20.25 days) in cv. Indra.

Kuldeepkumar *et al.,* (2019) showed that the vegetables are most important constituents of Indian agriculture and nutritional security due to their short duration, nutritional richness, high yield, economic viability and ability to generate on-farm and off- farm employment. The literatures available on pruning in vegetable crops are collected under the following heads: Response of pruning on the vegetative growth and yield, Response of pruning on quality characters, Economic studies.

2.1.2 Effect of pruning on flower and fruit:

Maboko *et al.,* (2012) showed that the effect of plant population, flower and stem pruning of hydroponically grown peppers in a 40% (black and white) shade net structure at the ARC-Roodeplaat VOPI. Stem pruning to four stems without removing any flowers at a plant population of 3 plants/m2 resulted in the highest yield and quality.

Ghanshyam *et al., (*2018) observed the Effect of plant spacing on growth,

flowering, fruiting and yield of Capsicum (*Capsicum annuum* L) hybrid buffalo under natural ventilated polyhouse. The different spacing level, the spacing S1 (45 cm x 30 cm) recorded maximum plant height (137.46 cm), yield (82.13t/ha.) and spacing S1 (45 cm x 30 cm) showed the early flower initiation as well as 50 per cent flowering (52.24 days). leaf area (97.24 dm2), number of branches (9.39), number of flower per plant (10.74), number of days for fruit set (66.20), least number of days to first harvest (89.06 days), fruit weight (185.31g), number of fruit per plant (18.48), yield per plant (3.38 kg.) was recorded under S3 (45 cm x 60 cm) and higher B: C ratio (5.60) was recorded under S2 rest of treatments.

MdRazzab Ali *et.al* (2018) in combination of stem pruning and variety, we found that stem pruning slightly decrease the yield of both tomato varieties. Two shoot pruning (P2) showed highest seed yield (14.5 g/plant; 49.6 kg/ha) and viability (85.2%). The highest seed yield was found from P0V1 (60.2 kg/ha), whereas the lowest (34.7 kg) from P0V2. The highest viability was found from P1V1 and P3V3 (99.0%) and the lowest viability (3.3%) recorded from P1V2. Both varieties performed differently to the different stem pruning.

2.1.3 Effect of pruning on yield and quality:

Eliojovich *et al.,* (1998) reported that greenhouse crops, fruit yield and quality can be increased by managing shoot pruning and plant density. Results indicated that 4 plant m $^{-2}$ pruned to four stems increased marketable and extra-large fruit yield in a short harvest period of a summer greenhouse sweet pepper crop in North central Florida.

Zoran *et al.,* (2009) studied that the influence of different colored shade nets (photo selective) on the plant development, yield and quality of bell pepper (Capsicum annuum L.). Pepper was grown under four different colored shade-nets (pearl, red, blue and black) with different relative shading (40% and 50%). In this investigation the potential use of pearl and red colored shade nets (40% by FAR) was demonstrated.

Halina *et al.,* (2010) studied that the effect of pruning intensity on yielding of this vegetable in rooms. The highest marketable fruit yield was obtained from plants managed for two (3.82 kg.m-2), three (3.98 kg.m-2), and four (3.87 kg.m-2) guiding shoots. The highest early yield was collected from plants managed for one and two guiding shoots.

Malik, *et al.,* (2011) recorded the growth, yield, and fruit quality. The highest fruit yield (686.39 kg.ha-1) was recorded in treatment T9, The treatment T9 also exhibited the highest fruit quality in terms of vitamin-C (243.34 mg/100g), total chlorophyll content (732.66 mg/100 g), dry matter content (9.93 g/100 g), nitrogen (4.38%), phosphorus (0.46%) and potassium (3.65%) in fruit.

Seifi *et al.,* (2012) studied the effects of plant density and pruning on yield characteristics and growth of two bell pepper cultivars, a 2×3×2 factor. The results showed that the effect of shoot pruning on yield per m2, yield per plant, fruit weight, number of fruits per plant and plant weight was significant ($P<0.01$).

Shivakumar, *et al* (2012) showed that the bell pepper belongs to the family solanaceae and genus Capsicum. The bell pepper (Capsicum annum L. var. Grossum Sendt.; 2n = 24) is commonly known as sweet pepper, bell pepper. Among spacing S1 had recorded maximum fruit length, girth and average fruit weight. However because of more plant population (1, 11,111) spacing S3 had recorded the maximum yield per hectare in F6 level (63.96 tons per hectare). This was supported by 6.40 kg per m2 and 9.78 kg per plot in same spacing level S3.

Sowley, *et.al*. (2013) at harvest, unstaked-unpruned and staked-unpruned plants indicated higher number of fruits per plant with small fruit size as compared to the other plants. Stake - prune and unstake - prune plants few number of fruit per plant but fruits size bigger than staked-unpruned and unstaked – unpruned. Staking and pruning gave clean and bigger fruits with an increase in total marketable fruit yield by weight.

Alabi *et al.,(*2014) studied that the hot pepper production based on the package of recommendations developed for closely-related sweet pepper has not given the desired growth and yield performances. The 60x40 cm spacing gave the highest number and weight of ripe fruits in both years and should be recommended for rodo production.

Goda *et.al*. (2014) Egypt to study the response of husk tomato to some pruning treatments on growth, yield and fruit quality. Plants were trained on thread and pruned as follows: plants were left to grow without pruning (Pr.0)as a control, plants were pruned to three shoots on the main stem(Pr.3), plants were pruned to six shoots on the main stem(Pr.6) and plants were pruned to nine shoots on the main stem(Pr.9). Results showed that all pruning treatments improved vegetative growth.

Mahmud *et al., (*2017) recorded that the optimum sowing date for quality seed production of sweet pepper. The highest individual fruit weight, 1000 seed weight was obtained from the October 15 sowing date in the year of 2011-2012 and it was significantly different from all other dates of sowing. Maximum seed yield (86.2 kg ha-1) was recorded in 2nd sowing date (15 October).

Bhat *et.al* (2017) Pruning the maximum plant height (119.18 cm) were obtained with plants pruned to one shoot (P1). Most of the yield parameters also recorded higher values due to vermicompost (S2) e.g., total fruit yield (10. 25 kg m-2) while in case of pruning the maximum total fruit yield (8.92 kg m-2) was observed in plants pruned to three shoots.

Zoran (2017) studied that the concept of photo-selective netting was studied in a sweet pepper (*Capsicum annuum* L.) cultivar 'Cameleon' from summer cultivation in south Serbia (under high solar radiation 910 W m-2, with a photosynthetic photon flux density of 1661 µmol m-2 s-1), The highest concentration of total soluble solids (TSS) was detected in pepper fruits grown under the open field conditions (8.03%). Total acid (TA) content was 0.19 in the control and 0.25 in pepper fruits grown under red nets. The highest concentration of vitamin C was detected in peppers grown in plastic tunnels integrated with red coloured nets (175.77 mg 100g-1).

Chatterjee *et al.,* (2018) studied that the open field and agro shade net under different transplanting dates and pruning level. The interaction effect combining shade net cultivation with 1st February planting date coupled with 3 shoot pruning proved superiority with respect to growth and yield characters of bell pepper and resulted in many fold improvement in the form of higher fruit number (16.21 plant-1), individual fruit weight (107.54 g) and maximum fruit yield (1743.21 g plant-1).

Ishmeet Singh *et al.,* (2018) observed that the effect of the tested systems of pruning on vegetative, fruiting, yield and quality traits of capsicum varieties.. The results showed that the two stem pruning treatment significantly affected the plant growth and flowering characteristics in terms of plant height (194.75cm), number of days to first flower (20.25 days) in cv. Indra.

Elazar *et al.,(*2019) observed that the effects of irrigation water quality and amount on yield and postharvest quality of pepper fruit (*Capsicum annuum* L.).

Pepper yield benefited by irrigation with fresh water (1.6 dS/m) and was not affected by water quantity, but post-storage fruit quality was maintained better after use of moderately-saline water (2.8 dS/m). Thus, irrigation water with salinity not exceeding 2.8 dS/m will not impair postharvest quality, although the yield will be reduced at this salinity level.

Ismail Ibrahim Garba *et al.*,(2020) The treatments consisted of two hybrid cucumber varieties (Sirana F1 and Marketer) and four pruning regimes (No pruning, pruning at 4, 5 and 6 weeks after sowing (WAS). These were laid out in Randomized Completely Block Design with three replications. Analysis of variance shows that pruning regime significantly ($P<0.05$) influenced plant height (cm), number of leaves per plant, days to physiological maturity, unit fruit weight (kg) and total yield.

2.2 Effect of Micronutrient

2.2.1 Effect of micronutrient on growth:

EI – Bassiony *et al*., (2010) showed that the response of sweet pepper plants cv. California wonder to different rates of potassium fertilization (50, 100 and 200 kg/fed.) results reported that the fruit measurements expressed as fruit length, average fruit weight and vitamin C content, as well as leaves chemical composition (N, P, K and total chlorophyll) were increased with increasing potassium fertilization rate.

Patil *et al., (*2013) studied that the effect of micro- nutrients on growth and yield parameters of capsicum (Capsicum annuum var. grossum). Results of the experiment showed that the effect of micro- nutrients on yield attributing character such number of fruits per plant, yield per plot (kg) and yield per hectare (q) was significant. The yield per hectare was maximum in treatment T12 (290.73)

Nalla Kumar *et al.,(*2016) observed that the micronutrients are present in lower concentrations in soil than macronutrients but are equally significant in plant nutrition. Foliar application of micronutrients shows better efficacy than soil application as the uptake and assimilation of micronutrients by later method takes more time. Owing to intensive agriculture and high yielding varieties of vegetables extra mining of nutrients takes place which leads to negative nutrient balance in the soil. Hence, to cope up with the needs of the crop, application of micronutrients in addition to macronutrients must be ensure.

Tajungsola et *al.,(*2017) studied that the three Bulky organic manures

(FYM, Vermicompost and Poultry manure) and three chemical fertilizers (Nitrogen, Phosphorus and Potassium).The result revealed that maximum plant height (44.55 cm), number of leaves plant-1 (35.97), leaf area plant-1 (56.27 cm2), number of flowers plant-1 (10.53), number of fruit set (4.77), fruit length (7.50 cm), number of fruits plant-1 (4.37), average fruit weight (140.47 g/fruit) and fruit yield plot-1 (4.23 kg) were produced by treatment T6 (50% RDN + 50% Vermicompost ha-1).

2.2.2 Effect of micronutrient on flower and fruit:

Natesh *et al.,(*2005) studied that the foliar spray of micronutrients at flowering stage increased the growth and yield of chilli. (*Capsicum annuum* L.) cv. Byadagikaddi. Foliar spray of ZnSO4 (0.1%) recorded higher yield (248.26 kg/ha) and quality parameters followed by borax and MgSO4 (0.1% each).

Patil *et al*.,(2010) The treatment Boron 100 ppm + Zinc 200 ppm was effective in increasing number of clusters (13.85) and number of flowers (51.24) per plant. Maximum number of flower (3.80) per cluster and per cent fruit setting (47.76%) was recorded with boron 50 ppm + Iron 100 ppm + zinc 100 ppm, while minimum was recorded in control.

2.2.3 Effect of micronutrient on yield and quality:

Shil *et al.,* (2013) conducted the field trial on chilli (cv. Bogra local). The highest yield (1138 kg/ha) was recorded from Zn3B1 kg/ha, which was closely followed by Zn3B2, Zn4.5B2 and the lowest (703 kg/ha) in control (Zn0B0). The yield benefit over control varied from 4.4 to 61.9 % due to interaction effect.

Shafeek *et al*.,(2014) observed that the growth, total yield and chemical parameters of hot pepper cv. Benisweif Hybrid F1 as influenced by sources of minor nutrient foliar application (Greenzit or Novatren). Foliar spraying of plants by both minor nutritional fertilizers at level of 3 L/fed gained the best plant growth and yield if compared with the other application levels.

Pandav *et al.,(*2016) studied the experiment during autumn-winter season of 2014-15.The plant height (cm) at 60, 90 and at maturity, the number of fruits per plant, fruit length and diameter (cm) and average fruit weight (g), increased significantly with increasing concentration of micronutrients (up to 0.4%).

Dhotre *et al.,* (2017) studied that the yield and quality parameters of sweet pepper as influenced by plant growth regulators and their spraying intervals were

studied. The fruit yield was significantly higher under the combinations of NAA @ 100 ppm sprayed at 4 intervals (2.42 kg/plant) CCC @ 600 ppm sprayed at 4 intervals (2.39 kg/plant) and the same interactions outperformed control with respect to TSS, ascorbic acid and dietary fibre components in sweet pepper.

Hossein *et al.,(*2018) studied that the fruit of bell pepper is one of the most important commercial crops in the world. This study was conducted to determine the effects of nitrogen (N) doses on the growth and yield of sweet pepper (*Capsicum annum* L. var. California Wander) under field conditions. It was observed that fertilization with 150 kg N ha-1 resulted to the highest fruit weight and fruit yield.

2.3 Effect of interaction of pruning and micronutrient

2.3.1 Effect of interaction of pruning and micronutrient on growth:

Baloch (2008) observed that the foliar fertilizer, Hi Grow is a composition of various macro and micronutrients was applied on chilies at the concentrations 4, 5, 6, 7 and 8 ml/L water in addition to soil applied NPK fertilizers at 50-50-25 kg ha-1 to investigate their associative effect on production of green chilies. 7 ml/L water was considered to be an optimum Hi Grow concentration for commercial production of chilies.

Sanjay *et al*., (2010) studied that the effect of pruning on leaf micro nutrient (Cu, Zn, Fe and Mn) status in nonfloral and floral shoots of three mango cultivars (‘Amrapali’, ‘Mallika’ and ‘Dashehari’) under high density planting during 2005-2007. Highest Cu, Fe and Mn content was recorded in ‘Mallika’ mango, while, Zn content was highest in ‘Dashehari’ mango

Almas *et al.,* (2014) observed that the effect of different levels of pruning and micronutrient (Fe) on growth, flowering and cut flower yield of Dutch rose (Rosa hybrida Linn.) cv. FIRST RED under greenhouse condition was carried out under poly house. The heavy pruning recorded maximum number of shoots, stem length of the flower, vase life, number of flowers per plant, per square meter and per hectare among the pruning levels. The shortest period noted to first flower bud appearance and first flower opening in FeSO4 1.5 per cent.

Ashutosh *et al.,* (2018) showed that the effect of pruning intensity, foliar feeding of plant growth regulators and micro-nutrients on vegetative growth of phalsa (Grewiasubinaequalis). Highest inter nodal length was measured with foliar spray of

Urea k2.0 per cent as compared to other treatments. It was evident that foliar application of Urea @ 2.0 per cent and ZnSO4 @ 0.4 per cent respectively at 50 cm pruning level effective to increase vegetative growth in phalsa fruits.

2.3.2 Effect of interaction of pruning and micronutrient on flower and fruit:

Almas *et al.,* (2014) observed that the effect of different levels of pruning and micronutrient (Fe) on growth, flowering and cut flower yield of Dutch rose (Rosa hybrida Linn.) cv. FIRST RED under greenhouse condition was carried out under poly house. The heavy pruning recorded maximum number of shoots, stem length of the flower, vase life, number of flowers per plant, per square meter and per hectare among the pruning levels. The shortest period noted to first flower bud appearance and first flower opening in FeSO4 1.5 per cent.

2.3.3 Effect of interaction of pruning and micronutrient on yield and quality:

Shetty et *al.,* (2008) studied the influence of pruning and growth regulators on the yield and quality of coloured capsicum (*Capsicum annuum* L.) cv. OROBELLE. The treatment T5 which was the combination of pruning to four branches per plant + NAA 10 ppm. This treatment had also significantly increased number of flowers per plant (34.34 and 39.41, respectively) and per cent fruit set (52.37 and 63.51%, respectively) fruit yield per plant (1.97 and 2.39 kg) and per hectare (118.20 and 143.40 t) in both summer and winter, respectively. Capsicum plants responded significantly to the pruning and application of growth regulators.

Madhu Singh *et al., (*2017) studied the response of growth and yield of poly house grown capsicum cultivar “Indira” (*Capsicum annum* L.) to different applications of humic acid and micro nutrients. Among the different treatments applied, T7 (RDF + soil application of humic acid 10 kg/ha + foliar application of humic acid 0.1 % + micronutrient mixture) was found statistically superior to enhance plant height (103.91cm), number of branches per plant (9.33), leaf area (391.30 cm2), fruit weight (174.28 g), number of fruits per plant (22.07), volume of fruit (376.57 cc), specific gravity (0.58g/cc) and yield per plant (3.85 kg).

Awalin *et al., (*2017) studied that the two levels shoot pruning viz., P0: no shoot pruning & P1: shoot pruning and six levels of foliar applications of micronutrients. Application of shoot pruning with mixed micronutrient with 100 ppm elicited (30.43 t/ha) the highest yield compared to other treatment and seems to be the

best combination for bell pepper production.

Sarika kumari *et al.,(*2017) studied the experiment in the field Nadia (West Bengal) during the year 2013-14 and 2014-15 to study the effect of transplanting dates and micronutrient complex application on yield and quality of capsicum varieties under protected condition. The highest fruit yield was obtained from transplanting on 17th November for variety Arya with micronutrient application (134.64 t/ha).

Ankur *et al.,(*2018) showed that the effect of growing environments (viz., underground trench, polycarbonate green house, polyench and open condition) and micronutrients (zinc, boron, manganese, magnesium, and copper) spray on yield performance and quality of capsicum var. California Wonder, Pusa Deepti and Yolo Wonder. Among the micronutrients spray, two sprays of zinc (100ppm) or boron (100ppm) were found best under greenhouse conditions for obtaining higher yield and quality of capsicum exhibiting fruit yield of 840.96g per plant significantly superior over control (768.43g per plant) irrespective of the variety. Interaction effects of micronutrients to variety were significant for marketable traits of capsicum.

Reddy (2018) the treatments consist of boron, zinc, molybdenum, copper, iron, manganese, mixture of all. Manganese sprayed @50 ppm. All the treatments recorded superior performance in plant growth characteristics viz. plant height, number of primary branches and compound leaves and yield parameters viz., tender and mature fruits per plant in both the varieties over control. In tomato cv. Arka sourabh,

Naik *et al., (*2018) studied that the capsicum cv. Solan Bharpur consisting of 11 treatments, replicated thrice with Randomized Block Design. The results revealed that, capsicum plants applied with 10 t/ha of well rotten farm yard manure (T10) recorded significantly taller plant (87.30 cm), stem girth (4.85 cm), higher number of fruits (25.66), fruit length (8.83 cm), fresh fruit weight (58.83 g), weight of 10 fruits (663.72 g), yield (16.32 t/ha).

Meenakshi *et al., (*2019) observed that the effect of foliar spray of micronutrients to enhance seed yield and quality in chilli (*Capsicum annuum* L). The results indicated that, application of FeSo4 @ 0.2% + Boron @ 0.1% spray recorded significantly higher seed yield (3.93 q/ha) and germination (81.83%) at Jabalpur region.

