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Effect of Pruning on Economics of Production of Indeterminate Variety of Tomato (*Lycopersicon esculentum* Mill.) in Polyhouse

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Authors' contributions

This work was carried out in collaboration among all authors. Authors AY, DPS, RBS, R, MKD, SM, UPS, AKM, AR and VPD reviewed and edited the manuscript. Authors UPS, AKM, AR, VPS provided the technical expertise to improve the article. Authors AY, MKD, SM performed the experiments and analysis. All authors read and approved the final manuscript.

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ABSTRACT

An experiment was conducted at the Department of Vegetable Science, CSAUAT- Kanpur to investigate the role of plant spacing and pruning in economics of production of indeterminate variety of tomato in polyhouse rabi season 2023-2024.The variety under observation is NS4266 .Although cultivation under polyhouse condition is capital intensive process but it is also highly remunerative. The experiment is conducted in randomized block design with four treatment and four replication. Pruning under single stem is best over all the other treatments and is comparative to double stem and triple stem in some cases. Single stem has prolonged market period and highly sustainable in nature.

Keywords: Economics; cost of cutivation; variable cost; pruning etc.

1. INTRODUCTION

India is the fifth largest producer of Tomato with an area of 850 (000' ha) and production of 208.19 (000'MT) respectively (NHB, First Advance estimate 2023-2024). Indeterminate variety have vigorous growth habit due to which management of plant foliage is very difficult. The present management tactics are not efficient to harness the full potential of polyhouse cultivation [1-3]. As we know the adoption protected cultivation is increasing in coming years to fulfill the needs of growing population but it is still challenging among smallholders farmers who use dome shaped with a limited resources; for growing indeterminate variety (Alam et al.,2016). The yield of tomatoes does not reach to its full potential due to poor management , which is caused by the highly-intensive nature of thsese 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). [4-7]. Stem training has been identified as one of the most important horticultural practices that is used to increase the yield and improve the fruit quality (Ara et al.,2017). The ultimate objective of this study to estimate the economics of production in polyhouse while cultivation of indeterminate variety of tomato under pruning condition [8]

2. MATERIALS AND METHODS

The present investigation entitled “Effect of pruning on economics of production of indeterminate variety of tomato (*Lycopersicon Esculentum* Mill.) in polyhouse” is conducted during Rabi season of 2023-24 at Vegetable Research Farm Department of Vegetable Science Chandra Shekhar Azad University of Agriculture and Technology Kalyanpur, Kanpur. Geographical experiment lies between the gangetic plains of Central UP. 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 at elevation of 125.90m above mean sea level .Kanpur is Characterized by sub-tropical climate with hot dry summer and cold winters .The rainfall is 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 .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 8 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 has 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 is calculated.

3. RESULTS AND DISCUSSION

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

3.1 Economics

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 Tomato. 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 [9].

3.2 Fixed Costs or Overhead Cost

Such cost does not cange 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.

3.3 Variable Cost or Prime Cost

It is the cost of using the variable inputs. Such variable inputs are directly related to the production. examples of variable cost 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.

3.4 Implicit and Explicit Cost

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.

3.5 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)

Average Fixed Cost (AFC)-

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

Fixed cost per unit production is called Average Fexed cost.

(4) Total Variable Cost (TVC or VC)-

It is also called Prime cost Special Cost Direct Cost.

(5) 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 amount of land. Marginal Cost (MC) is independent of the size of fixed cost.

3.6 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.[10]

3.7 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:[11]

