Original Research Article

Effect of pruning on economics of production of indeterminate variety of tomato (*Lycopersicon Esculentum* Mill.) in polyhouse

ABSTRACT

An experiment was conducted at the Department of Vegetable Science, CSAUAT- Kanpur, India, to investigate the role of plant spacing and pruning in the production economics of ~~production~~ of an indeterminate variety (NS4266) ~~-~~of tomato in polyhouse rabi season 2023. ~~The variety under observation is NS4266 .~~Although cultivation under polyhouse condition is a capital intensive process, ~~, but~~ it is also highly remunerative. The experiment was~~is~~ conducted in randomized block design with four treatments and four replications. Pruning under single stem ~~is~~ was better than~~st over~~ all the other tested treatments, beeing ~~and is~~ comparative to double stem and triple stem pruning methods in some cases. Single stem has prolonged market period and is highly sustainable in nature.

Keywords- Economics; ~~Cost of~~ Cutivation Cost;Variable Cost; ~~Pruning etc.~~

INTRODUCTION:

India is the fifth largest producer of t~~T~~omato (*Solanum lycopersicum* L.) worldwide, with an area of 850 (000' ha) and production of 20819 (000'MT) respectively **(NHB, First Advance estimate 2023-2024).** Indeterminate varieties~~y~~ have vigorous growth habit due to which management of plant foliage is very difficult.The in the research is present management tactics are not efficient to harness the full potential of polyhouse cultivation**.[5,6,7].**~~As we know t~~The adoption of protected cultivation will continue to ~~is~~ increas~~e~~ing in coming years to fulfill the needs of growing population. However, ~~, but~~ it is still challenging among small~~holders~~ farmers who use dome shaped structures, with ~~a~~ limited resources ~~;~~ for growing indeterminate tomato varieties~~y~~ **(Alam et al., 2016)**~~.~~. The yield of tomatoes does not reach to

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its full potential due to poor management -, which is caused by the highly-intensive nature of thesesethese systems. Therefore several management practices have been developed that aim to improve the yield by enhancing the fruit number -, the fruit size and the quality of the fruit **(Maboko and du Plooy 2008).[1,2,3,4].**Stem training has been identified as one of the most important horticultural practices that is used to increase tomatothe yield and improve the fruit quality **(Ara et al.,2017).**

The ultimate objective of this study was to estimate the production economics of production in polyhouse of the while cultivation of a indeterminate tomato variety (NS4266) of tomatousing several pruning methods under pruning condition.**[12]**.

MATERIAL & METHODS

The present investigation entitled "**Effect of pruning on economics of production of indeterminate variety of tomato (*Lycopersicon Esculentum* Mill.) in polyhouse**" iswas conducted during Rabi season of 2023 at Vegetable Research Farm –, Department of Vegetable Science –, Chandra Shekhar Azad University of Agriculture and Technology –, Kalyanpur, Kanpur, India. The gGeographical location of the experiment lies between the gangetic plains of Central UP, its . It lies in a latitude and longitude ranges between 25.28^{0} to28.50^{0} north and 79.31^{0} to 84.34^{0} east, with an at elevation of 125.90m above mean sea level –. Kanpur is cCharacterized by sub-tropical climate with hot dry summer and cold winters, with .The rainfall ofis about 800-880mm.The major major portion of rain is received from the North East monsoon –. The maximum temperature ranges from 24 to 46^{0}C and with minimum 7.0 to 24.8^{o}C with relative humidity from 32 to 98% in different months of the year

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.The soil of the experimental site is sandy loam with average fertility before sowing and fertilizer application. The plot size is 32 x 6 m which is further divided into sub-plots of 7.7 x .75 m having 30 cm distance between the beds~~.~~. Total no of sub-plots are 16 in number .Planting of nursery is done at 25 days of old seedling on raised bed of 10 cm.It should be planted at .50 m distance within the rows planted on both sides of the beds. It ha~~d~~s four treatment and four replication arrange in randomized block design. ~~.~~The four treatments are single stem ,double stem , triple stem and control.The pruning is performed at 10 days interval and staking of 20-25 days after transplanting .Staking is also performed after 30 days after transplanting and continues at regular intervals till the harvest of final fruiting .Lowering of plant is another practice which is done at some interval when plant has attained a height of 10 feet such all the fruit are coming on the upper shoot so ,to bring fruiting braches in the reach of picker it is necessary task. Deleafing is also done at later stage ,it is process in which all the leaf from plant is removed keeping only 1.5m of the shoot from the upper side.The basic reason behind this practice is to make availability of nutrient and space for the fruiting branches. All the data is recorded at regular intervals of time and finally economics of production was~~is~~ calculated.