Materialand Methods

CHAPTER -III

MATERIAL AND METHODS

The details of material used and methods followed while conducting the present investigation are given in this chapter.

3.1 General information

3.1.1 Location

The present investigation entitled "Response of pruning and application of micronutrient on growth and yield of sweet pepper (Capsicum annuum) was undertaken at Department of Horticulture, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani Maharashtra 2019- 2020.

3.1.2 Geographical location of the experimental site

Field was situated at $19^{o}16$ North latitude and $76^{0}47$ East longitudes and at an altitude of 408.50m above the mean sea level (MSL) and has subtropical climate.

3.1.3 Climate

The data on weather parameters such as rainfall (mm), mean maximum and minimum temperature (^{0}C) and relative humidity (%) recorded at Meteorological Observatory, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during the experimental year 2019- 2020. The field experiment was conducted in Kharif season during 2019-2020 in greenhouse department of horticulture, VNMKV, Parbhani.

3.2 Experimental site

The present experiment was conducted at Department of Horticulture, College of Agriculture Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during 2019- 2020.

3.3 Experimental details

The experiment was laid out in Factorial Randomized Block Design. There were 12 treatments consisting of micronutrients alone and in combination with different pruning level.

Details of layout:

Name of the crop	Sweet pepper (*Capsicum annuum*)
Family	Solanaceae
Variety	Raja
Experimental design	Factorial Randomized Block Design
Number of replication	3
Number of treatments	12
Number of plant	576
Spacing	50 x 40 cm
Horticultural practices	As per recommendation
Place of research work	Department of Horticulture, College of Agriculture, V. N. M. K. V.,Parbhani
Date of sowing	22-6-2019
Date of transplanting	29-7-2019
Pruning	At 20 DAT and 30 DAT

3.3 Treatment detail:

Factors:

Factor A	**Micronutrient**	**Rate of Application**
M_1	Chelated Zn	0.2 %
M_2	Chelated Fe	0.2 %
M_3	Chelated Bo	0.1 %
M_4	Chelated Cu	0.1 %
M_5	Chelated Mn	0.2 %
M_6	Chelated Mix	0.2 %
Factor B		
P_1pruning	20 DAT	
P_2 pruning	30 DAT	

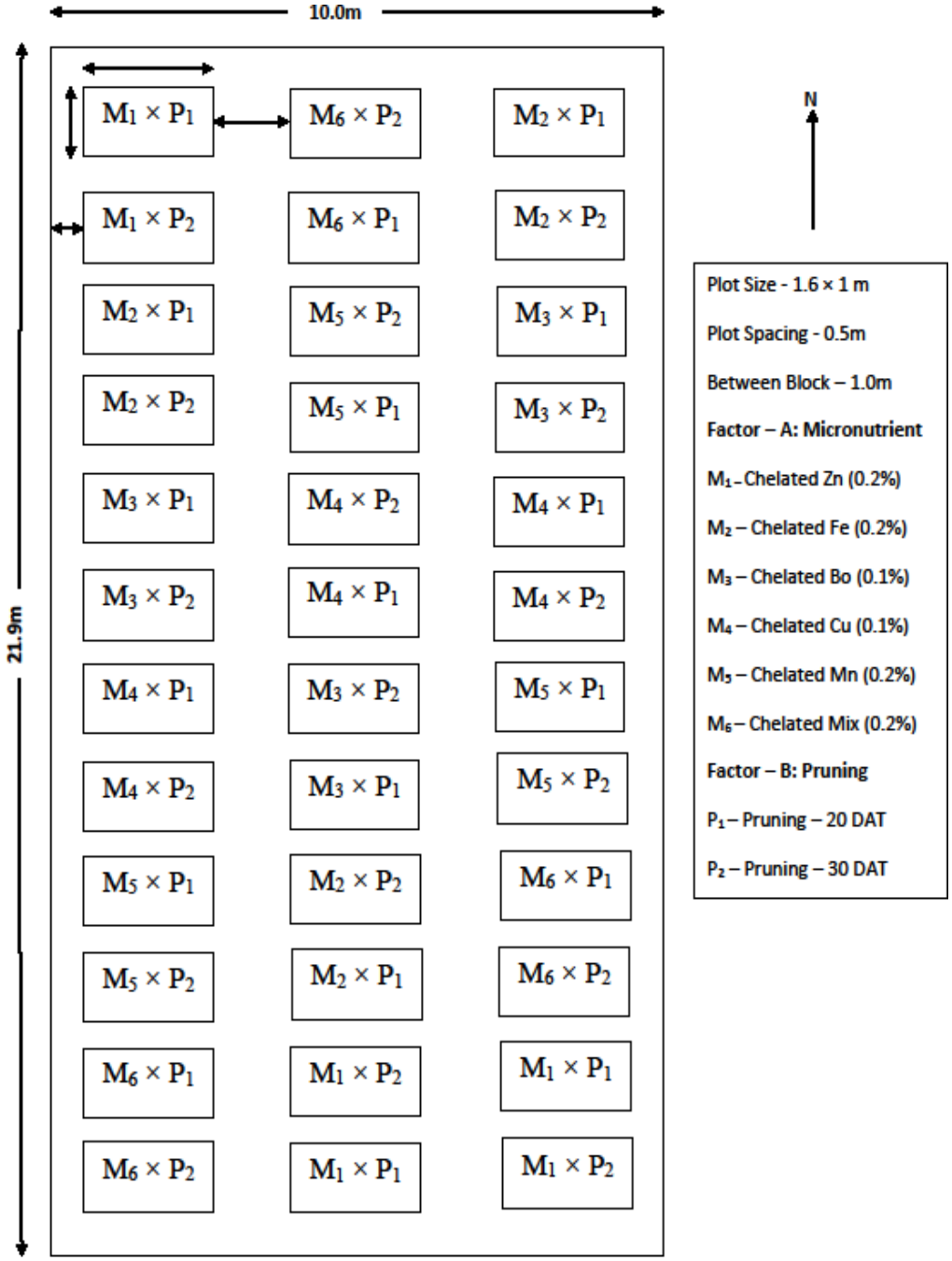

Figure 1 : Layout of the experimental plot

3.4 Materials:

- Chemical used for seedling treatment (By deeping method)
    1. Imadachlopride
    2. Copperoxychloride
- **Other materials**
    1. Thread (Sutali)
    2. Hand spray
    3. Tags

Material required for recording observations

1. Electronic digital weighing balance
2. Digital vernier caliper
3. Leaf area meter
4. Fluorometer for chlorophyll determination

3.5 Selection of plant materials

Capsicum variety "Raja" (F_1 hybrid) were used as experimental materials. The seeds were collected from Bioseed Company, 206, Kavuri Hills, Madhapur, Hyderabad, Telangana– 500033, India.

3.6 Design and layout of experiment

The two factors experiment was laid out in a Factorial Randomized Block Design (FRBD) with three replications. The total area of the experimental plot was 219.0 m2 with length 21.9 m and width 10.0 m which was divided into three equal blocks. Each block was divided into 12 plots where 12 treatments combination were allotted at random. There were 36 unit plots altogether in the experiment. The size of the each plot was 1.6 m × 1m. The distance maintained between two blocks and two plots were 1.0 m and 0.5 m, respectively. Seeds were sown in the plot with maintaining distance between row to row and plant to plant was 50 cm and 40 cm.

3.7 Seedbed preparation

Seedbed was prepared on 10th May 2019 for raising seedlings of capsicum and the size of the seedbed was 3 m × 1 m. For making seedbed, the soil was well ploughed. Weeds, stubbles and dead roots were removed from the seedbed. Cow dung was applied to the prepared seedbed @ 10 ton/ha.

Plate I: Experimental Plot

Plate II: Sweet pepper Seedlings

3.8 Seed sowing

Seeds were sown on 22 June 2019 in the seedbed. Sowing was done in lines spaced at 5 cm distance. Seeds were sown at a depth of 2 cm and covered with a fine layer of soil followed by light watering by watering can. Thereafter, the beds were covered with polythene to maintain required temperature and moisture.

3.9 Raising of seedlings

Light watering and weeding were done several times as per needed. No chemical fertilizers were applied for raising of seedlings. Seedlings were not attacked by any kind of insect or disease. Healthy and 30 days old seedlings were transplanted into the experimental field on 29July 2019.

3.10 Preparation of the main field

The plot selected for conducting the experiment was opened in the first week of April 2019, with a power tiller and left exposed to the sun for a week to kill soil born pathogens and soil inhabitant insects. After one week the land was harrowed, ploughed and cross- ploughed several times followed by laddering to obtain until good tilth. The land was leveled, corners were shaped and the clods were broken into pieces. Weeds, crop residues and stables were removed from the field. The basal dose of manure and fertilizers were applied at the finally ploughing.

3.11 Application of manure and fertilizers

The fertilizers N, P, K and S in the form of urea were applied. Half of the quantities were applied in two equal installments at before flowering and fruit setting. Micronutrients were applied as per treatment.

3.12 Transplanting

Healthy and uniform 30 days old capsicum seedlings were transplanting in the experimental plots on 29 July, 2019. The seedlings were uprooted carefully from the seed bed to avoid damage to the root system. The seedlings were watered immediately after transplanting. Seedlings were sown in the plot with maintaining distance between row to row and plant to plant was 50 cm and 40 cm, respectively and total 12 plants were accommodated in each plot.

3.13 Intercultural operation

After raising seedlings, various intercultural operations, such as gap filling, weeding, earthing up, irrigation pest and disease control etc. were

accomplished for better growth and development of the capsicum seedlings.

3.13.1 Gap filling

The transplanted seedlings in the experimental plot were kept under careful observation. Very few seedlings were damaged after transplanting and such seedling were replaced by new seedlings from the same stock. Planted earlier on the border of the experimental plots same as planting time treatment. Those seedlings were transplanted with a big mass of soil with roots to minimize transplanting stock. Replacement was done with healthy seedling having a boll of earth. The transplants were given shading and watering for 7 days for their proper establishment.

3.13.2 Pruning of plants

Pruning operation was carried out at 20 days after transplanting (DAT). And 30 after transplanting (DAT) shoot pruning was done with remaining four shoot in a plant with a sharp knife and in case of no pruning it was allowed normal growth of a plant.

3.13.3 Collection and application of micronutrients

Micronutrients were applied as per treatment. For each treatment 100 ppm were sprayed on the foliage of the plants during vegetative stage, flower initiation stage and 2 times at blooming by a mini hand sprayer.

3.13.4 Weeding

The hand weeding was done 15, 30 and 45, 60 after transplanting to keep the plots free from weeds.

3.13.5 Earthing up

Earthing up was done at 20 and 40 days after transplanting on both sides of rows by taking the soil from the space between the rows by a small spade.

3.13.6 Irrigation

Light watering was given by a watering cane at every morning and afternoon. Following transplanting and it was continued for a week for rapid and well establishment of the transplanted seedlings.

3.13.7 Pest and disease control

Insect infestation was a serious problem during the period of

Plate III: Transplanting of Sweet pepper Seedlings

establishment of seeding in the field. In spite of Cirocarb 3G applications during final land preparation few young plants were damaged due to attack of mole cricket and cut worm. Cut worms were controlled both mechanically and spraying Darsban 29 EC @ 3%. Some of plants were infected by Alternaria leaf spot diseases caused by Alternaria brassicae. To prevent the spread of the disease Rovral @ 2 gm per liter of water was sprayed in the field. The diseased leaves were also collected from the infested plant and removed from the field.

3.14 Harvesting

Harvesting of fruits was started at 80 DAT and continued upto final harvest based on the marketable sized of fruits. Harvesting was done by hand picking.

3.15 Data collection

Three plants were randomly selected for data collection from the middle rows of each unit plot for avoiding border effect, except yields of fruits, which was recorded plot wise. Data were collected in respect of the following parameters to assess plant growth, yield attributes and yields.

3.15.1 Plant height

Plant height of bell pepper was measured from sample plants in centimeter from the ground level to the tip of the longest stem and mean value was calculated. Plant height was also recorded starting from 30 days after transplanting (DAT) upto 105 days at 15 days interval and at final harvest to observe the vegetative growth rate of plants.

3.15.2 Leaf area

Leaf area is measured by using planimeter this is the simplest tool that is used, but it is destructive. A leaf is plucked and its boundary traced.

3.15.3 Days from transplanting to 1st flowering

Difference between the dates of transplanting to the date of 1st flower emergence of a plot was counted and recorded.

3.15.4 Number of flowers/plant

The number of flowers per plant was counted from each plot after flowering and recorded per plant basis.

3.15.5 Diameter of fruit

The diameter of individual fruit was measured in several directions with meter scale and the average of all directions was finally recorded and expressed in centimeter (cm).

3.15.6 Length of fruit

The length of individual fruit was measured in one side to another side of fruit from five selected fruits with a meter scale and average of individual fruit length recorded and expressed in centimeter (cm).

3.15.7 Number of total fruits/plant

The number of total fruits per plant was counted after setting of fruits and recorded per plant basis.

3.15.8 Individual fruit weight

The weight of individual fruit was recorded in gram (g) by a beam balance from all fruits of selected three plants and converted individually.

3.15.9 Fruit setting (%)

Fruit setting was calculated by using the following formula and recorded -

$$\text{Fruit setting (\%)} = \frac{\text{Number of fruits per plant}}{\text{No. flowers per plant}} \times 100$$

3.15.10 Chlorophyll content in leaves

Chlorophyll extraction is carried out by using Arnon method.

3.15.11 Fruit yield/plot

Yield of bell pepper per plot was recorded as the whole fruit per plot and was expressed in kilogram.

3.15.12 Fruit yield/hectare (ton)

Yield per hectare of bell pepper was calculated by converting the weight of plot yield into hectare and was expressed in ton.

3.15.13 Vitamin C (mg/100 ml fresh fruit)

Vitamin C is carried out by titration method.

Results and Discussion

CHAPTER - IV

RESULTS AND DISCUSSION

The present experiment entitled "Response of pruning and application of micronutrient on growth and yield of sweet pepper (*Capsicum annuum*) Cv. Raja" was conducted at Department of Horticulture, VNMKV Parbhani during the year 2019 – 2020. The result obtained during the experiment was recorded analyzed and discussed with available literature in this chapter under appropriate heading and sub heading.

4.1 Plant growth parameters

4.1.1 Plant height (cm)

4.1.1.1 Plant height at 30 DAT

Effect of micronutrients, pruning and their interaction on plant height at 30 DAT presented in table 2 and graphically depicted in fig. 1

Effect of micronutrients (M)

Plant height (cm) as influenced by micronutrients was found to be differ significant. The data shown that maximum plant height (31.52 cm) was found in treatment M_1 (Chelated Zn 0.2%) which was at par with treatment M_2 (Chelated Fe 0.2%) and minimum plant height (27.02 cm) in treatment M_4 (Chelated Cu 0.1%).

Application of zinc, boron, and micronutrient mixture has been reported to be increasing the plant height of tomato. Increase in plant height might be attributed to the role of zinc in auxin synthesis and association of boron with development of cell wall and cell differentiation which helps in root and shoot growth of plants. The similar result was also notified by Purna Datta Reddy, G. (2018) in tomato.

Effect of pruning (P)

Effect of pruning on plant height (cm) was found non-significant.

Interaction of micronutrients and pruning (M X P)

The interaction effect of micronutrients and pruning on plant height (cm) at 30 DAT was found non-significant.

4.1.1.2 Plant height at 60 DAT

Effect of micronutrients, pruning and their interaction on plant height at 60 DAT presented in table 2 and graphically depicted in fig. 1

Effect of micronutrients (M)

Plant height (cm) as influenced by micronutrients was found to be differ significant. The data shown that highest plant height (64.02 cm) was found in treatment M_1 (Chelated Zn 0.2%) which was at par with treatment M_2 (Chelated Fe 0.2%) and lowest plant (51.54 cm) in treatment M_6 (Chelated Mix 0.2%).

Increase in plant height and branches per plant may be due to the involvement of zinc in chlorophyll formation, which might have helped to influence cell division, meristematic activity in apical tissue, expansion of cell and formation of cell wall, development and differentiation of vascular tissue formation and lignification of cell wall, protein synthesis, organic acid metabolism and they are involved in photosynthesis. Above finding supported by Natesh *et.al* (2005) in chilli.

Effect of pruning (P)

Effect of pruning on plant height (cm) was found non-significant.

Interaction of micronutrients and pruning (M X P)

The interaction effect of micronutrients and pruning on plant height (cm) at 90 DAT was non-significant.

4.1.1.3 Plant height at 90 DAT

Effect of micronutrients, pruning and their interaction on plant height presented in table 2 and graphically depicted in fig. 1

Effect of micronutrient (M)

Plant height (cm) as influenced by micronutrients was found to be differ significant. The data shown that increase in plant height (124.76 cm) was found in treatment M_1 (Chelated Zn 0.2%) which was at par with treatment M_2 (Chelated Fe 0.2%) and decrease in plant height (103.36 cm) in treatment M_6 (Chelated mix 0.2%).

The increase in plant height under zinc sulfate might be due to the fact that zinc in addition to its role in chlorophyll synthesis it also influenced the cell division, meristamatic activity of tissue, expansion of cell and formation of cell. Foliar application of zinc increased the photosynthetic activity, which ultimately resulted in improving the plant growth. Similar result were obtained by Pandav, A.K *et al,* (2016) in binjal.

Effect of pruning (P)

Effect of pruning on plant height (cm) at 90 DAT was non-significant.