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

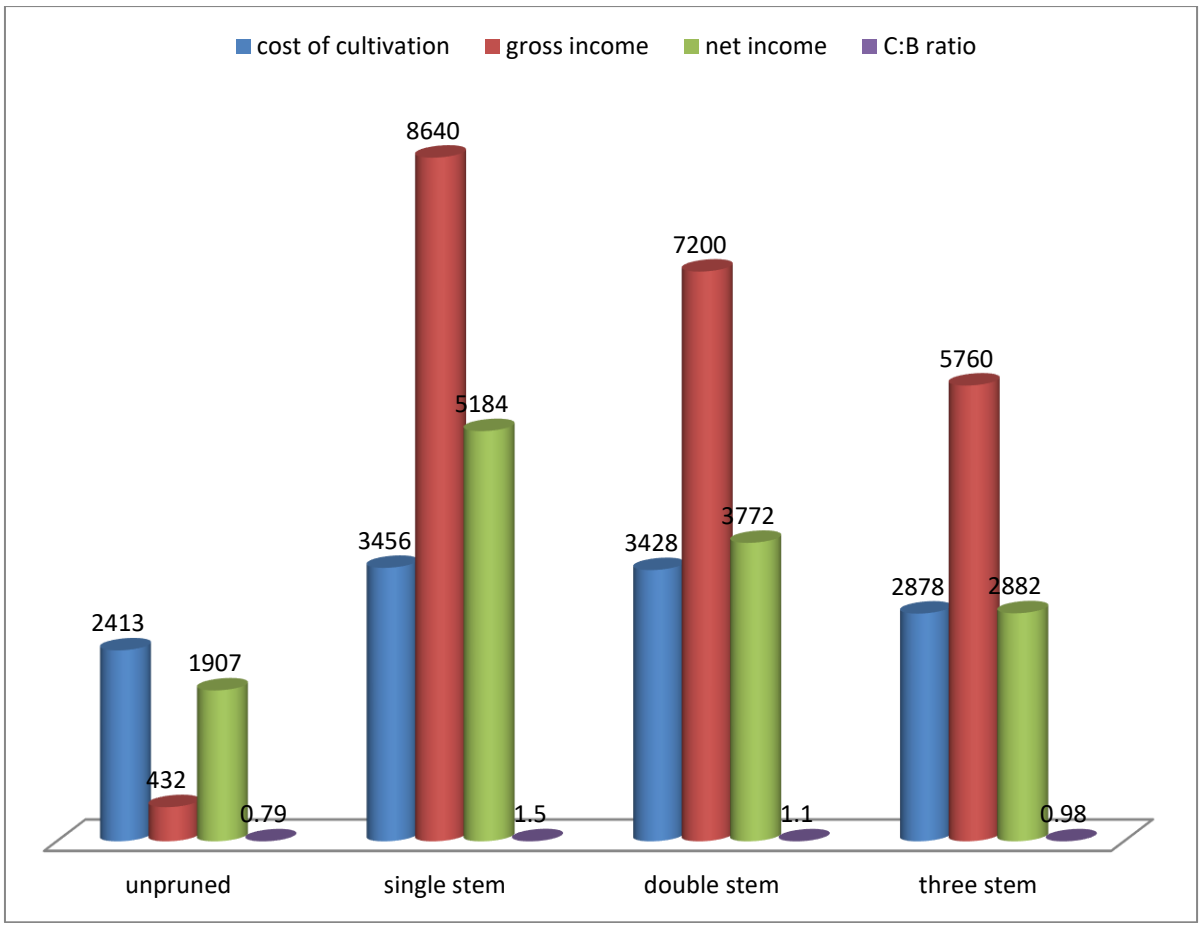

Fig. 1. Graph of C:B ratio

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

S. No.	Particulars	Unit	Rate(Rs)	Rs/192sqm (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 media and protrays	1 Labour	250 + additional Charges(300+335+320+200)	1405
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	1500kg	1/kg	1500
(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	2times	1labour (250)	500
9.	Staking Charges	5	125/day	625
10.	Pruning Charges	15	125/day(payable @ of 4 hours day)	1875
11.	Picking Charge	7	125/day	875
12.	Fixed charges	17500	(Polyhouse+Drip)	17500
13.	Miscellaneous			1000
	Total			29776.77

Table 2. Cost of cultivation gross and net returns (Rs. ha^{-1}) and benefit cost ratio of tomato

		Rs./192sqm		
Treatment	**Cost of cultivation**	**Gross income**	**Net income**	**C: B Ratio**
T_1	2413	4320	1907	0.79
T_2	3456	8640	5184	1.50
T_3	3428	7200	3772	1.10
T_4	2878	5760	2882	0.98

4. CONCLUSION

Upruned system tomato has wide foliage growth which prevent the penetration of sunlight into the canopy and thus reduce the rate of photosysthesis .Lack of nutrient and space is the main reason behind the low yield in case of unpruned system [12].yield in other systems are somehow comparable but single stem system out 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 get enhanced as compared to all methods. The qualitative and quantitative aspect of single stem system is better than both other system .so it posses slightly high B:C ratio as compared to other systems.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Bitala MF. The effect of pruning on growth and yield of tomato. Special Project Repot. SUA, Morogoro.Tanzania. 2001;46.
2. Singh Praveen Kumar, Hussain Zakir. Pusa tomato (Protected)-1:New promising tomato variety for protected cultivation; 2022.
Available:https://www.researchgate.net/publication/362469657
3. Rana N, Kumar M, Walia A, Sharma S. Tomato fruit quality under protected environment and open field conditions .International Journal of Bio-resource and Stress Management. 2014;5(3):422-426.
4. Snyder RG. 2007. Greenhouse tomato. Handbook. Mississippi state Ext, Ser, Bul. P1828; 2011.
Available:http://msucares.com/pubs/publication/p1828.htm
5. Kanyomeka L, Shivute B. Influence of pruning on tomato production under controlled ecvironments. Agicult Trop Subtrop. 2005;38(2):79-83.
6. Navarrete M, Jeannequin B, Sebillotte M. Vigour of greenhouse tomato plants (*Lycopersicon Esculentum* Mill.) analysis of the criteria used by growers and search for objective criteria. J Hortic Sci. 1997;72: 821-829.
7. Ara N, Bashar MK, Begum S, kakon SS. Effect of spacing and stem pruning on the growth and yiels of tomato. Int. J. Sustain.Crop Production. 2007;2(3):3535-39.
8. Sowley ENK, Damba Y. Influence of staking and pruning on growth and yield of tomato in the guinea savannah zone of Ghana. International Journal of Scientific and technology Research. 2013;2.
9. Prakash HG, Singh Sanjeev Kumar. Practical Manual of M.Sc.(Horticulture) – vegetable Science on vegetable crop. 2001;12-13.
10. Kafi Abdillah Hil, Zahidul KM, Professor Islam, Tseen Nabila. Report on cost of production; 2022.
DOI: 10.13140/RG.2.2.35104.87044
11. Stoenoiu Carmen. Comparative analysis for estimating production costs.Annual session of scientific Papers IMT ORADE A; 2018.
DOI: http://doi.org/10.1051/matecconf/201818404004.
12. Lamptey S, Koomson E. The role of staking and pruning methods on yield and profitability of tomato (*Lycopersicon Esculentum* Mill.) production in the Guinea Savanna Zone of Ghana. Advances in Agriculture; 2021.
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