RESEARCH PROGRAMME

Evaluation of canopy regulation practices in certain tomato (*Solanum lycopersicum L.*) cultivars under Punjab conditions.

PRE-DISSERTATION REPORT

Submitted to the

LOVELY PROFESSIONAL UNIVERSITY, PHAGWARA, PUNJAB, INDIA

In partial fulfillment of the requirements for the award of degree of

MASTER OF SCIENCE

IN

HORTICULTURE

BY

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CERTIFICATE

I hereby declare that the Synopsis entitled **"Evaluation of canopy regulation practices in certain tomato (*Solanum lycopersicum L.*) cultivars' under Punjab conditions**" is an authentic record of my work and carried out at Lovely Professional University as requirement for the degree of Master of Science in the discipline of Horticulture, under the guidance of, **Dr. Themmeichon Chamroy** Assistant Professor, Department of Horticulture, School of Agriculture and no part of this Synopsis has been submitted for any other degree and diploma.

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1. INTRODUCTION

In India, vegetables are an important part of agriculture system due to their short duration, high yield, and nutritional richness. India ranks second in vegetable production (1690.64MT) after China **(NHB 2015)**. Vegetables play an important role to meet the nutritional requirements of human beings. They are rich sources of minerals, vitamins, dietary fibers, micronutrients, proteins, antioxidants, and phytochemicals. Tomato (*Solanum lycopersicum.*L) belongs to the Solanaceae and chromosome number, 2n=24. Tomato is a herbaceous sprawling plant growing to 1-3 m in height with the weak woody stem. It ranks first in the list of canned vegetables. Most cultivars produce red fruits when ripe.

According to FAO data 2015, Tomato is the world's largest producing vegetable crop after potato and sweet potato. The total global area under tomato is 46.16 lakh ha with a production of 1279.93 lakh tonnes and the major tomato growing countries are China, USA, Italy, Turkey, India, and Egypt. Whereas in India total area under these crops is 774 thousand ha with production is 18732 thousand metric tonnes and total area under vegetable 10106 thousand ha with production 169064 thousand metric tonnes (2015). The major tomato-producing states are Maharashtra, Bihar, Karnataka, Uttar Pradesh, Orissa, Andhra Pradesh, Madhya Pradesh and Assam.

This is one of the most important “protective foods” because it’s a rich source of vitamin A, B, and C. It also contains lycopene, an antioxidant, ascorbic acid, beta-carotene and valued for their color and flavor. One hundred gram of ripe tomato fruit contains 93.1 percent moisture, 3.6g carbohydrate, 1.9g protein, 1.9g fat, sugar 4g, starch 1.2g, 320 IU vitamin-A, 31 mg vitamin B, 15-30 mg ascorbic acid, other minerals and total dry matter content in different tomato cultivars varies from 4% to 7.5% of fruit fresh mass. Soluble solids account for 75% of the total solids and are comprised primarily of the reducing sugars, which represent 55–65% of the total soluble solids content. **(Audrius, et al., 2016).**

It is one most powerful natural antioxidant. High antioxidant capacity in both fresh and processed tomatoes associated with the higher capacity to eliminate reactive oxygen species (ROS) and it helps in lowering the incidence of certain forms of human cancer and uses like cooked vegetable, salad, soup, pickles, ketchup, puree, sauces and unripe green fruits are used

for preparation of pickles and chutney. In many countries, it is considered as "poor man's orange" because of its improved nutritional values. Recent epidemiological studies have shown that their consumption helps to prevent cardiovascular disease and some other types of cancers, such as prostate cancer.

The optimum temperature for tomato growth and development is 20–24°C. Temperatures above 34°C are considered super-optimal thermal stress. The optimum range of night temperature for fruit set is 15-20 °C, above 32 °C day and 22°C night or below 18 day and 12°C night temperatures after fruit set. Below 10°C fruit are develop the red color. Above 30°C red color start to disappear and fruit becomes yellowish red color. When the temperature goes to above 40 c lycopene is completely destroyed. The optimum temperature for good color development is 21-24°C.

Tomato maturity is traditionally classified into six ripening stages according to the color change of the fruit from green to red. Color evolution during fruit ripening is mainly related to the breakdown of chlorophyll and synthesis of lycopene and the level of lycopene in fruit increases 500 times during ripening, which is responsible for the red color and constitutes 75–83% of the total pigment content at full ripeness.

Problem background:

Pruning and training is an important factor necessary in growing long stem greenhouse and open field tomatoes which leads to early fruiting, increase plant height, increase in the qualitative and quantitative crop yield, better pest control, and cleaner fruit harvest, ease of fertilizing operation through solution spray and powder spray.