Table 2 Effect of application of micronutrient, response of pruning and their interaction on plant height of sweet pepper (*Capsicum annuum*) cv. Raja

Treatment		Plant height (Cm)	
Factor A (Micronutrient)	**30 DAT**	**60 DAT**	**90 DAT**
M1	31.52	64.02	124.76
M2	28.67	57.87	116.30
M3	29.18	59.54	118.16
M4	27.02	54.72	109.88
M5	29.68	59.72	119.70
M6	25.52	51.54	103.36
SE+_	**0.99**	**1.98**	**3.75**
CD at 5 % level	**2.92**	**5.48**	**11.07**
Factor – B (Pruning)			
P1	27.85	56.49	113.37
P2	29.34	59.31	117.34
SE+_	**0.57**	**1.14**	**2.16**
CD at 5% level	**NS**	**NS**	**NS**
Interaction (M X P)			
M1P1	29.68	60.03	118.86
M1P2	33.52	68.00	130.66
M2P1	29.01	58.36	117.13
M2P2	28.33	57.87	115.46
M3P1	27.69	56.39	113.86
M3P2	30.67	62.70	112.46
M4P1	26.01	52.72	106.29
M4P2	28.02	56.71	113.46
M5P1	29.01	58.40	117.93
M5P2	30.35	61.04	121.46
M6P1	25.70	53.02	106.16
M6P2	25.34	50.06	100.56
SE+_	**1.40**	**2.80**	**5.30**
CD at 5 % level	**NS**	**NS**	**NS**
Treatment details			
M1- Chelated Zn (0.2%)		M5- Chelated Mn (0.2%)	
M2 – Chelated Fe (0.2 %)		M6 - Chelated Mix (0.2%)	
M3 – Chelated Bo (0.1%)		P1 – Pruning (20 DAT)	
M4 – Chelated Cu (0.1%)		P2 – Pruning (30 DAT)	

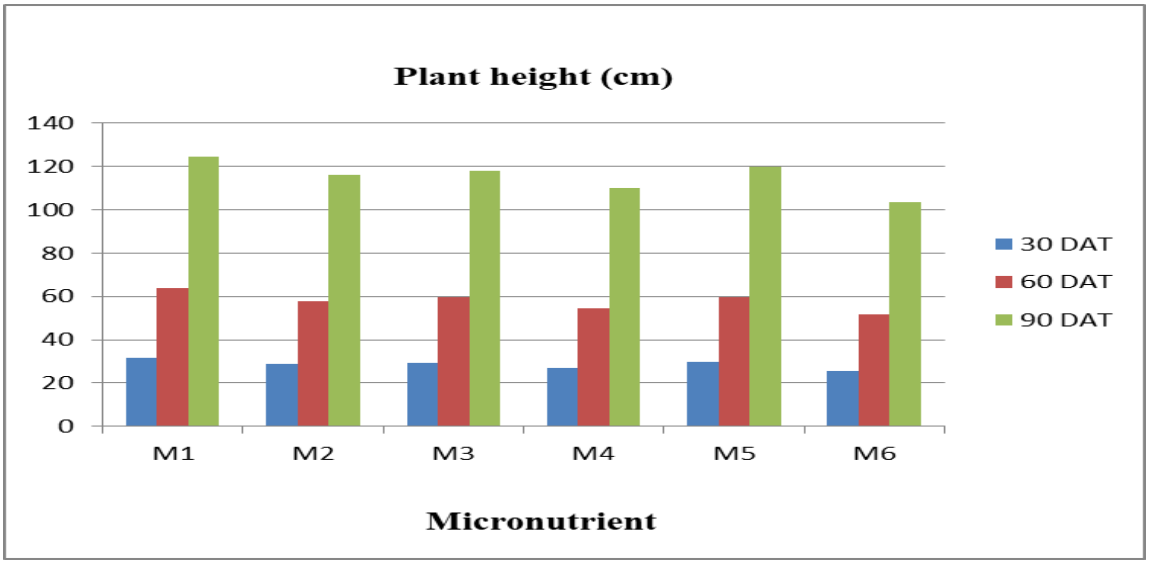

Fig. 1 Effect of micronutrient on plant height in sweet pepper Cv. Raja.

Interaction of micronutrients and pruning (M X P)

The interaction effect of micronutrients and pruning on plant height (cm) was found non-significant.

4.1.2. Leaf area (cm^2)

Effect of micronutrients, pruning and their interaction on leaf area presented in table 3 and graphically depicted in fig. 2 & 3.

Effect of micronutrients (M)

Leaf area (cm^2) as influenced by micronutrients was found to be differ significant. The data shown that highest leaf area (96.01 cm^2) was found in treatment M_2 (Chelated Fe 0.2%) which was at par with treatment M_3 (Chelated Bo 0.1%) and lowest leaf area (59.43 cm^2) in treatment M_6 (Chelated mix 0.2%).

Leaf area is an important variable for most physiological and agronomic studies involving plant growth, light interception, photosynthetic efficiency, evapotranspiration and response to fertilizers and irrigation. This significant increase may be due to dynamics of uptake of soil nutrients and soil physical conditions and have a major effect on plant growth and essential role of boron in the growth and development. These results were in conformation with the Singh, Madhu. *et al,* (2017) in capsicum.

Effect of pruning (P)

Effect of pruning on leaf area (cm^2) was found significant. The highest leaf area (85.85 cm^2) was found in treatment P_2 (30 DAT) and lowest (75.75 cm^2) in treatment P_1 (20 DAT).

The effect of interaction of different pruning configuration systems and bell pepper cultivars had been significant on leaf area. The plants trained to two shoot (180.90 cm2) produced substantially larger leaf area as compared to other treatment combinations. This may be due to development and differentiation of vascular tissue formation and lightificatin of cell wall, protein synthesis, organic acid metabolism and they are involved in photosynthesis .Above finding were confirmed by Ismeet Singh *et al,* (2018) in capsicum and Natesh, N. *et al,* (2005) in chilli.

Table 3 Effect of application of micronutrient, response of pruning and their interaction on leaf area and chlorophyll content of sweet pepper (*Capsicum annuum*) cv. Raja

Treatment	Leaf area	Chlorophyll content
Factor A (Micronutrient)		
M1	95.15	58.37
M2	96.01	62.10
M3	90.55	62.49
M4	70.07	63.14
M5	73.56	62.05
M6	59.43	63.52
SE+_	**0.16**	**1.11**
CD at 5 % level	**0.49**	**3.28**
Factor – B (Pruning)		
P1	75.75	62.16
P2	85.85	61.73
SE+_	**0.09**	**0.64**
CD at 5% level	**0.28**	**NS**
Interaction (M X P)		
M1P1	91.94	58.30
M1P2	98.37	58.44
M2P1	84.51	63.01
M2P2	107.52	61.20
M3P1	81.01	62.98
M3P2	100.10	62.00
M4P1	58.14	62.64
M4P2	82.01	63.64
M5P1	75.70	62.57
M5P2	71.42	61.52
M6P1	63.18	63.44
M6P2	55.68	63.60
SE+_	**0.23**	**1.57**
CD at 5 % level	**0.70**	**NS**

Treatment details	
M1- Chelated Zn (0.2%)	M5- Chelated Mn (0.2%)
M2 – Chelated Fe (0.2 %)	M6- Chelated Mix (0.2%)
M3 – Chelated Bo (0.1%)	P1- Pruning (20 DAT)
M4 – Chelated Cu (0.1%)	P2 – Pruning (30 DAT)

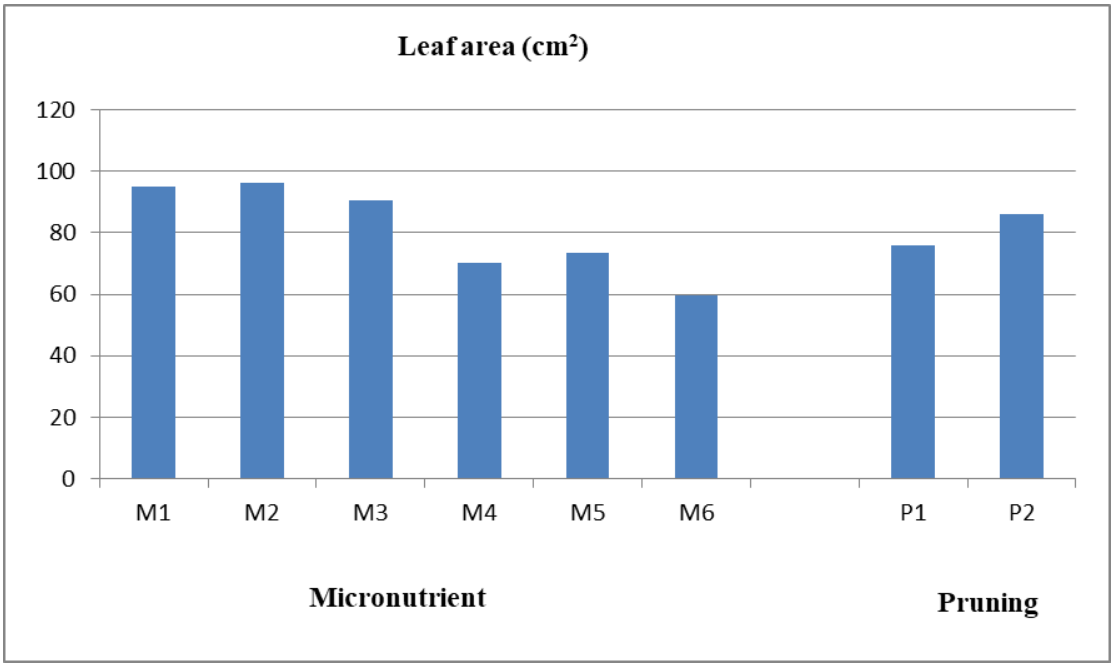

Fig. 2 Effect of micronutrient and pruning on leaf area in sweet pepper Cv. Raja.

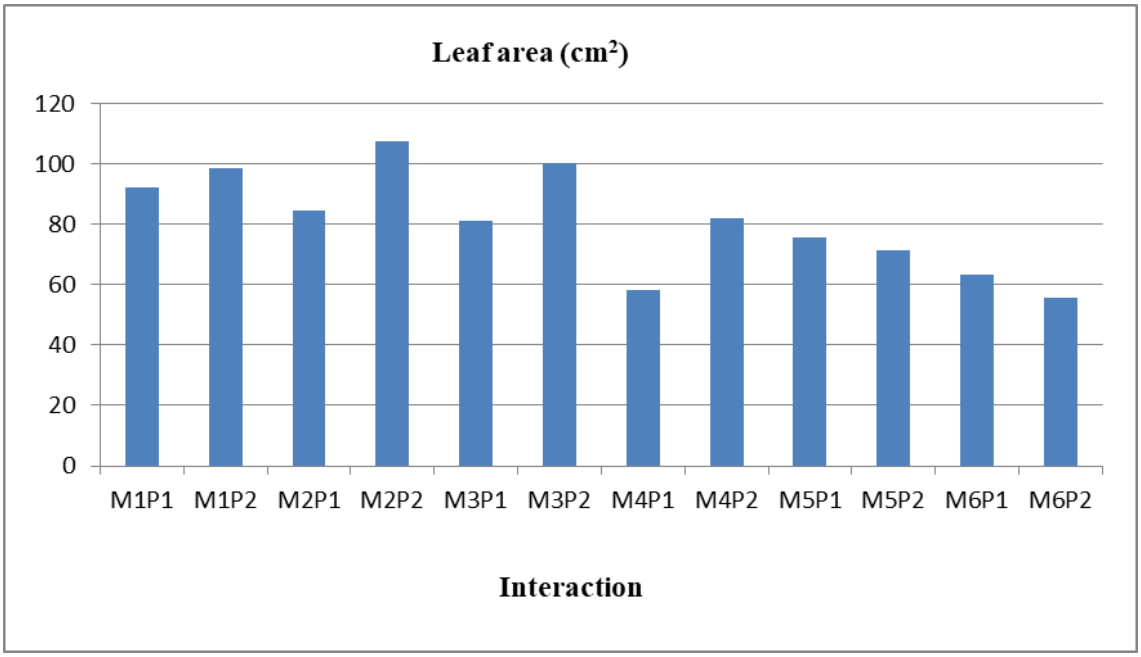

Fig. 3 Interaction effect of micronutrient and pruning on leaf area in sweet pepper Cv. Raja.

Interaction of micronutrients and pruning (M X P)

The interaction effect of micronutrients and pruning on leaf area (cm^2) was found significant. The data show that highest leaf area (107.52 cm^2) recorded in treatment M_2P_2 which was followed by treatment M_1P_1 and M_1P_2 however lowest leaf area (55.68 cm^2) recorded in treatment M_6P_2. Similar result was also found by Ismeet, Singh *et.al* (2018) in capsicum.

4.2 Flower attributes

4.2.1 Minimum1stday flowering

Effect of micronutrients, pruning and their interaction on days to 1st flowering in table 4and graphically depicted in fig. 4 & 5.

Effect of micronutrients (M)

Days to 1st flowering as influenced by micronutrients was found to be differ significant. The data shown that increase in day to 1st flowering (57.14) was found in treatment M_2 (Chelated Fe 0.2%) which was at par with treatment M_3 (Chelated Bo 0.1%) and decrease in days to 1st flowering (53.15) in treatment M_5 (Chelated Mn0.2%).

The possible reason might be due to the fact that micronutrient is an essential element found in the meristematic regions of plants such as root tips, emerging leaves and buds. Flowering of the plant is the reproductive phase of the plant life. Health of plant is affected by the availability of nutrients to the plant. Similar result was also notified by Kumari *et al*, (2017) in capsicum.

Effect of pruning (P)

Effect of pruning on days to 1st flowering was found significant. The increase in days to 1st flowering (59.93) was found in treatment P_1 (20 DAT) and decrease (57.04) in treatment P_2 (30 DAT).

Interaction of micronutrients and pruning (M X P)

The interaction effect of micronutrients and pruning on days to 1st flowering was found significant. The data show that increase in days to 1st flowering (60.05) recorded in treatment M_1P_1 which was followed by treatment M_2P_1 and M_2P_2 however decrease in days to 1st flowering (48.69) recorded in M1P1

Table 4 Effect of application of micronutrient, response of pruning and their interaction on days to 1st flowering and fruit setting of sweet pepper (Capsicum annuum) cv. Raja.

Treatment	Days to 1st flowering	Fruit setting
Factor A (Micronutrient)		
M1	54.37	60.37
M2	57.14	58.78
M3	55.98	58.29
M4	54.95	58.15
M5	53.15	59.86
M6	54.32	59.27
SE+_	**0.01**	**0.307**
CD at 5 % level	**0.04**	**0.907**
Factor – B (Pruning)		
P1	59.93	58.15
Days	57.04	60.09
SE+_	**0.008**	**0.17**
CD at 5% level	**0.24**	**0.52**
Interaction (M X P)		
M1P1	48.69	58.03
M1P2	60.05	62.71
M2P1	54.65	58.68
M2P2	59.63	58.88
M3P1	56.32	58.38
M3P2	55.63	58.20
M4P1	55.30	57.52
M4P2	54.60	58.79
M5P1	51.28	58.57
M5P2	55.03	61.15
M6P1	51.34	57.72
M6P2	57.29	60.82
SE+_	**0.02**	**0.435**
CD at 5 % level	**0.05**	**1.283**

Treatment details	
M1- Chelated Zn (0.2%)	M5- Chelated Mn(0.2%)
M2 – Chelated Fe (0.2 %)	M6- Chelated Mix (0.2%)
M3 – Chelated Bo (0.1%)	P1- Pruning (20 DAT)
M4 – Chelated Cu (0.1%)	P2- Pruning (30 DAT)

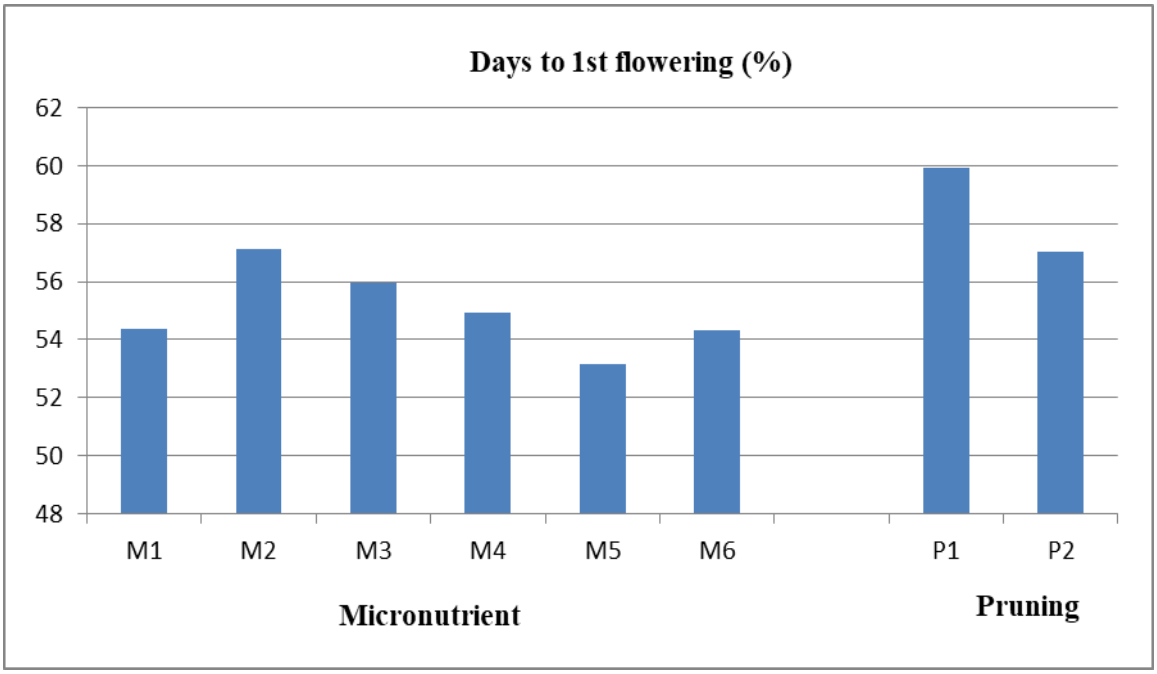

Fig. 4 Effect of micronutrient and pruning on days to 1st flowering in sweet pepper Cv. Raja.

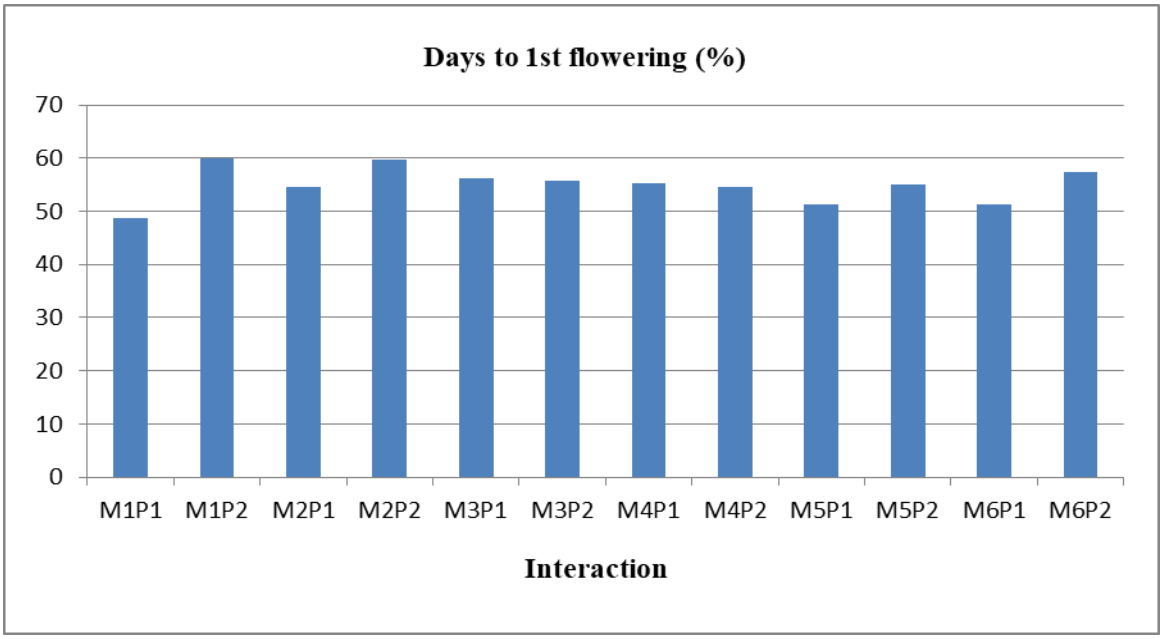

Fig. 5 Interaction effect of micronutrient and pruning on days to 1st flowering in sweet pepper Cv. Raja

4.2.2 Number of flower

Effect of micronutrients, pruning and their interaction on number of flower presented in Table 5 and graphically depicted in fig.6 & 7.