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~~RESULT AND DISCUSSION~~

~~Effect of pruning on economics of production of indeterminate variety of tomato (*Lycopersicon Esculentum* Mill.) in polyhouse are as under following:~~

Production e~~E~~conomics~~-~~

Total cost of cultivation can be calculated on the basis of cost of inputs used. Gross monetary returns are calculated by multiplying the dry fruit yield per hectare (q) with existing market

price of chilli. Net monetary returns were calculated by deducting the cost of cultivation from gross returns for each treatments-. Benefit cost was calculated by using the formula . \

With a view to work out the validity of each treatment-, economics was calculated taking the consideration the expenses in each operation. The following aspects of economics were studied. [8]

Fixed costs or overhead cost-

Such cost does not change in magnitude as the amount of the production process changes and are incurred when production is not under taken. These are Sunk cost and may cash or noncash fixed costs .The examples of fixed cash cost are Land taxes, Interest, Insurance premium, annually hired labour etc.Whereas the non-cash fixed costs are depreciation on capital investment,cost of family labour and costs of management, machinery equipment, interest on capital management.

Variable cost or Prime cost-

It is the cost of using the variable inputs. Such variable inputs are directly related to the production. Eexamples of variable cost of of seed, feed, fertilizers, water,labour hired occasionally, interest on current investment, current repair replacement, diesel etc. Here expenses are the function of farm output.

Farming Expenses= f(farm output)

It means higher the production ,higher will be the variable cost .Variable cost is also known as Prime cost or special cost or direct cost.

Implicit and Explicit cost-

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Implicit cost is the money value of those inputs which are supplied by the farmer himself. Whereas Explicit cost is the actual money expenses directly incurred in raising a farm commodity and monetary estimate of implicit cost .Explicit cost is also known as ccounting cost .

Economic Cost = Accounting (Explicit) cost + Implicit Cost

Opportunity Cost or Social /Alternative Cost-The farm resources have normally a number of alternatives uses .For example a farmer raise paddy on his farm instead of maize ,it means the farmer utilizes the other opportunity by giving up the first alternative .Here the social cost of raising paddy will be the amount of maize sacrificed as opportunity cost or alternative cost.

Cost elements

The different elements but broadly two categoriesviz-

Fixed cost and variable cost .The cost element are derived from these two costs.

(1)Total cost(TC)-

TC = total Fixed Cost + Total Variable Cost

TFC + TVC $\Longrightarrow$ TC = FC + VC

In the beginning total prodiction cost is lower but increases gradually. When total cost is less than the Gross Income at the farm,The profit will be maximum.

(2)Average Total Cost/Average Total Unit Cost-

Average Total cost (ATC) or Average total unit cost (ATUC) is also known as simply Average Cost(AC).

A.C. or ATC/ATUC = TC/Output(Q)

ATC is called unit of production.

(3)Total Fixed Cost (AFC or FC)

(4)Average Fixed Cost (AFC)-

$$AFC = TC/Output(Q) = FC/Q$$

Fixed cost per unit production is called Average Fexed cost .

(5)Total Variable cost (TVC or VC)-

It is also called Prime cost Special Cost Direct Cost.

(6)Average Variable Cost (AVC)-

$$AVC = TVC/Unit\ of\ Output\ (Q) = VC/Q$$

The variable cost per unit production is called AVC.

(6)Marginal Cost(MC)-

$$MC = increase\ in\ variable\ cost\ /increase\ in\ Output = VC/Q$$

The additional increase in variable cost with the additional cost .Marginal Fixed Cost is always zero because fixed cost does not change with the change in output.Therefore Marginal Cost is necessarily marginal Variable cost and the change in fixed cost (FC) will not affect marginal cost (MC) .For example .the cost of producing few more vegetable by farming a given amount of land more intensively is not affected by the amount of rent for the fixed amout of land .Marginal Cost (MC) is independent of the size of fixed cost.

Cost of Cultivation(Rs,ha^{-1}) –

Cost of cultivation was calculated in two steps–. Firstly as the cost of common to all the treatment and secondly as the variable cost under different treatment, sum of these two were taken as the total cost of cultivation for different treatments.[9]

Gross income (Rs,ha^{-1}) –

The treatment wise gross profit was calculated by multiplying the seed and stover yield ha^{-1} with the prevailing market prices of the seed and stover.

Net returns (Rs.) - The relative figure of cost of cultivation for each treatment were deducted from gross profit of the corresponding treatments. It is expressed in following formula:[10]

B:C Ratio = Net Returns hectare^{-1}(Rs.) / Cost of Cultivation hectare $^{-1}$(Rs.)