Pruning increases cost of cultivation in tomato production, however, it improves light penetration inside the plant canopy and increases photosynthesis efficiency and so fruit yield. Many pieces of research as done on the effect of pruning on qualitative and quantitative characteristics of tomato show that pruning limits vegetative growth and allow more light penetration and so improves qualitative and quantitative characteristics of tomato fruits **(Preece and Read 2005)**. Nonetheless, there are some reports stating that pruning causes yield loss and low-quality production **(Kanyomeka and Shivute, 2005; Resh, 2002)**. There is some evidence that pruning not only improves fruit quality but also increases plant health against pests and disease

(Kanyomeka and Shivute, 2005). In case of indeterminate cultivars despite high yield, there is low quality due to low light penetration into the canopy. Thus there is a need for proper regulation of canopy through training and pruning practice better quality of plant and fruit.

Staking systems are usually done 2-3 weeks after transplanting or when plants reach a height of 12-15 inches. At the same time, plants are usually pruned to reduce vegetative growth and to increase fruit production or to reduce disease problems and fruit rotting, whether in high tunnels or in field production. In spite of the associated labor and material costs for training tomatoes, the benefits of increased air circulation and reduced contact with the soil are significant. Wrap a short piece of twine around the middle of the leader, cross it over on itself, and loosely tie it to give the support. Fruit will form along this stem. Eventually, the stem will bend over and crease. Luckily, as the stem matures, it toughens; by the time fruit develops, the stem can tolerate a tighter tie. To support a fruit cluster as it fills and gains weight, loop a longer piece of twine, 12 to 18 inches, around the stem just above the fruit cluster, creating a sling. Then gently pull it up to take the weight off the stem. Wrap the twine twice around the stake, and firmly tie it to the stake 6 to 10 inches higher than the point of attachment to the vine to keep the tie from sleeping and provide the highest yield.

Keeping in view the importance of tomato and its management process the research entitled "Evaluation of canopy regulation practices in certain tomato (*Solanum lycopersicum* L.) Cultivars' under Punjab conditions" will be conducted in research field of LPU Jalandhar.

Proposed research objective -:

1. To find out the effect of canopy regulation on growth and yield of tomato.

2. To find out the response of tomato varieties to canopy regulation.

3. To find out the best treatment combination for growth and yield of tomato.

4. To work out the economics of tomato cultivation.

2. REVIEW OF LITERATURE:

Kanyomeka and Shivute (2005) conducted a trial to evaluate the influence of pruning on tomato production. The result revealed that pruning does not increase tomato yield. The only benefits obtained from tomato pruning were increased quality and plant health. Pruned tomatoes were less prone to pest attack than those, which were not pruned.

Arora *et al.,* (2006) evaluated eighteen hybrids of tomato under greenhouse conditions during the winter season of 2002 and reported highest plant height, highest no of leaves and early flowering in Rakshita. However the variety NTH-2004 recorded ware no of flower per cluster and better quality in fruit.

Prema *et al.,* (2011) evaluated six genotypes (Tomy Toe, Stupice Harry, Red Pear, Portland Pink, Broad Ripper and EC-1) of cherry tomato for growth, yield, and quality attributes and observed that Early flower, early fruiting, higher no of flower and higher yield but fruit quality reduce in Broad Riper. While harry red give late fruiting, late flowering, and less yield, but fruit quality is better than other cultivars.

Abdolai *et al.,* (2012) studied the effect of shoot pruning on quality and quantity of Semi-determinate Tomato, the Parameters under study were shoot pruning (single branch pruning, double branch pruning, pyramidal pruning and control) and flower thinning (Cluster with 4 and 5 remained flowers and control) and observed that Yields from pyramidal pruning and cluster thinning with 5 remaining flowers were significantly higher than other treatments and qualitative study identified that pyramidal pruning increases vitamin C in fruits, but no significant effect on total soluble solids.

Islam *et al.,* (2012) while conducting genetic variability studies with 11 cherry tomato lines at Chittagong during rabi 2003-2004 observed, less number of days to first flowering, less no of days to first fruiting and highest no of fruit per plant in the variety CH157, while, the highest number of days to flowering, highest no of fruit per cluster and better yield per plant in CLNI5554.

Sumathi *et al.,* (2013) evaluated the performance of 24 tomato genotypes under the polyhouse and open condition for yield characters and observed that earlier flowering, earlier fruiting, and fruit quality in portland genotype under protected cultivation.

Razzak *et al*., (2013) conducted an experiment in the greenhouse on a response of cherry tomato to pruning systems and irrigation rates and reported that one branch pruning produced the tallest Plants. Wahundeniya *et al.* (2013) also evaluated 15 tomato varieties under control environment condition for growth and yield performance and observed highest plant height, no of fruit per plant and higher yield in Alhambra F1.

Elias and Damba (2013) studied the influence of training and pruning on growth and yield of tomato and reported that pruning affected plant height negatively and unstaked- unpruned plants were significantly higher than unstaked-pruned and staked -pruned plants.