Effect of micronutrients (M)

Number of flower as influenced by micronutrients was found to be differ significant. The data shown that maximum number of flower (63.48) was found in treatment M_1 (Chelated Zn 0.2%) which was at par with treatment M_2 (Chelated Fe 0.2%) and minimum number of flower (18.71) in treatment M_5 (Chelated Mn0.2%). Same result found by Patil V. K. *et.al* (2010) in tomato.

Effect of pruning (P)

Effect of pruning on number of flower was found significant. The maximum number of flower (63.39) was found in treatment P_2 (30 DAT) and minimum (61.77) in treatment P_1 (20 DAT).

Number of flowers and fruits were affected by pruning and. This may be due to fact that cultivars used varied in their genetic make-up. Temperature variation during the experiment could have also affected the number of flowers and fruits a plant can produce. Temperature could have caused flower and fruit abortion during data collection. Above findings were confirmed by Sowley, E. N.*et.al*.(2013) in tomato.

Interaction of micronutrients and pruning (M X P)

The interaction effect of micronutrients and pruning on number of flower. The data show that maximum number of flower (65.03) recorded in treatment M_1P_2 which was followed by treatment M_2P_1 and M_2P_2 however minimum number of flower (60.94) recorded in M_4P_1.

Table 5 Effect of application of micronutrient, response of pruning and their interaction on number of flower and number of fruit of sweet pepper (*Capsicum annuum*) cv. Raja

Treatment	Number of flower	Number of fruit
Factor A (Micronutrient)		
M1	63.48	38.36
M2	62.29	36.62
M3	61.85	36.06
M4	61.97	36.05
M5	62.81	37.51
M6	63.06	37.40
SE+_	**0.26**	**0.26**
CD at 5 % level	**0.77**	**0.78**
Factor – B (Pruning)		
P1	61.77	35.89
P2	63.39	38.11
SE+_	**0.15**	**0.15**
CD at 5% level	**0.44**	**0.45**
Interaction (M X P)		
M1P1	61.93	35.95
M1P2	65.03	40.77
M2P1	62.00	36.39
M2P2	62.58	36.85
M3P1	61.70	36.03
M3P2	62.00	36.09
M4P1	60.94	35.06
M4P2	63.00	37.05
M5P1	61.90	36.05
M5P2	63.73	38.97
M6P1	62.14	35.87
M6P2	63.99	38.93
SE+_	**0.37**	**0.37**
CD at 5 % level	**1.09**	**1.11**
	Treatment details	
M1- Chelated Zn (0.2%)	M5- Chelated Mn (0.2%)	
M2 – Chelated Fe (0.2 %)	M6- Chelated Mix (0.2%)	
M3 – Chelated Bo (0.1%)	P1- Pruning (20 DAT)	
M4 – Chelated Cu (0.1%)	P2- Pruning (30 DAT)	

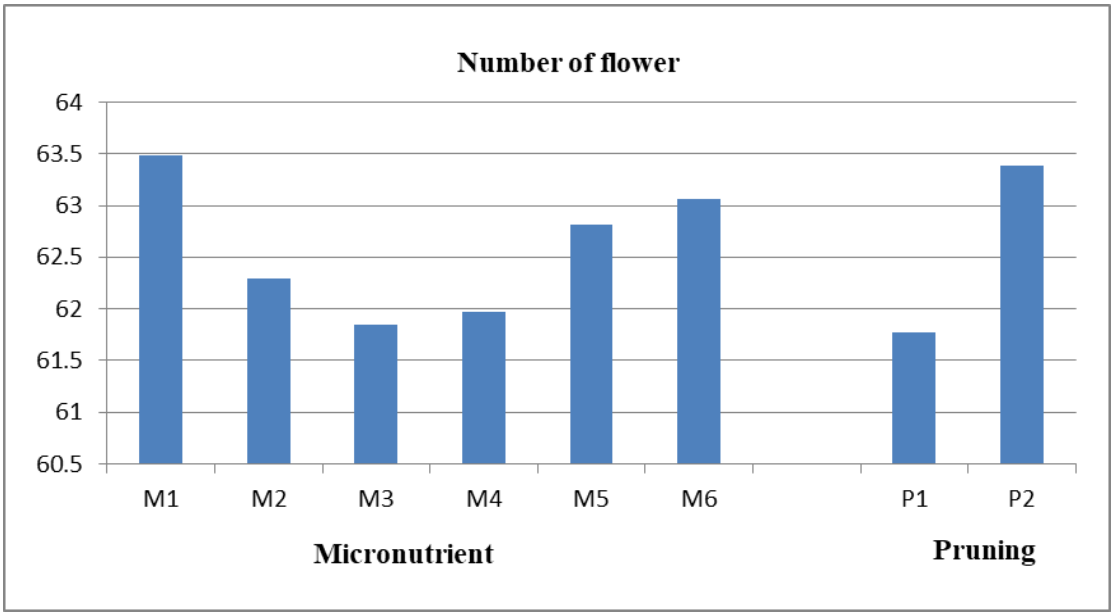

Fig. 6 Effect of micronutrient and pruning on number of flower in sweet pepper Cv. Raja.

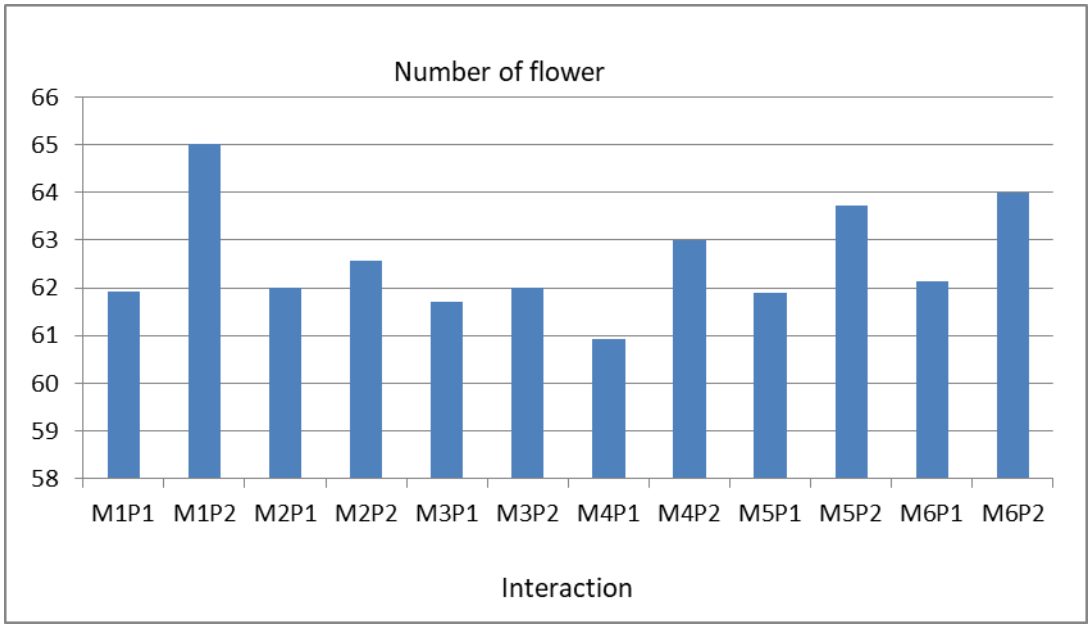

Fig. 7 Interaction effect of micronutrient and pruning on number of flower in sweet pepper Cv. Raja.

4.3 Fruit attributes

4.3.1 Diameter of fruit

Effect of micronutrients, pruning and their interaction on diameter of fruit presented in Table 6 and graphically depicted in fig. 8 & 9.

Effect of micronutrients (M)

Diameter of fruit (cm) as influenced by micronutrients was found to be differ significant. The data shown that highest diameter of fruit (7.65 cm) was found in treatment M_1 (Chelated Zn 0.2%) which was at par with treatment M_2 (Chelated Fe 0.2%) and lowest diameter of fruit (6.59 cm) in treatment M_5 (Chelated Mn 0.2%).

Maximum fruits diameter was might be due to zinc and boron as these act as catalyst in the oxidation and reduction process and in sugar metabolism which might have increased fruit diameter. The present finding was in accordance with the result of Singh, Madhu. *et al,* (2017) in capsicum

Effect of pruning (P)

Effect of pruning on diameter of fruit (cm) was found significant. The highest diameter of fruit (7.29 cm) was found in treatment P_2 (30 DAT) and lowest (6.66 cm) in treatment P_1 (20 DAT).

The results indicated that, the pruning treatments have a positive effect in average fruit weight, size and diameter. The best results were obtained when the plants trained to the lowest shoots, while the plants grown without pruning gave the lowest results. On the other side fruit. The increment of average fruit weight, size, and diameter according to pruning treatments than the control may be due to that the control treatment produced much number of shoots as it utilizes nutrients absorption from the plants, and slow down nutrient uptake by shoot growth causing less in fruit weight, diameter and size. On the other side, since vegetative growth, as a powerful sink, consumes produced assimilates, limitation of vegetative growth enhances assimilate transport to roots or fruits. Thus, proper balance between vegetative and reproductive growth could improve fruit quantity. Above findings were confirmed by Goda, Y (2014) in tomato.

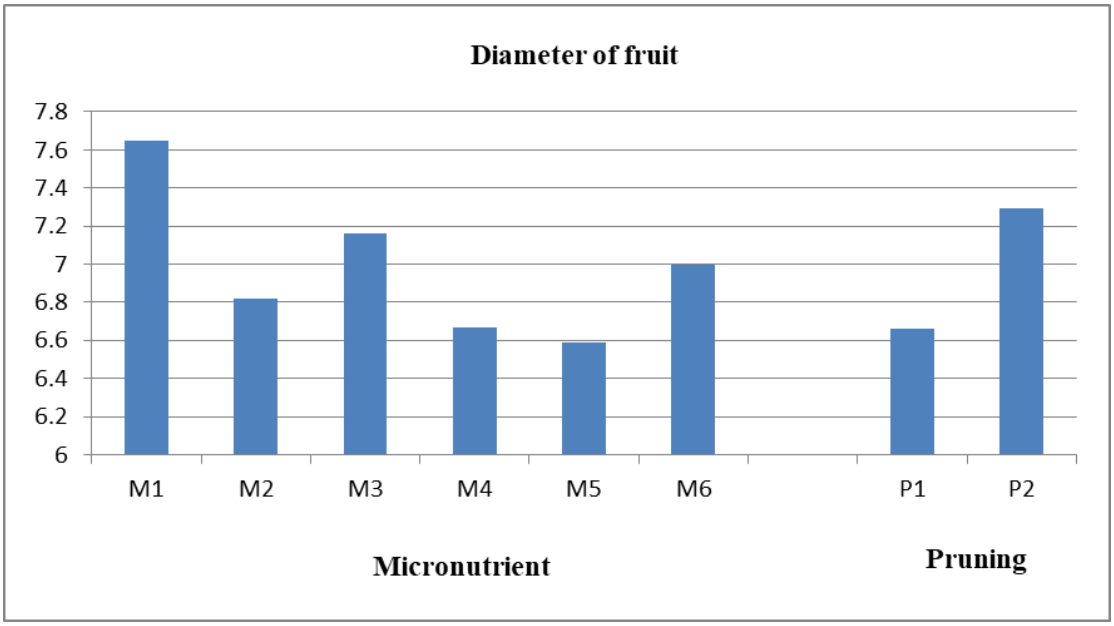

Fig. 8 Effect of micronutrient and pruning on diameter of fruit in sweet pepper Cv. Raja.

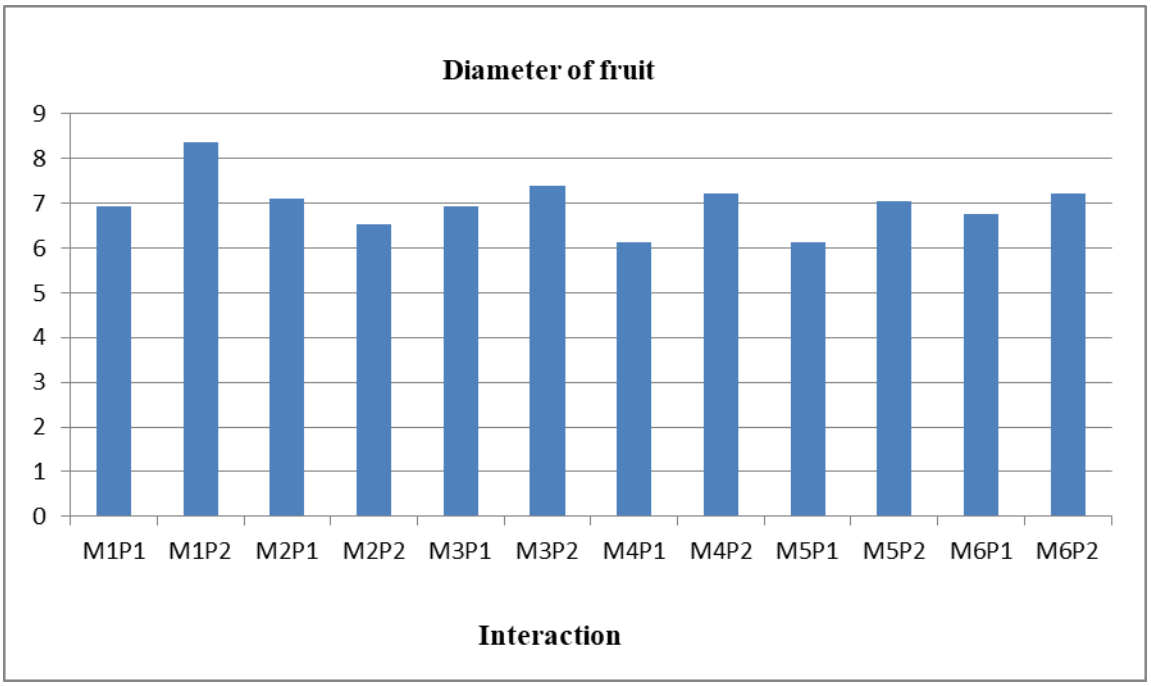

Fig. 9 Interaction effect of micronutrient and pruning on diameter of fruit in sweet pepper Cv. Raja.

Interaction of micronutrients and pruning (M x P)

The interaction effect of micronutrients and pruning on diameter of fruit (cm) was found significant. The data show that highest diameter of fruit (6.93 cm) recorded in treatment M_1P_2 which was followed by treatment M_2P_1 and M_2P_2 however lowest diameter of fruit (6.93 cm) recorded in treatment M_1P_1.Similar result were obtained by Madhu, Singh*et.al* (2017) in capsicum.

4.3.2 Length of fruit

Effect of micronutrients, pruning and their interaction on length of fruit presented in Table 6 and graphically depicted in fig. 10 & 11.

Effect of micronutrients (M)

Length of fruit (cm) as influenced by micronutrients was found to be differ significant. The data shown that increase in length of fruit (11.65 cm) was found in treatment M_1 (Chelated Zn 0.2%) which was at par with treatment M_3 (Chelated Bo 0.1 %) and decrease length of fruit (10.59 cm) in treatment M5 (Chelated Mn 0.2%).

Maximum fruit length might be due to involvement of zinc micro nutrients in cell division and cell expansion, involvement of boron on synthesis of metabolites and rapid translocation of photosynthetic and mineral iron from other parts of the plant to developing fruit The similar result was also reported by Singh, *et al*, (2017) in capsicum.

Effect of pruning (P)

Effect of pruning on length of fruit (cm) was found significant. The increase length of fruit (11.29 cm) was found in treatment P_2 (30 DAT) and decrease (10.66 cm) in treatment P_1 (20 DAT).

When pepper plants pruned it was found that early yield as well as 1st harvest period longer significantly. Fruit length was greatest in plants which had one stem. Pepper plants pruned to one branch resulted in a significant increase in fruit size. The above findings are in accordance with the result of Sadia, *et al*, (2017) in bell pepper.

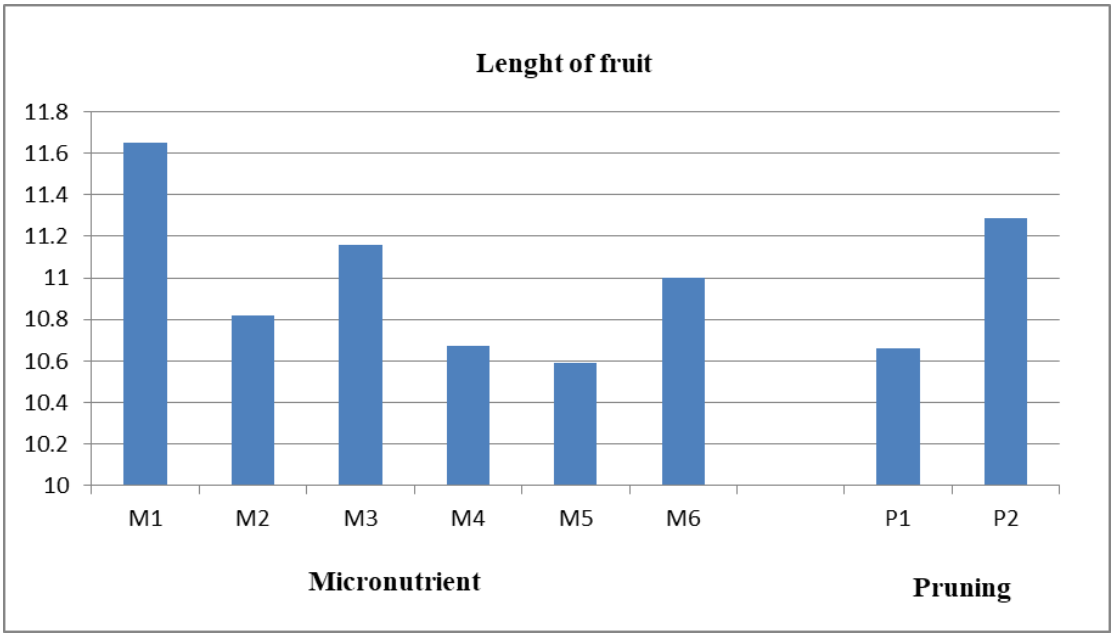

Fig. 10 Effect of micronutrient and pruning on length of fruit in sweet pepper Cv. Raja.