Table 1. Cultivation cost of indeterminate variety of Tomato in polyhouse (area-192sqm)

S.No.	Particulars	Unit	Rate(Rs)	Rs(Total)
1.	**Land Preparation**			
(a)	Ploughing by Power tiller	1h	350/h	350
(b)	Bed preparation	2 Labour	250/day	500
(c)	Drip Laying	2	250	500
(d)	Mulch Laying	2	250	500
2.	**Cost of Seed**	4g	63.8	255.2
3.	Nursery Raising Charges + Cost of	1 Labour	250 + additional Charges(300+335+320+200)	1405

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What is 192sqm? Do you mean 192 m^2?
The table should include the costs and profits for all the 4 tested pruning treatments, adding additional columns

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	media and protrays			
4.	**Plant protection at time nursery raising**			
(a)	Captain	.2g/100 seed	650/kg	.13
(b)	Copperoxychloride	1.2g	800/kg	.96
(c)	N:P:K(19:19:19)	.4g	142/kg	.058
(d)	Acephate	.15g	125/kg	.018
(e)	Imidacloprid	.006g	1099/l	.006594
4.	**Manure and Fertilizer**			
(a)	FYM	1905kg	1/kg	1905
(b)	N:P:K(19:19:19)	200g	142/kg(10times in 150days)	284
(c)	Nitrogen(46:0:0)	220g	130/kg(10times in 150days)	286
(d)	Potash(0:0:50)	280g	155/kg	434
(e)	Micronutrient mix	30g	1.076	32.28
5.	Transplanting Charges	1 labour	250/labour	250
6.	Irrigation Charges	25	100/labour	
7.	Plastic Mulching Charges	128m	4.6/m + 2 labour	1100
8.	**Plant Protection**			
(a)	Fungicide	10g	529/kg	5.29
(b)	Cost of Application	250	1labour (2times)	500

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9.	Staking Charges	10	125/day	1250
10.	Pruning Charges	24	125/day(payable @ of 4 hours day)	3000
11.	Picking Charge	7	125/day	875
12.	Miscellaneous			5000
	Total			**18,432.942**

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Table2: Cost of Cultivation gross and net returns (Rs.ha^{-1}) and benefit cost ratio of tomato

TREATMENT	**Cost of cultivation**	**Rs.ha^{-1} Gross income**	**Net income**	**B:C Ratio**
T_1	3115	5633.2	2518.2	.8083
T_2	3800	8678	4878	1.283
T_3	3348	6950	3627	1.083
T_4	3276.8	6546.8	3270	.9979

Fig1 Bar graph showing cost cultivation, gross and net income, B:C ratio

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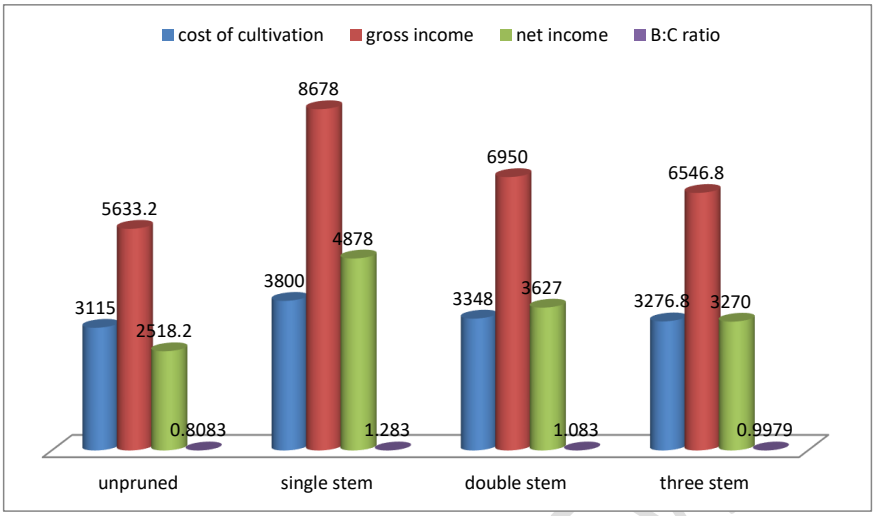
The Figure caption should be putted bellow the figure
The figure (or table) should be mentioned previously in the text

The experiments had 4 repetitions, which is good because it allows statistical calculations. For fruit production (and respective market yield) ANOVA should be carried out, followed by separation of means with a post hoc test (Duncan or other). These statistical calculations would make it possible to say, without a doubt, which method(s) were the most interesting and whether there were statistical differences from the other studied methods. In this case, you can only say that the T2 method is numerically larger.



Conclusion-

Upruned system tomato has wide foliage growth which prevent the penetration of sunlight into the canopy and thus reduce the rate of ~~photosysthesis~~photosynthesis~~.~~. Lack of nutrient and space is the main reason behind the low yield in case of unpruned system [11].yield in other systems are somehow comparable but single stem system out~~form~~performed all two other method of pruning as it take less labour and management cost is less. The quality of fruit in term of fruit weight ,TSS, moisture content ,appearance ~~altogather~~altogether get enhanced as compared to all methods. The qualitative and quantitative aspect of single stem system was~~is~~ better than both other systems in the tested conditions of the experimental field, considering the indeterminate tomato variety NS4266 ~~.~~so it ~~posses~~possess slightly high B:C ratio ~~as~~ in comparison with the ~~ed to~~ other tested pruning systems.

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