Harmanjeet *et al.,* (2013) studied spacing and pruning on growth characteristics and yield under protected cultivation. Plants spaced at 70 × 60 cm with 3 stems pruning had a higher number of nodes per plant, number of fruits per plant, fruit weight.

Khoshkam *et al., (*2014) studied the impact of different plant training systems on quantitative and qualitative parameters of greenhouse tomato cultivars and reported that qualitative and quantitative characteristics of fruit in salomy cultivars two, branch training method give a much better growth and yield as compare other treatments.

Khairul *et al.,* (2015) carried out an experiment on stem pruning in tomato. Where the treatment details were P0=No pruning; P1=One stem pruning; P2=Two stem pruning and P3=Three stem pruning and Concluded that three stem pruning gives the highest yield and cost-benefit ratio (3:72).

Pathirana *et al*., (2016) studied three levels of cluster pruning and canopy management namely; pruning and fruit thinning, pruning with thinning up to 2 fruit per cluster and 5 fruit clusters per plant, pruning with thinning up to 5 fruit per cluster and 5 fruit cluster per plant and observed that pruning with thinning up to 3 fruit per cluster and 5 fruit cluster per plant yield highest shoot length and larger fruit compared with others.

Alam *et al*., (2017) studied three staking and four level of pruning methods namely; staked on inverted „V" shaped staking, high platform and string and two stem pruning, three stem pruning, four stem pruning and no pruning and observed that string staking with four stem pruning methods give highest total number of fruits per plant (37.1), marketable fruits per plant (33.7), yield per plant (1.68 kg) and total yield (44.6 t/ha) and highest fruit set (43.50%) in string staking, three stem pruning and string staking, two stem pruning gave the maximum length in diameter (4.83) and weight of single fruit (53.3) as well as maximum fruit firmness (3.43kg).

Omesh *et al*., (2018) studied the growth and canopy characteristics namely; leaf area index, fruit dry weight harvest indices, main-stem node number, and fruit weight of per plant, no of internodes, and observed that maximum leaf area index optioned 11 weeks after transplanting, fruit dry weight harvest indices is 10-20gper plant, and maximum rate of main-stem node development was 0.5nodes.

Sowley and Damba (2018) studied the effect of staking, three tomato cultivars parameters which included fruit yield, plant height, and number of branches, days to flowering, number of flowers and no of fruit, dry meter, fruit yield, and concluded that staking and pruning gave clean and bigger fruit with an increase in total marketable fruit yield by weight.

3. PROPOSED RESEARCH METHODOLOGY:

Experimental site

Two experiments were conducted during the 2018 and 2019 warm seasons at the Agricultural Research Farm in Lovely Professional University, Phagwara (Punjab).

Experimental details

An experimental material for the present investigation comprises factor A: 10 varieties and factor B: canopy management practice.

Treatment details:

Factor- A-: variety combinations

Varieties	**Sources**
V1- Punjab Ratta	Punjab agriculture university
V2- Punjab Red cherry	Punjab agriculture university
V3- Leader- 211	National seed store, Jalandhar
V4- TS 15	National seed store, Jalandhar
V5- Roma VF	National seed store, Jalandhar
V6- San Marza No 3	National seed store, Jalandhar
V7- Ronaldo	National seed store, Jalandhar
V8- Wild cherry tomato	National seed store, Jalandhar
V9- Royal England	National seed store, Jalandhar
V1-0 Ayushman	National seed store, Jalandhar

Factor B -: Canopy management practice

Treatment	Practices
T1	Training and pruning
T2	Untrained and unpruned

TREATMENT COMBINATIONS:

TREATMENTS	COMBINATION
V_1T_1	Punjab Ratta + Training and pruning
V_1T_2	Punjab Ratta + No training and pruning
V_2T_1	Punjab red cherry + Training and pruning
V_2T_2	Punjab red cherry + No training and pruning
V_3T_1	Leader 211 + Training and pruning
V_3T_2	Leader 211 + No training and pruning
V_4T_1	TS 15 + Training and pruning
V_4T_2	TS 15 + No training and pruning
V_5T_1	Roma VF + Training and pruning
V_5T_2	Roma VF + No training and pruning
V_6T_1	San Marza No 3 + Training and pruning
V_6T_2	San Marza No 3 + No training and pruning
V_7T_1	Ronaldo + Training and pruning
V_7T_2	Ronaldo + No training and pruning
V_8T_1	Wild cherry tomato + Training and pruning
V_8T_2	Wild cherry tomato + No training and pruning
V_9T_1	Royal England + Training and pruning
V_9T_2	Royal England + No training and pruning
$V_{10}T_1$	Ayushman + Training and pruning
$V_{10}T_2$	Ayushman + No training and pruning