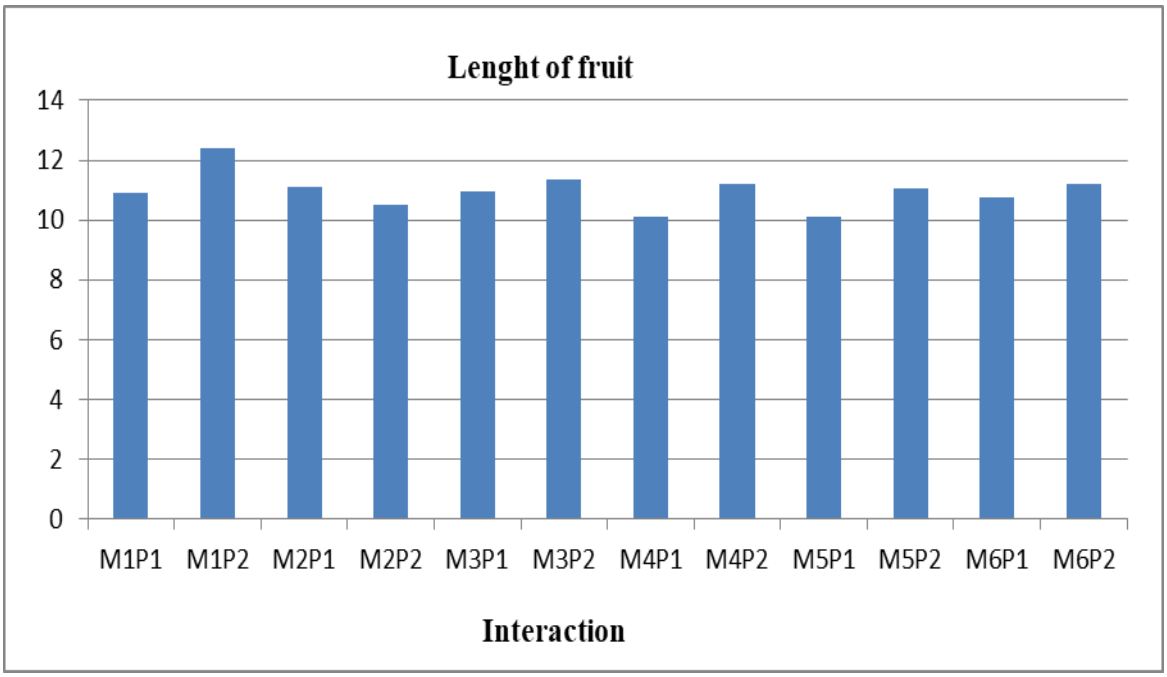

Fig. 11 Interaction effect of micronutrient and pruning on length of fruit in sweet pepper Cv. Raja.

Table 6 Effect of application of micronutrient, response of pruning and their interaction on diameter of fruit, weight of fruit and length of fruit of sweet pepper (Capsicum annuum) cv. Raja.

Treatment	Diameter of fruit	Weight of fruit	Length of fruit
Factor A (Micronutrient)			
M1	7.65	119.86	11.65
M2	6.82	118.62	10.82
M3	7.16	118.06	11.16
M4	6.67	118.05	10.67
M5	6.59	118.91	10.59
M6	7.00	118.90	11.00
SE+_	**0.21**	**0.27**	**0.21**
CD at 5 % level	**0.63**	**0.81**	**0.63**
Factor – B (Pruning)			
P1	6.66	117.89	10.66
P2	7.29	119.58	11.29
SE+_	**0.12**	**0.15**	**0.12**
CD at 5% level	**0.36**	**0.47**	**0.36**
Interaction (M X P)			
M1P1	6.93	117.95	10.93
M1P2	8.38	121.77	12.38
M2P1	7.12	118.39	11.12
M2P2	6.52	118.85	10.52
M3P1	6.94	118.03	10.94
M3P2	7.38	118.09	11.38
M4P1	6.12	117.06	10.12
M4P2	7.22	119.05	11.22
M5P1	6.12	118.05	10.12
M5P2	7.06	119.77	11.06
M6P1	6.76	117.87	10.76
M6P2	7.23	119.93	11.23
SE+_	**0.30**	**0.39**	**0.30**
CD at 5 % level	**0.89**	**1.15**	**0.89**

Treatment details	
M1- Chelated Zn (0.2%)	M5- Chelated Mn(0.2%)
M2 – Chelated Fe (0.2 %)	M6- Chelated Mix (0.2%)
M3 – Chelated Bo (0.1%)	P1- Pruning (20 DAT)
M4 – Chelated Cu (0.1%)	P2- Pruning (30 DAT)

.

Interaction of micronutrients and pruning (M x P)

The interaction effect of micronutrients and pruning on length of fruit (cm) was found significant. The data show that increase in length of fruit (12.38cm) recorded in treatment M_1P_2 which was followed by treatments M_2P_1 and M_2P_2 however decrease length of fruit (10.93 cm) recorded in treatment M_1P_1.

Similar result was obtained by Sadia. *et.al,* (2017) in bell pepper found foliar application of mixed micronutrients @ 100 ppm each (B, Zn, Cu and Mn as H3BO3, ZnSO4, CuSO4 and MnSO4) was recorded best. It was also noted that the treatment combination, shoot pruning plus mixed micronutrients @ 100 ppm each: B, Zn, Cu and Mn showed best potentiality on the growth and yield of capsicum.

4.3.3 Number of fruit per plant

Effect of micronutrients, pruning and their interaction on number of fruit per plant presented in Table 5 and graphically in fig. 12 & 13.

Effect of micronutrients (M)

Number of fruit per plant as influenced by micronutrients was found to be differ significant. The data shown that maximum number of fruit per plant (38.36) was found in treatment M_1 (Chelated Zn 0.2%) which was at par with treatment M_2 (Chelated Fe 0.2%) and minimum number of fruit per plant (36.05) in treatment M_4 (Chelated Cu 0.1%).

Increased number of fruits due to foliar spray of micronutrients might be attributed to enhanced photosynthetic activity, resulting in increased production and accumulation of carbohydrates and favorable effect on vegetative growth and retention of flowers and fruits, which might have increased number and weight of fruits. Increased number of fruits in response to micronutrients (B, Zn and mixture). Above finding were confirmed by Pandav, A.K. *et al,* (2016) in brinjal.

Effect of pruning (P)

Effect of pruning on number of fruit per plant was found significant. The maximum number of fruit per plant (38.11) was found in treatment P_2 (30 DAT) and minimum (35.89) in treatment P_1 (20 DAT).

pruning treatments than the control may be due to that the control

treatment produced much number of shoots as it utilizes nutrients absorption from the plants, and slow down nutrient uptake by shoot growth causing less in fruit weight, diameter and size. On the other side, since vegetative growth, as a powerful sink, consumes produced assimilates, limitation of vegetative growth enhances assimilate transport to roots or fruits. Similar result was obtained by Goda. Y et.al (2014) in tomato.

Interaction of micronutrients and pruning (M x P)

The interaction effect of micronutrients and pruning on number of fruit per plant was found significant. The data show that maximum number of fruit per plant (40.77) recorded in treatment M_1P_2 which was followed by treatment M_2P_1 and M_2P_2 however minimum number of fruit per plant (35.87) recorded in treatment M_6P_1.

Zinc and Boron treatments. Increases in the number of mature fruits per plant in tomato. The increase in number of fruit per plant might be due to better mineral utilization of plants accompanied with enhancement of photosynthesis, other metabolic activity and greater diversion of food material to fruits. Similar result were obtained by Purna Datta Reddy, G.(2018) in tomato.

4.3.4 Fruit weight

Effect of micronutrients, pruning and their interaction on weight of fruit presented in Table 6 and graphically depicted in fig. 14 & 15.

Effect of micronutrients (M)

Weight of fruit (g) as influenced by micronutrients was found to be differ significant. The data shown that highest weight of fruit (119.86 g) was found in treatment M_1 (Chelated Zn 0.2%) which was at par with treatment M_2 (Chelated Fe 0.2%) and lowest fruit weight (118.05) in treatment M_4 (Chelated Cu 0.1%).

The average value for the trait was the maximum under zinc spray. Average fruit weight also exhibited the beneficial effect of micronutrient spray over control. Improvement in the fruit weight and size due to spray of micronutrients may be attributed to the role of these elements in the plant nitrogen metabolism, carbohydrate metabolism and translocation of photosynthates. The similar result was also notified by Agarwal *et al*, (2018) in capsicum.

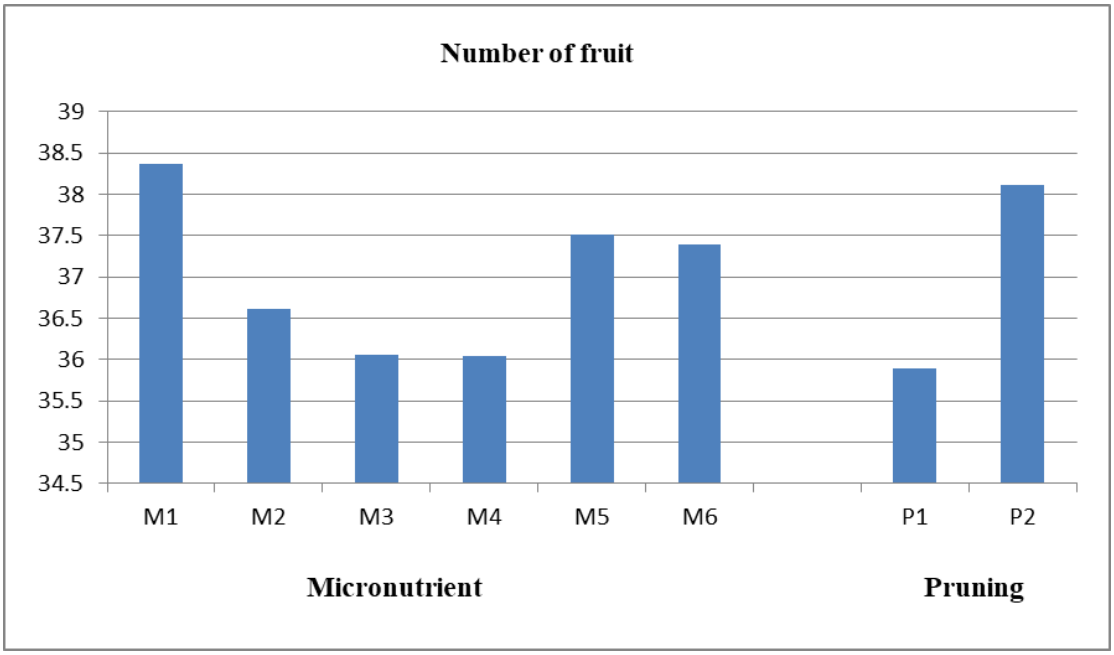

Fig. 12 Effect of micronutrient and pruning on number of fruit in sweet pepper Cv. Raja.

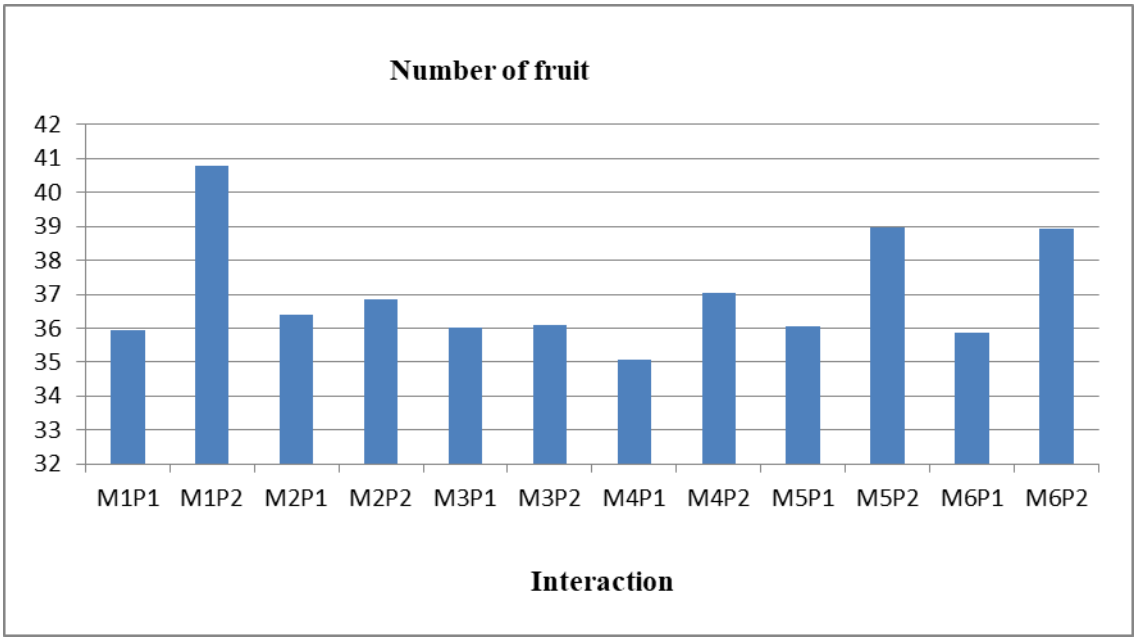

Fig. 13 Interaction effect of micronutrient and pruning on number of fruit in sweet pepper Cv. Raja.

Effect of pruning

Effect of pruning on weight of fruit (g) was found significant. The highest weight of fruit (119.58 g) was found in treatment P_2 (30 DAT) and lowest (117.89 g) in treatment P_1 (20 DAT).

The results indicated that, the pruning treatments have a positive effect in average fruit weight, size and diameter. The best results were obtained when the plants trained to the lowest shoots, while the plants grown without pruning gave the lowest results. On the other side fruit the increment of average fruit weight, size, and diameter according to pruning treatments than the control may be due to that the control treatment produced much number of shoots as it utilizes nutrients absorption from the plants, and slow down nutrient uptake by shoot growth causing less in fruit weight, diameter and size. On the other side, since vegetative growth, as a powerful sink, consumes produced assimilates, limitation of vegetative growth enhances assimilate transport to roots or fruits. Thus, proper balance between vegetative and reproductive growth could improve fruit quantity. Above findings were confirmed by Goda, Y (2014) in tomato.

Interaction of micronutrients and pruning (M x P)

The interaction effect of micronutrients and pruning on weight of fruit (g) was found significant. The data show that highest weight of fruit (121.77 g) recorded in treatment M_1P_2 which was followed by treatments M_2P_1 and M_2P_2 however lowest weight of fruit (117.06 g) recorded in treatment M_4P_1.

4.3.5 Fruit setting

Effect of micronutrients, pruning and their interaction on fruit setting presented in Table 4 and graphically depicted in fig. 16 & 17.

Effect of micronutrients (M)

Fruit setting (%) as influenced by micronutrients was found to be differ significant. The data shown that increase in fruit setting (60.37%) was found in treatment M_1 (Chelated Zn 0.2%) which was at par with treatment M_5 (Chelated Mn 0.2%) and decrease in fruit setting (58.15 %) in treatment M_4.

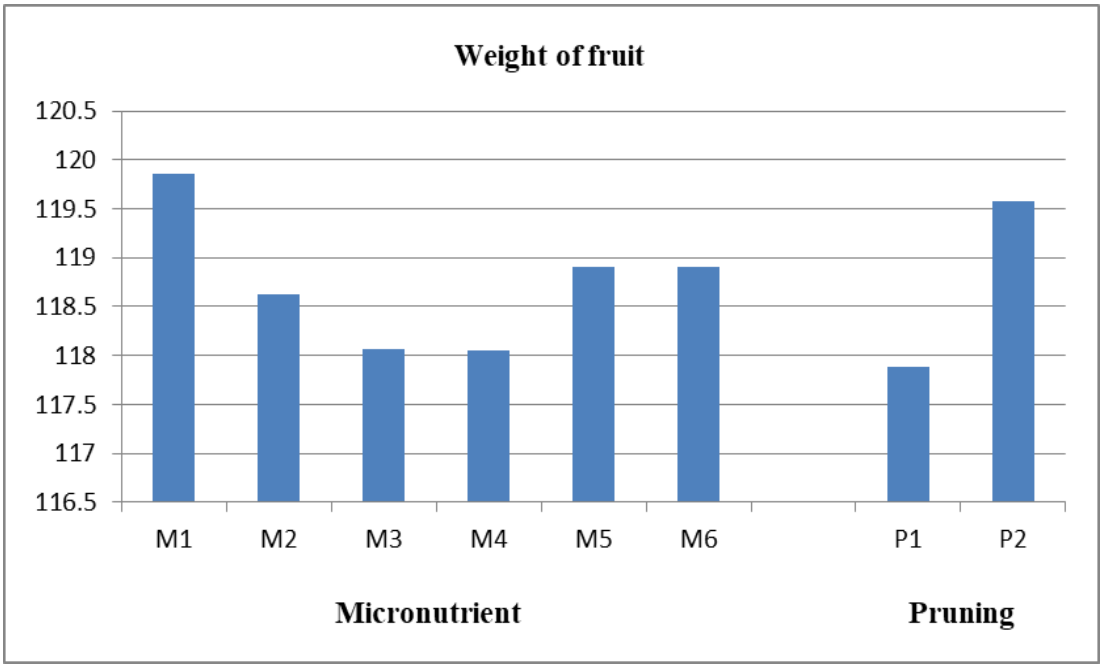

Fig. 14 Effect of micronutrient and pruning on fruit weight in sweet pepper Cv. Raja.

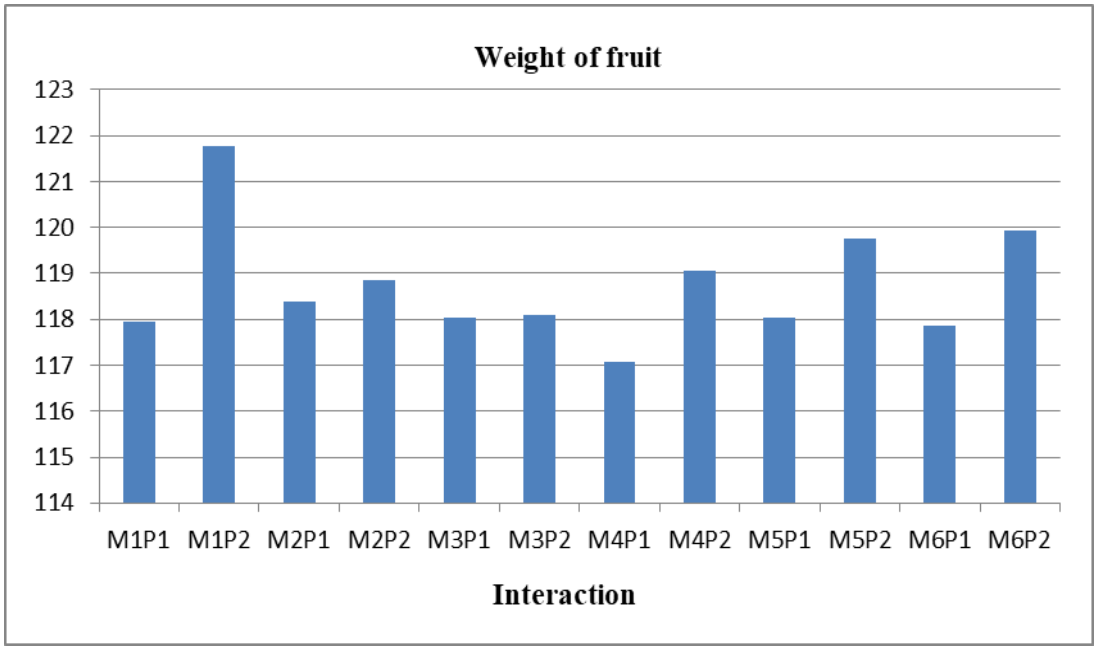

Fig. 15 Interaction effect of micronutrient and pruning on weight of fruit in sweet pepper Cv. Raja.