OBSERVATIONS TO BE RECORDED:

A. Growth parameter:

Plant height (30, 45, 60 and Last Harvesting)

No of leaf per plant (30, 45, 60 and Last Harvesting)

Days to first flowering

Days to 50% flowering

No of flowers per cluster

Days to first fruiting

Days to first harvesting

B. Yield parameters

No of fruit per cluster

No of fruit per plant

Fruit length (cm)

Fruit diameter (cm)

Fruit weight (g)

Fruit weight per plant (kg)

Yield per plot (kg)

Yield per hectare (q)

C. Quality parameters

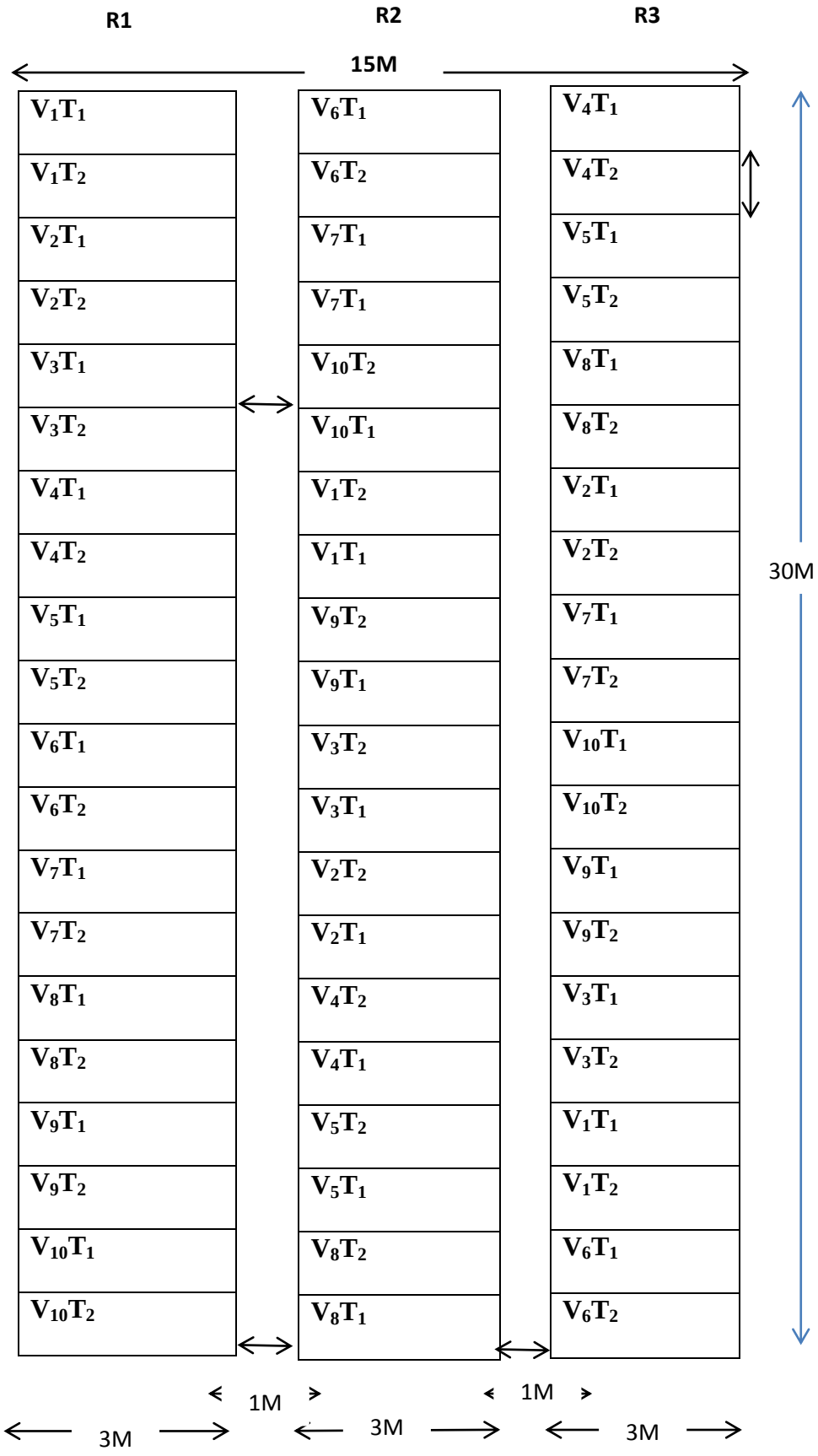
TSS (total soluble solids)

Ascorbic acid (mg)

Acidity (%)

Lycopene

The Layout of the field -:



Expected research outcome:

Through this research, the effect of Canopy regulation practices in tomato varieties will be known and the best practices for better growth and development of the plant and thereby higher yield of better quality fruit will be obtained.

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