Maximum number of fruit set may be due to the application of NPK and Vermicompost leading to increased uptake of NPK. Vermicompost also contains micro nutrients. It enhances microbial activity, which may have improved the availability of macro and micro nutrients to the plants. It also acts as a chelating agent and regulates availability of metabolic micro-nutrients to plants. The present finding s is in accordance with the result of Jamir, Tajungsola *et al,* (2017) in capsicum.

Effect of pruning (P)

Effect of pruning on fruit setting (%) was found significant. The increase in fruit setting (60.09 %) was found in treatment P_2 (30 DAT) and decrease (58.15 %) in treatment P_1 (20 DAT).The same result found by Sadia *et al.* (2017).

Interaction of micronutrients and pruning (M x P)

The interaction effect of micronutrients and pruning on fruit setting (%) was found significant. The data show that increase in fruit setting (62.71%) recorded in treatment M_1P_2 which was followed by treatments M_2P_1 and M_2P_2 however decrease in fruit setting (58.03 %) recorded in treatment M_1P_1.

4.4 Chlorophyll content

4.4.1 Chlorophyll content in leaves (mg)

Effect of micronutrients, pruning and their interaction on chlorophyll content of leaves (mg) presented in Table 3 and graphically depicted in fig. 18.

Effect of micronutrients (M)

Chlorophyll content of leaves (mg) as influenced by micronutrients was found to be differ significant. The data shown that maximum chlorophyll content of leaves (63.52 mg) was found in treatment M_6 (Chelated Mix 0.2 %) which was at par with treatment M_5 (Chelated Mn 0.2%) and minimum chlorophyll content of leaves (58.37 mg) in treatment M_1 (Chelated Zn 0.2%).

The increase in plant height under zinc sulfate might be due to the fact that zinc in addition to its role in chlorophyll synthesis it also influenced the cell division, meristematic activity of tissue, expansion of cell and formation of cell wall. Foliar application of zinc increased the photosynthetic activity, which ultimately resulted in improving the plant growth. The similar result was also reported by

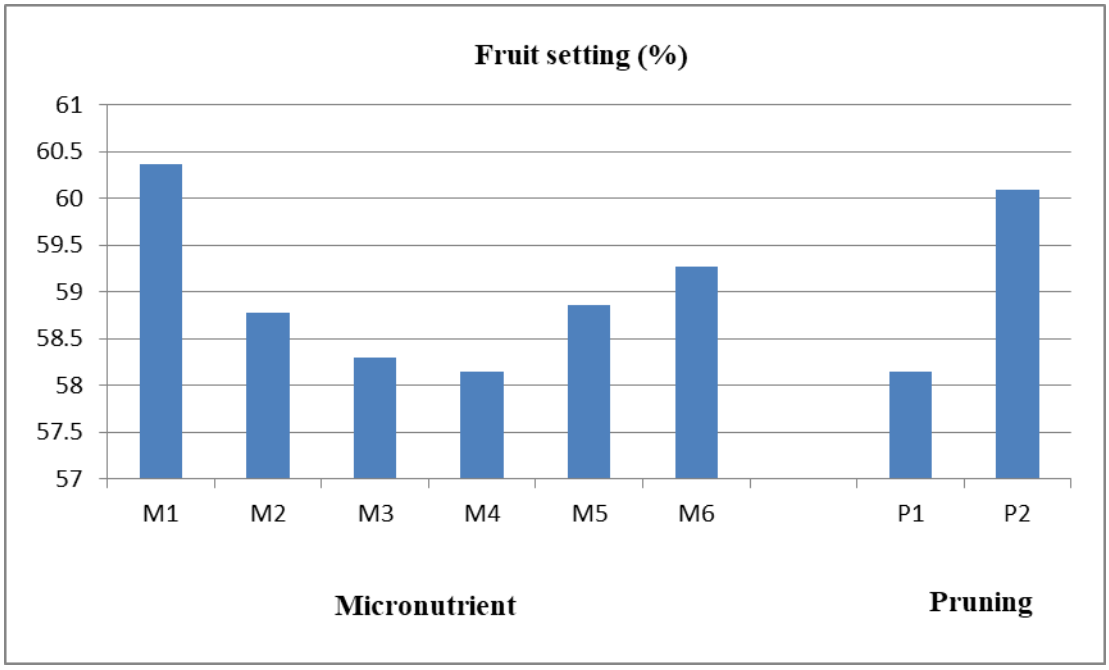

Fig. 16 Effect of micronutrient and pruning on fruit setting in sweet pepper Cv. Raja.

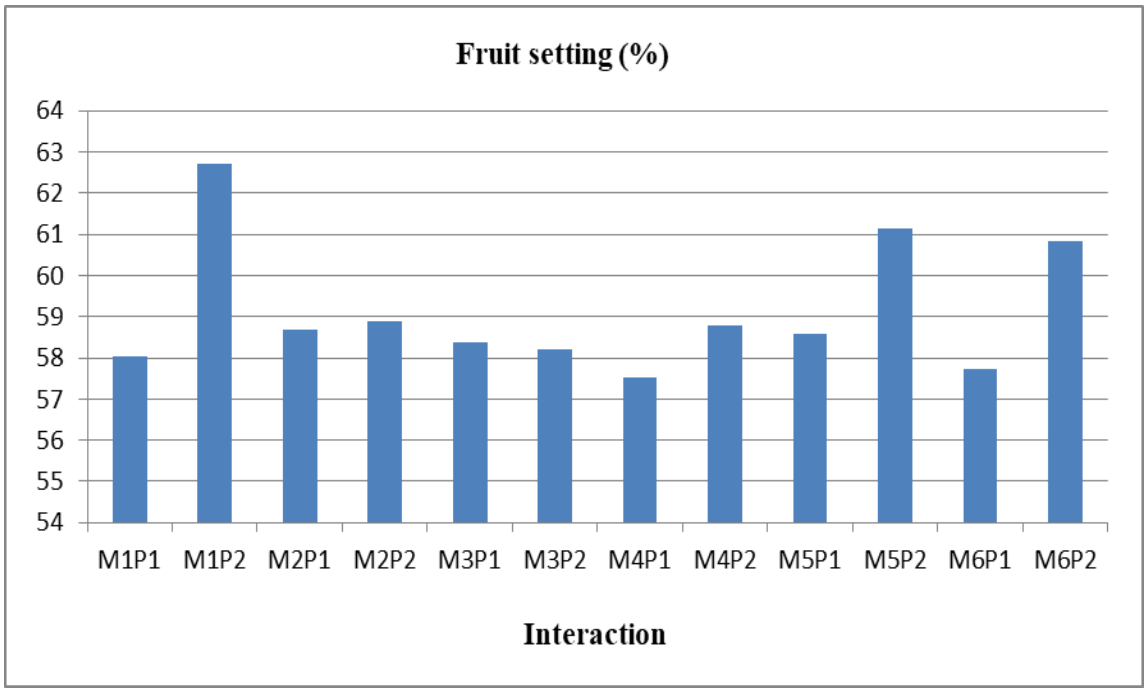

Fig. 17 Interaction effect of micronutrient and pruning on fruit setting in sweet pepper Cv. Raja.

Pandav *et al*, (2016) in brinjal.

Effect of pruning (P)

Effect of pruning on chlorophyll content of leaves (mg) was found non-significant.

Interaction of micronutrients and pruning (M X P)

The interaction effect of micronutrients and pruning on chlorophyll content of leaves (mg) was found non-significant.

4.5 Yield attributes

4.5.1 Fruit yield per plant (g)

Effect of micronutrients, pruning and their interaction on fruit yield per plant (g) presented in Table 7 and graphically depicted in fig.19 & 20.

Effect of micronutrients (M)

Fruit yield per plant (g) as influenced by micronutrient was found to be differ significant. The data shown that highest fruit yield per plant (4603.19g) was found in treatment M_1 (Chelated Zn 0.2%) which was at par with treatment M_5 (Chelated Mn 0.2%) and lowest fruit yield per plant (4258.07g) in treatment M_4 (Chelated Cu 0.1 %).

Fruit yield was the minimum under control and the maximum in zinc spray treatment. It is clear from the results that among the micronutrients, zinc (100ppm) spray twice before onset of flowering is beneficial in increasing the marketable yield by 10-13% and size of fruits in capsicum. Improvement in the fruit weight and size due to spray of micronutrients may be attributed to the role of these elements in the plant nitrogen metabolism, carbohydrate metabolism and translocation of photosynthates. Above findings are in accordance with the result of Agarwal, Ankur *et al*, (2018) in capsicum.

Effect of Pruning (P)

Effect of pruning on fruit yield per plant (g) was found significant. The highest fruit yield per plant (4561.56g) was found in treatment P_2 (30 DAT) and lowest (4232.13g) in treatment P_1 (20 DAT).

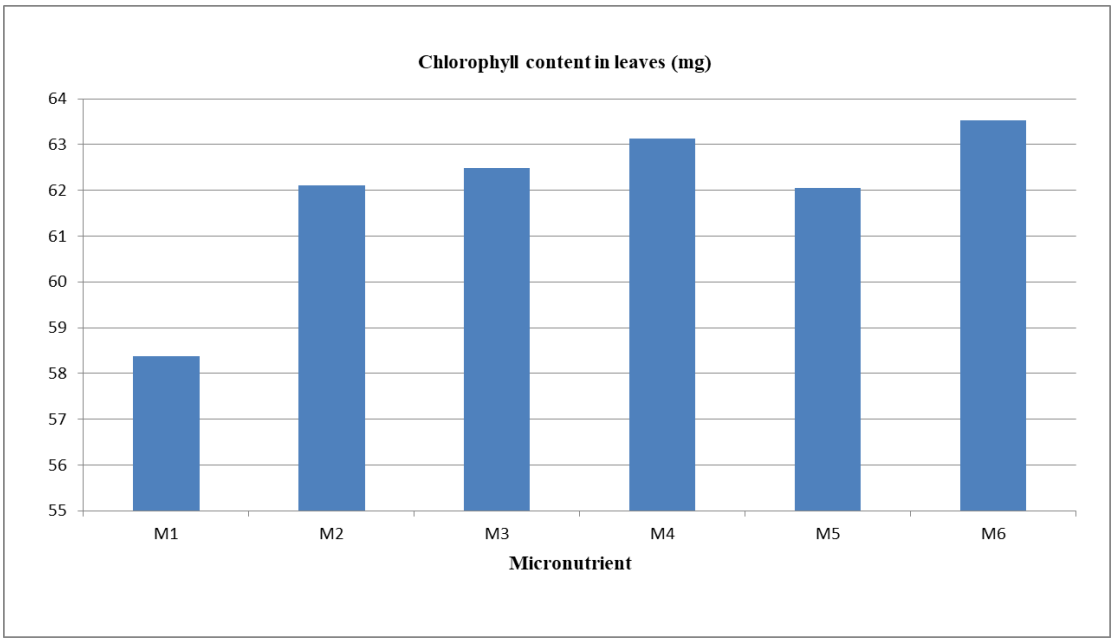

Fig. 18 Effect of micronutrient and pruning on chlorophyll content in leaves in sweet pepper Cv. Raja.

Interaction of micronutrients and pruning (M x P)

The interaction effect of micronutrients and pruning on fruit yield per plant (g) was found significant. The data shown that highest fruit yield per plant (4966.00g) recorded in treatment M_1P_2 which was followed by treatments M_2P_1 and M_2P_2 however lowest fruit yield per plant (4240.38g) recorded in treatment M_1P_1.

Fruit yield calculated on per plant and per hectare basis, was significantly affected by micronutrient treatments application of micronutrients produced the maximum fruit yield followed by retention of flowers and fruits, which might have increased the number and weight of fruits. Increased yield in response to micronutrients (B, Zn and mixture).The similar result was also reported by Purna Datta Reddy, G (2018).

4.5.2 Fruit yield per plot (kg/ m^2)

Effect of micronutrients, pruning and their interaction on fruit yield per plot presents in Table 7 and graphically in fig. 21 & 22.

Effect of micronutrients (M)

Fruit yield per plot (kg/ m^2) was found to be differ significant. The data shown that increase in fruit yield pre plot (55.23 kg/m^2) was found in treatment M_1 (Chelated Zn 0.2%) which was at par with treatment M_5 (Chelated Mn 0.2%) and decrease in fruit yield per plot (51.09 kg/m^2) in treatment M_3(Chelated Bo 0.1%).

These results are apparently due to the role of the micronutrients and the other macro elements in the nutrient compounds affecting the metabolic process and in turn in plant growth. Foliar application of micronutrients seems to stimulate the metabolic process within the plant through their direct effect on the enzymatic reactions. Above finding were supported by Shafeek *et al*, (2014) in capsicum.

Effect of pruning (P)

Effect of pruning on fruit yield per plot (kg/m^2) was found significant. The increase in fruit yield per plot (54.72kg/m^2) was found in treatment P_2 (30 DAT) and decrease (50.78kg/m^2) in treatment P_1 (20 DAT).

Yield of tomato was found to increase with an increase in branch number. Conversely the early yield per plot increased due to the pruning treatments especially

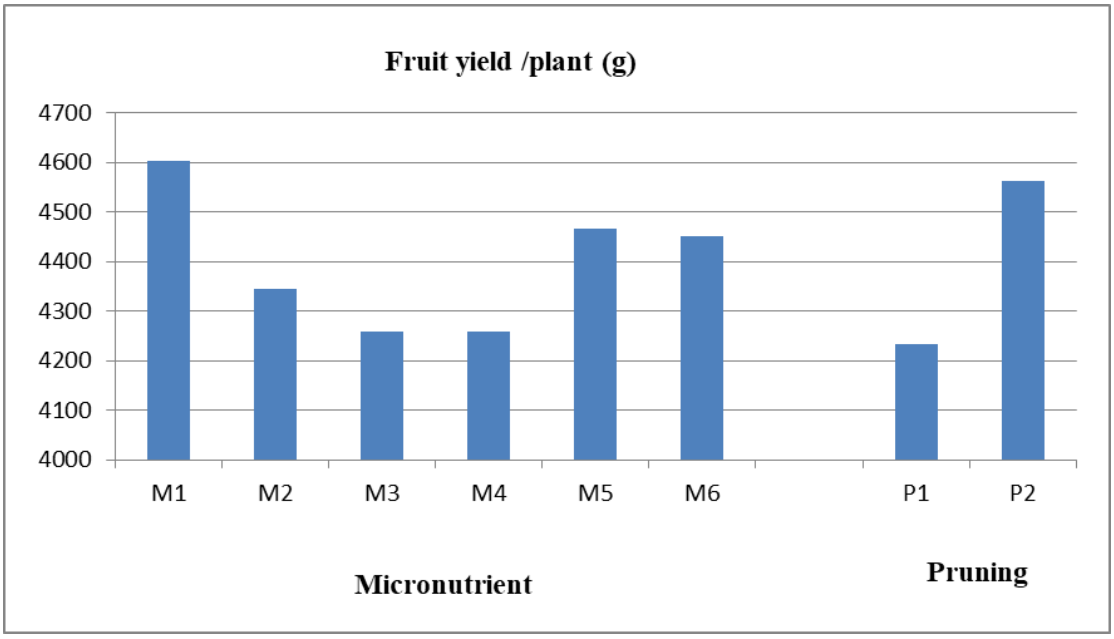

Fig. 19 Effect of micronutrient and pruning on fruit yield per plant in sweet pepper Cv. Raja.

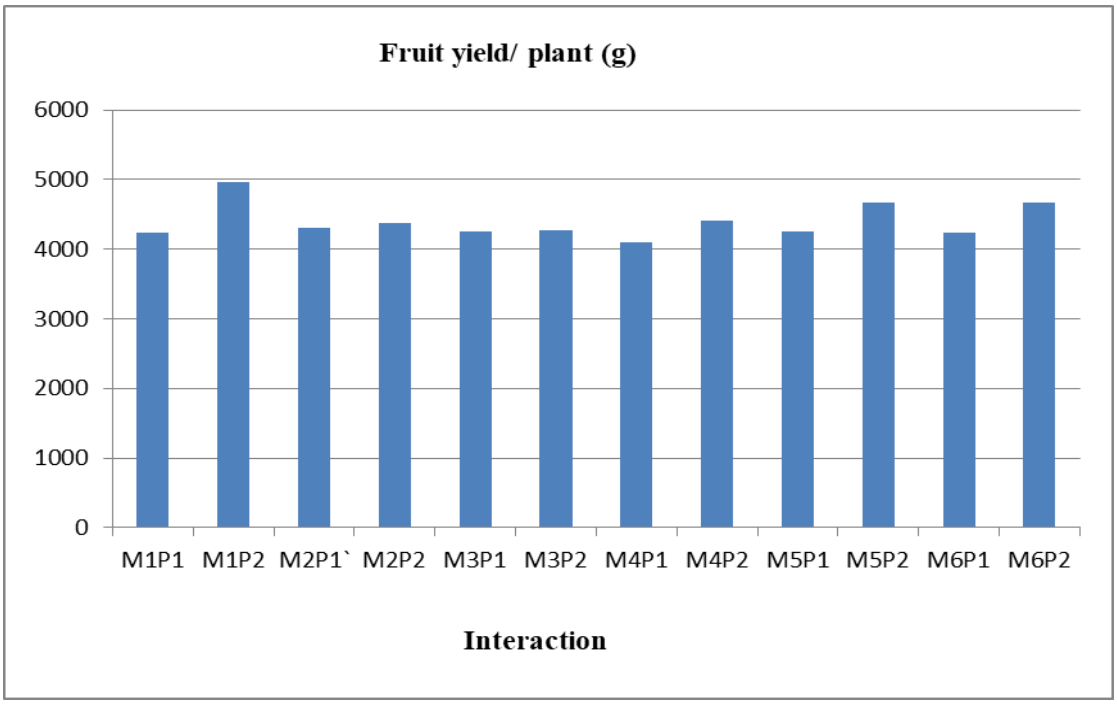

Fig. 20 Interaction effect of micronutrient and pruning on fruit yield per plant in sweet pepper Cv. Raja

with the treatment of pruning plants to three shoots. These results may be attributed to the effect of pruning on vegetative characteristics of plants and shows that vegetative growth has direct relation with leaf area, dry matter and stem diameter; however, pruning limits vegetative growth and allows more light penetration and increases photosynthesis efficiency and so improve vegetative growth of plants hence average fruit weight increased and early fruit yield increased. The present findings are in accordance with result of Goda, Y. (2014) in tomato.

Interaction of micronutrients and pruning (M x P)

The interaction effect of micronutrients and pruning on fruit yield per plot (kg/m^2) was found significant. The data shown that increase in fruit yield per plot (59.58 kg/m^2) recorded in treatment M_1P_2 which was followed by treatments M_2P_1 and M_2P_2 however decrease fruit yield per plot (49.24 kg/m^2) recorded in treatment M_4P_1.

4.5.3 Fruit yield per hectare (ton)

Effect of micronutrients, pruning and their interaction on fruit yield per hectare presented in Table 7 and graphically in fig. 23 & 24.

Effect of micronutrients (M)

Fruit yield per hectare (ton) as influenced by micronutrient was found to be differ significant. The data shown that maximum fruit yield per hectare (34.51ton/ha) was found in treatment M_1 (Chelated Zn 0.2 %) which was at par with treatment M_5 (Chelated Mn 0.2 %) and minimum fruit yield per hectare (31.76 ton/ha) in treatment M_4 (Chelated Cu 0.1%).

Fruit yield calculated on per plant and per hectare basis, was significantly affected by micronutrient treatments application of micronutrients produced the maximum fruit yield followed by retention of flowers and fruits, which might have increased the number and weight of fruits. Increased yield in response to micronutrients (B, Zn and mixture). Above finding were confirmed by Purna Datta Reddy, G (2018).

Effect of pruning (P)

Effect of pruning on fruit yield per hectare (ton) was found significant. The maximum fruit yield per hectare (34.14ton/ha) was found in treatment

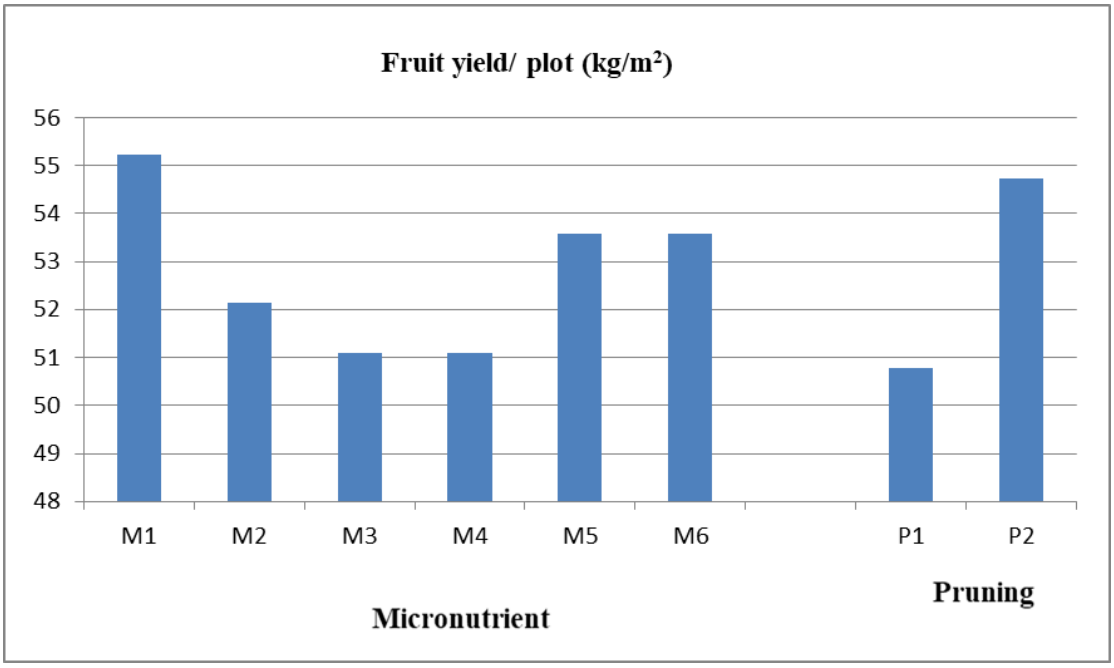

Fig. 21 Effect of micronutrient and pruning on fruit yield per plot in sweet pepper Cv. Raja.

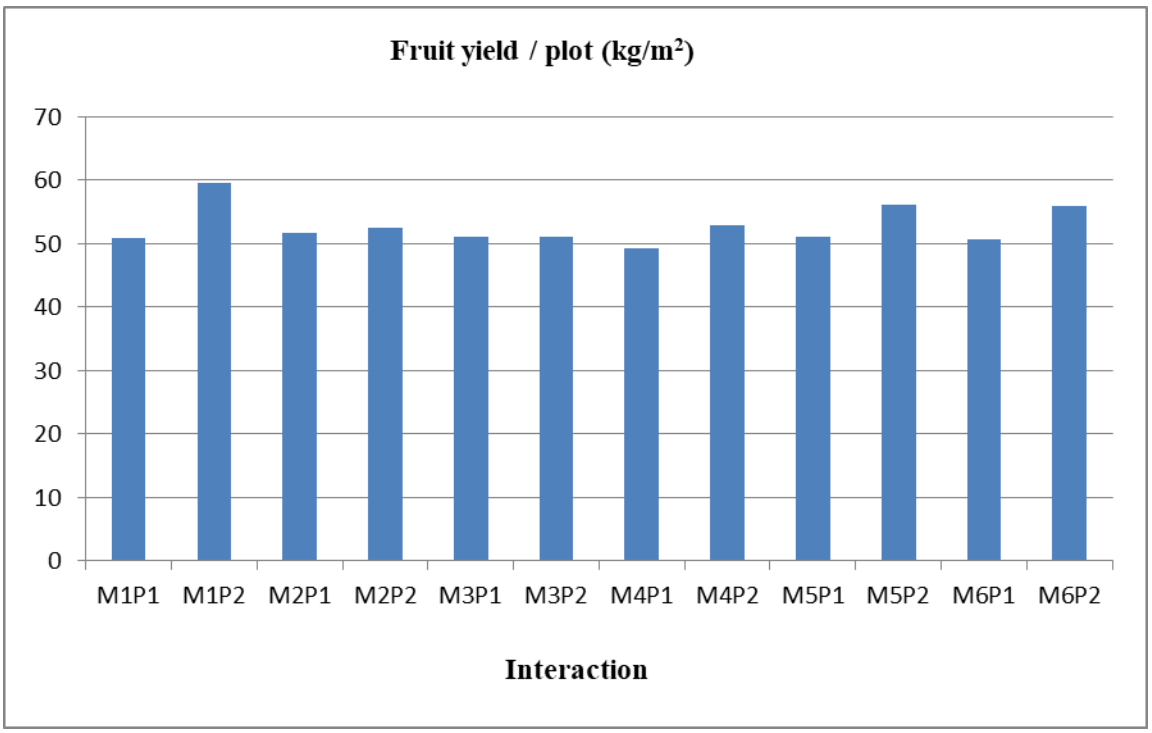

Fig. 22 Interaction effect of micronutrient and pruning on fruit yield per plot in sweet pepper Cv. Raja.

Table 7 Effect of application of micronutrient, response of pruning and their interaction on yield per plant, yield pre plot and yield per hectare of sweet pepper (*Capsicum annuum*) cv. Raja

Treatment	Fruit yield / plant (g)	Fruit yield/plot (kg/m^2)	Fruit yield/ ha (ton)
Factor- A (Micronutrient)			
M1	4603.19	55.23	34.51
M2	4344.83	52.13	32.57
M3	4258.10	51.09	31.93
M4	4258.07	51.09	31.76
M5	4466.25	53.58	33.48
M6	4450.61	53.58	33.36
SE+_	**41.67**	**0.498**	**0.31**
CD at 5 % level	**123.02**	**1.47**	**0.92**
Factor – B (Pruning)			
P1	4232.13	50.78	31.73
P2	4561.56	54.72	34.14
SE+_	**24.06**	**0.28**	**0.18**
CD at 5% level	**71.02**	**0.84**	**0.53**
Interaction (M X P)			
M1P1	4240.38	50.88	31.79
M1P2	4966.00	59.58	37.24
M2P1	4309.36	51.71	32.31
M2P2	4380.31	52.55	32.84
M3P1	4253.01	51.03	31.89
M3P2	4263.18	51.15	31.96
M4P1	4104.42	49.24	30.77
M4P2	4411.72	52.93	32.75
M5P1	4256.17	51.06	31.91
M5P2	4676.33	56.11	35.06
M6P1	4229.43	50.74	31.71
M6P2	4671.80	56.02	35.01
SE+_	**58.94**	**0.70**	**0.44**
CD at 5 % level	**173.98**	**2.07**	**1.03**

Treatment details	
M1- Chelated Zn (0.2%)	M5- Chelated Mn(0.2%)
M2 – Chelated Fe (0.2 %)	M6- Chelated Mix (0.2%)
M3 – Chelated Bo (0.1%)	P1- Pruning (20 DAT)
M4 – Chelated Cu (0.1%)	P2- Pruning (30 DAT)

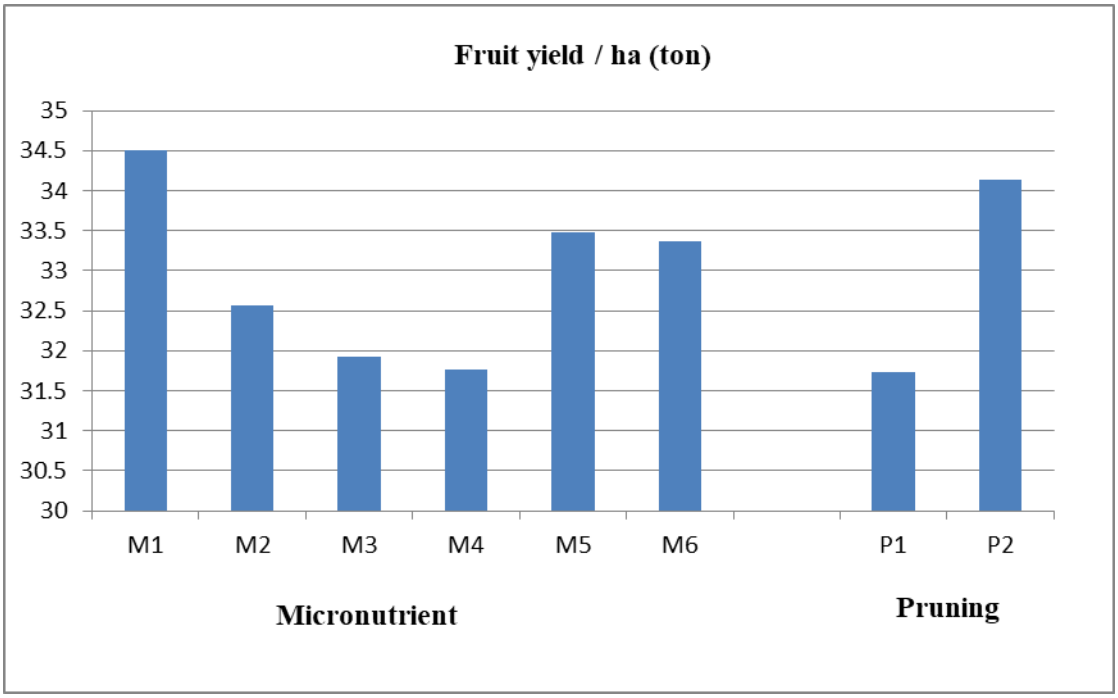

Fig. 23 Effect of micronutrient and pruning on fruit yield per hectare in sweet pepper Cv. Raja.

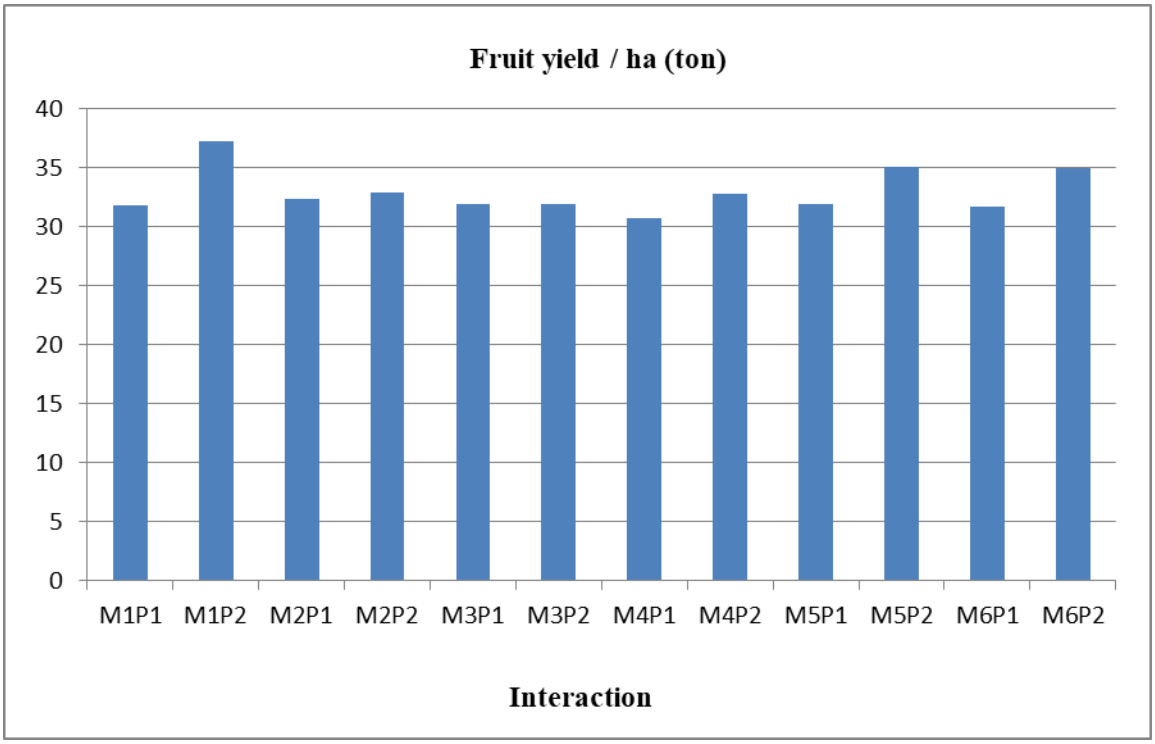

Fig. 24 Interaction effect of micronutrient and pruning on fruit yield per hectare in sweet pepper Cv. Raja.

P_2 (30 DAT) and minimum (31.73ton/ha) in treatment P_1 (20 DAT).

Interaction of micronutrients and pruning (M x P)

The interaction effect of micronutrients and pruning on fruit yield per hectare (ton) was found significant. The data shown that maximum fruit yield per hectare (37.24 ton/ha) recorded in treatment M_1P_2 which was followed by treatments M_2P_1 and M_2P_2 however minimum fruit yield per hectare (30.77ton/ha) recorded in treatment M_4P_1.

The micronutrients spray, two sprays of zinc (100ppm) or boron (100ppm) were found best under greenhouse conditions for obtaining higher yield and quality of capsicum irrespective of the variety. Interaction effects of micronutrients to variety were significant for marketable traits of capsicum. Above finding are in accordance with result of Agarwal, Ankur., *et al,* (2018) in capsicum.

4.6 Quality parameter

4.6.1 Vitamin C (mg/ 100 ml fresh fruit)

Effect of micronutrients, pruning and their interaction on vitamin C content of fruit presents in Table 8 and graphically depicted in fig. 25 & 26.

Effect of Micronutrients (M)

Vitamin C content of fruit (mg / 100ml of fresh fruit) as influenced by micronutrients was found to be differ significant. The data shown that maximum vitamin C content of fruit (25.65 mg/ 100 ml of fresh fruit) was found in treatment M_1(Chelated Zn 0.2%) which was at par with treatment M_2 (Chelated Fe 0.2%) and minimum vitamin C content of fruit (24.44 mg/ 100 ml of fresh fruit) in treatment M_4 (Chelated Cu 0.1%).

The increase in ascorbic acid content may be due to good growth of plants resulting from higher assimilation of the micronutrients which are made available to the plant due to decompose organic matter. The increased activity of ascorbic acid oxidase enzyme in presence of micronutrients may be concerned to another reason for increase in ascorbic acid content. The similar result was also notified by Kumari, Sarika., *et.al* (2017) in capsicum.

Effect of pruning (P)

Effect of pruning on vitamin C content of fruit (mg /100 ml of fresh fruit) was found significant. The maximum vitamin C content of fruit (25.52 mg/100ml of fresh fruit) was found in treatment P_2 (30 DAT) and minimum (24.23mg / 100 ml of fresh fruit) in treatment P_1 (20 DAT).

Vitamin C (ascorbic acid), total sugar, total carotenoids and dry matter increased due to pruning treatments. The positive effect of pruning treatments on total soluble solids (T.S.S.%), vitamin C, total sugar, total carotenoids and dry matter may be attributed the effect of pruning in limits vegetative growth and allows more light penetration and increases photosynthesis efficiency and so increase vitamin C as it is well known that light is the major factor effecting vitamin C content. Above finding were confirmed by Goda, Y (2014) in tomato.

Interaction of micronutrients and pruning (M x P)

The interaction effect of micronutrients and pruning in vitamin C content of fruit (mg/ 100ml of fresh fruit) was found significant. The data shown that maximum vitamin C content of fruit (27.27 mg/ 100ml of fresh fruit) recorded in treatment M_1P_2 which was followed by treatments M_2P_1 and M_2P_2 however minimum vitamin C content of fruit (24.04 mg/100 ml of fresh fruit) recorded in treatment M_1P

Table 8 Effect of application of micronutrient, response of pruning and their interaction on vitamin C content of sweet pepper (*Capsicum annuum*) cv. Raja.

Treatment	Vitamin C (mg /100ml of fruit)
Factor- A (Micronutrient)	
M1	25.65
M2	25.28
M3	24.49
M4	24.44
M5	24.66
M6	24.73
SE+_	**0.22**
CD at 5 % level	**0.66**
Factor – B (Pruning)	
P1	24.23
P2	25.52
SE+_	**0.13**
CD at 5% level	**0.38**
Interaction (M X P)	
M1P1	24.04
M1P2	27.27
M2P1	24.77
M2P2	25.80
M3P1	24.10
M3P2	24.89
M4P1	23.78
M4P2	25.10
M5P1	25.07
M5P2	24.25
M6P1	23.62
M6P2	25.84
SE+_	**0.31**
CD at 5 % level	**0.94**
	Treatment details
M1- Chelated Zn (0.2%)	M5- Chelated Mn (0.2%)
M2 – Chelated Fe (0.2 %)	M6- Chelated Mix (0.2%)
M3 – Chelated Bo (0.1%)	P1- Pruning (20 DAT)
M4 – Chelated Cu (0.1%)	P2- Pruning (30 DAT)

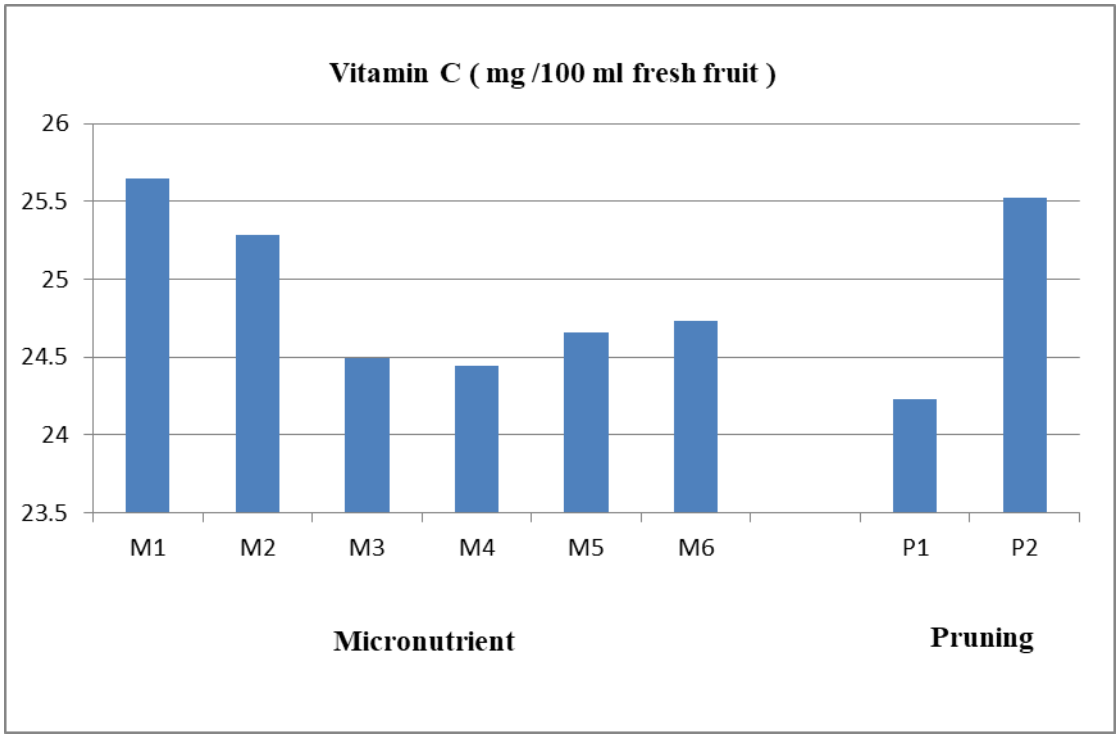

Fig. 25 Effect of micronutrient and pruning on vitamin C content in sweet pepper CV. Raja.

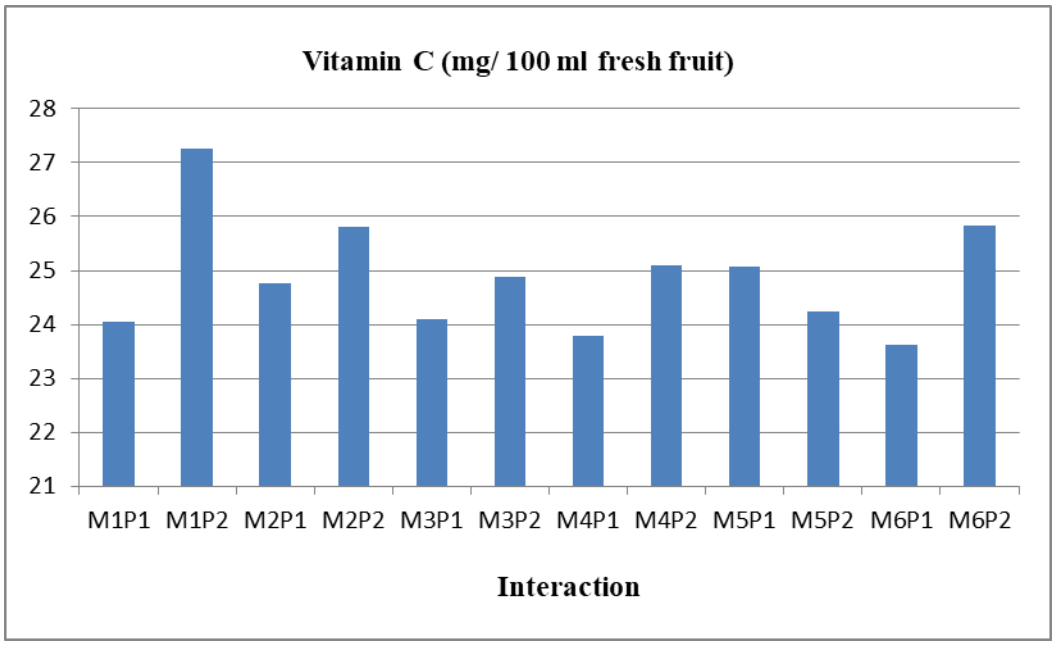

Fig. 26 Interaction effect of micronutrient and pruning on vitamin c content in sweet pepper CV. Raja

Plate IV: General View of Experimental Plot

Plate V: Treatment Wise Sweet pepper Fruit

Summary and Conclusion

CHAPTER- V

SUMMARY AND CONCLUSION

The present investigation entitled "Response of pruning and application of micronutrient on growth and yield of sweet pepper (Capsicum annuum) Cv. Raja" was conducted at Experimental Farm, Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during 2019-2020. The experiment was laid down in factorial randomized block design comprising of three replications and twelve treatments. The result obtained in this investigation is summarized in this chapter under appropriate heading.

6.1 Growth parameters

6.1.1 Plant height (cm)

The plant height of sweet pepper was maximum in micronutrient treatment M_1 (Chelated Zn 0.2%) is (124. 76 cm).

Pruning P_2 (30 DAT) recorded maximum plant height is (117. 34 cm).

Treatment combination of micronutrient and pruning M_1P_2 (Chelated Zn 0.2 % + Pruning 30 DAT) recorded maximum plant height is (130. 66 cm).

6.1.2 Leaf area (cm^2)

The leaf area of sweet pepper was maximum in micronutrient treatment M_2 (Chelated Fe 0.2%) is (96.01 cm^2).

Pruning P_2 (30 DAT) recorded maximum leaf area is (85.85cm^2).

Treatment combination of micronutrient and pruning M_2P_2 (Chelated Fe 0.2 % + Pruning 30 DAT) recorded maximum leaf area is (107.52cm^2).

6.2 Flower attributes

6.2.1 Days to 1st flowering

The days to 1st flowering of sweet pepper was minimum in micronutrient treatment M_1 (Chelated Zn 0.2%) is (54.37).

Pruning P_2 (30 DAT) recorded maximum days to 1st flowering is (57.04).

Treatment combination of micronutrient and pruning M_1P_2 (Chelated Zn 0.2 % +

Pruning 30 DAT) recorded minimum days to 1st flowering is (60.05).

6.2.2 Number of flower

The number of flower of sweet pepper was maximum in micronutrient treatment M_1 (Chelated Zn 0.2%) is (63.48).

Pruning P_2 (30 DAT) recorded maximum number of flower is (63.39).

Treatment combination of micronutrient and pruning M_1P_2 (Chelated Zn 0.2 % + Pruning 30 DAT) recorded maximum number of flower is (65.03).

6.3 Fruit attributes

6.3.1 Diameter of fruit (cm)

The diameter of fruit of sweet pepper was maximum in micronutrient treatment M_1 (Chelated Zn 0.2%) is (7.65 cm).

Pruning P_2 (30 DAT) recorded maximum diameter of fruit is (7.29 cm).

Treatment combination of micronutrient and pruning M_1P_2 (Chelated Zn 0.2 % + Pruning 30 DAT) recorded maximum diameter of fruit is (8.38 cm).

6.3.2 Length of fruit (cm)

The length of fruit of sweet pepper was maximum in micronutrient treatment M_1 (Chelated Zn 0.2%) is (11.65 cm).

Pruning P_2 (30 DAT) recorded maximum length of fruit is (11.29 cm).

Treatment combination of micronutrient and pruning M_1P_2 (Chelated Zn 0.2 % + Pruning 30 DAT) recorded maximum length of fruit is (12.38 cm).

6.3.3 Number of fruit per plant

The number of fruit per plant of sweet pepper was maximum in micronutrient treatment M_1 (Chelated Zn 0.2%) is (38.36).

Pruning P_2 (30 DAT) recorded maximum number of fruit per plant is (38.11).

Treatment combination of micronutrient and pruning M_1P_2 (Chelated Zn 0.2 % + Pruning 30 DAT) recorded maximum number of fruit per plant is (40.77).

6.3.4 Fruit weight (g)

The weight of fruit of sweet pepper was maximum in micronutrient treatment M_1 (Chelated Zn 0.2%) is (119.86 g).

Pruning P_2 (30 DAT) recorded maximum weight of fruit is (119.58g).

Treatment combination of micronutrient and pruning M_1P_2 (Chelated Zn 0.2 % + Pruning 30 DAT) recorded maximum weight of fruit is (121.77 g).

6.3.5 Fruit setting (%)

The fruit setting of sweet pepper was maximum in micronutrient treatment M_1 (Chelated Zn 0.2%) is (60.37 %).

Pruning P_2 (30 DAT) recorded maximum fruit setting is (60.09 %).

Treatment combination of micronutrient and pruning M_1P_2 (Chelated Zn 0.2 % + Pruning 30 DAT) recorded maximum fruit setting is (62.71 %).

6.4 Chlorophyll content

6.4.1 Chlorophyll content in leaves (mg)

The chlorophyll content of leaves of sweet pepper was maximum in micronutrient treatment M_1 (Chelated Zn 0.2%) is (63.52 mg / 100 ml).

Pruning P_2 (30 DAT) recorded maximum chlorophyll content of leaves is (61.73 mg / 100 ml).

Treatment combination of micronutrient and pruning M_1P_2 (Chelated Zn 0.2 % + Pruning 30 DAT) recorded maximum chlorophyll content of leaves is (63.40 mg /100 ml).

6.5 Yield attributes

6.5.1 Fruit yield per plant (g)

The fruit yield per plant of sweet pepper was maximum in micronutrient treatment M_1 (Chelated Zn 0.2%) is (4603.19 g).

Pruning P_2 (30 DAT) recorded maximum fruit yield per plant is (4561.56 g).

Treatment combination of micronutrient and pruning M_1P_2 (Chelated Zn 0.2 % + Pruning 30 DAT) recorded maximum fruit yield per plant is (4966.00g).

6.5.2 Yield per plot (kg/ m^2)

The fruit yield per plot of sweet pepper was maximum in micronutrient treatment M_1 (Chelated Zn 0.2%) is (55.23 kg/m^2).

Pruning P_2 (30 DAT) recorded maximum fruit yield per plot is (54.72 kg/m^2).

Treatment combination of micronutrient and pruning M_1P_2 (Chelated Zn 0.2 % + Pruning 30 DAT) recorded maximum fruit yield per plot is (59.88 kg/m^2).

6.5.3 Yield per hectare (ton)

The fruit yield per hectare of sweet pepper was maximum in micronutrient treatment M_1 (Chelated Zn 0.2%) is (34.51 ton/ha).

Pruning P_2 (30 DAT) recorded maximum fruit yield per hectare is (34.14 ton/ha).

Treatment combination of micronutrient and pruning M_1P_2 (Chelated Zn 0.2 % + Pruning 30 DAT) recorded maximum fruit yield per hectare is (37.24 ton/ha).

CONCLUSION

The finding of the present investigation of experiment is concluded as below:

The result of experiment on “Response of pruning and application of micronutrient on growth and yield of sweet pepper (*Capsicum annuum*) cv. Raja” confirmed the efficiency of micronutrient and pruning for obtaining better growth, yield and quality of sweet pepper.

However, among the various treatment combinations, overall performance of treatment M_1P_2 (Chelated Zn 0.2% + Pruning 30 DAT) was superior over all other treatment. This was further followed by treatment M_1P_1 (Chelated Zn 0.2% + Pruning 20 DAT). It was helpful to enhance the growth, yield and quality parameters of sweet pepper crop. Interaction of micronutrient and pruning enhanced the vegetative and reproductive growth as well as yield attributes. Therefore, amongst all the treatments interaction of Chelated Zn 0.2% and Pruning 30 DAT can be considered as most beneficial in terms of growth, yield and quality.

From the present investigation it is revealed that, foliar application of micronutrient and pruning is an instant and effective way of application which significantly influenced vegetative characters of plant and physiochemical properties of fruit of sweet pepper.

These results are based on one year study and for confirmation few more experimental trials are needed.

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Thesis Abstract

ABSTRACT

‘‘RESPONSE OF PRUNNING AND APPLICATION OF MICRONUTRIENT ON GROWTH AND YIELD OF SWEET PEPPER ((*Capsicum annuum*) cv. Raja”

By

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of

Master of Science (Horticulture)

In

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Investigation on “Response of Pruning and Application of Micronutrient on Growth and Yield of Sweet Pepper (*Capsicum annuum*) cv. Raja” was undertaken with objective to increase the number of fruit and fruit weight of sweet pepper and to identify the days of pruning in shade net of sweet pepper.

Present experiment conducted at Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during the year 2019-2020 on sweet pepper cv. Raja. The experiment was conducted on well-established shade net with Factorial Randomized Block Design having two factor the Factor A consisted six levels of micronutrients viz. M_1 chelated Zn 0.2%, M_2 chelated Fe 0.2%, M_3 chelated Bo 0.1%, M_4 chelated Cu 0.1%, M_5 chelated Mn 0.2%. M_6 chelated Mix 0.2% and Factor B consisted two levels of pruning viz. P_1 pruning 20 DAT. P_2 pruning 30 DAT.

Foliar applications of micronutrients were sprayed at two times, first

spraying was done at 20 days after transplanting and second spraying was done at 30 days after transplanting. It was ensure that plant was sprayed in all directions. Pruning was done manually in all direction after counting number of branches per plant. The observation was recorded on growth parameter, fruit parameter, yield and quality parameter.

With respect to foliar application of micronutrient chelated zinc M_1 0.2% recorded significantly highest leaf area, fruit weight, fruit set percentage, diameter, length, plant height, ascorbic acid (mg/100 ml).

Among the different pruning, treatment P_2 i.e. pruning at 30 days after transplanting recorded significantly maximum fruit set, fruit weight, fruit diameter, yield per plant, ascorbic acid (mg / 100 ml). However minimum values were found in treatment P_1 i.e. pruning at 20 days after transplanting.

The treatment combination M_1P_2 (Chelated Zinc 0.2% + Pruning at 30 days after transplanting) recorded significantly highest plant height, leaf area, maximum weight, fruit set, number of flower, chlorophyll content, number of fruit. Similarly, fruit chemical parameters i.e. ascorbic acid (mg/100 ml) was found better into M_1P_2 (Chelated Zinc 0.2 %+ Pruning at 20 days after transplanting).

Appendix

APPENDIX-I

WEEKLY WEATHER DATA FOR YEAR 2019-20									
Wk	Period	RF (mm)	Temperature °C		Humidity (%)		EVP (mm)	BSS (Hrs.)	WS (Kmph)
			Max	Min	RH1	RH2			
23	04 Jun – 10 Jun	33.7	40.9	24.8	76	24	8.5	5.9	6.8
24	11 Jun – 17 Jun	0.0	39.3	25.2	62	30	10.4	9.8	7.9
25	18 Jun – 24 Jun	10.5	35.3	24.7	69	48	8.6	6.4	7.3
26	25 Jun – 01 Jul	46.9	33.2	22.7	85	59	4.9	4.8	5.6
27	02 Jul –08 Jul	10.6	33.2	23.1	76	58	5.1	2.7	8.3
28	09 Jul – 15 Jul	34.2	33.5	22.6	83	49	5.5	6.7	7.0
29	16 Jul – 22 Jul	11.2	34.2	22.9	79	46	6.6	7.7	5.8
30	23 Jul – 29 Jul	64.3	30.6	22.6	81	62	4.5	4.1	6.3
31	30 Jul – 05 Aug	85.4	28.1	21.8	92	85	2.1	1.2	6.6
32	06 Aug – 12 Aug	62.2	30.5	22.0	89	65	4.0	3.5	6.2
33	13 Aug – 19 Aug	9.7	32.3	21.5	80	57	4.6	5.4	4.6
34	20 Aug – 26 Aug	1.2	32.2	22.0	80	56	5.6	6.5	6.0
35	27 Aug – 02 Sep	78.0	31.2	21.5	88	59	4.6	5.6	4.7
36	03 Sep – 09 Sep	13.2	30.1	21.6	83	70	2.9	2.0	4.7
37	10 Sep – 16 Sep	86.4	30.0	21.2	88	68	2.8	4.7	5.4
38	17 Sep – 23 Sep	118.8	30.9	21.9	94	67	2.3	5.1	3.5
39	24 Sep – 30 Sep	35.6	31.3	21.1	92	62	3.7	6.5	3.3
40	01 Oct – 07 Oct	21.2	31.4	20.5	88	60	3.8	7.3	2.8
41	08 Oct – 14 Oct	5.1	31.5	20.1	87	53	4.1	7.0	2.7
42	15 Oct – 21 Oct	121.4	30.1	18.6	82	55	3.5	5.9	4.1
43	22 Oct – 28 Oct	100.0	29.7	20.6	82	63	2.4	4.3	3.6
44	29 Oct – 04 Nov	13.0	30.4	20.7	84	62	3.2	6.9	3.8
45	05 Nov – 11 Nov	0.0	31.4	18.4	89	48	3.4	8.6	1.6
46	12 Nov – 18 Nov	0.0	30.0	14.7	77	45	3.7	8.3	2.7
47	19 Nov – 25 Nov	0.0	30.0	13.2	81	44	3.4	8.5	2.1
48	26 Nov – 02 Dec	0.0	30.1	15.4	80	46	3.8	7.9	2.6
49	03 Dec – 09 Dec	0.0	28.9	14.8	76.3	46.4	4.2	7.4	3.5
50	10 Dec – 16 Dec	0.0	30.0	15.6	86.4	44.3	3.6	7.1	2.5
51	17 Dec – 23 Dec	0.0	28.3	14.9	88.3	44.6	3.3	6.1	2.9
52	24 Dec – 31 Dec	4.4	26.2	15.2	81.1	49.0	2.7	3.0	4.1

Vitae

VITAE

Miss. Patil Shrotika Dattatray

A candidate for the degree

of

MASTER OF SCIENCE (HORTICULTURE)

in

VEGETABLE SCIENCE

2020

Title of Thesis	: Response of pruning and application of micronutrient On growth and yield of sweet pepper (Capsicum annuum L.) Cv. Raja.
Major Field	: Horticulture (Vegetable Science)
Personal Information	: Born on 04 May, 1997 at Islampur Dist Sangli Maharashtra
Education	: Passed S.S.C. with 64.88% in 2012 from Adarsh Balak Mandir, Islampur, Dist. Sangli
	: Passed H.S.C. with 68.76% in 2014 from Sadguru Arts and Science Junior college Islampur
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