RESEARCH ARTICLE

ASSESS THE EFFECT OF DIFFERENT DATES OF TRANSPLANTING AND MULCHING ON YIELD AND ECONOMICS OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL.)

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Abstract: The present study was conducted during two consecutive Rabi seasons of 2016-17 and 2017-18 with aim to find out the effect of transplanting dates and mulching on fruit yield, yield parameters and economics of treatments of tomato cv. Azad T-6. The study was consisted four different dates of transplanting (D_1-15th October, D_2-31st October, D_3-15th November and D_4-30th November) and four treatments of mulch (M_1-Black polyethylene, M_2- White polyethylene, M_3- Bio Mulch (Paddy straw) and M_4-control) the experiments were laid out in Factorial Randomized Block Design. The study revealed that the crop transplanted on 30th October produced and mulching with bio mulch paddy straw produced maximum number of fruits per plant, average fruit weight and marketable fruit yield and Un-marketable fruit total yield during both the years, respectively. The crop planted on 30th October and application of bio-mulch found economic as compared to other treatments. Maximum benefit cost ratio was calculated with crop planted on 30th October and grown with bio mulch during both the years.

Keywords: Tomato. Different dates of planting, Mulching, Fruit yield, Net return

INTRODUCTION

It is one of the most popular and widely cultivated vegetable throughout the world and ranking second in importance after potato in many countries including India. The total area of world in tomato under cultivation is 4.78 m ha and total production is 177.04 m tones with 37.00 tones / ha productivity (Anonymous, 2016). In India, total area is 0.77 m ha and production is 18.73 m tones with 19.5 tones / ha productivity (Anonymous, 2016), which is very low as compared to average productivity at world level.

For the cultivation of tomato the various cultural practices followed, planting time is one of the most important factors that greatly influence its growth and yield. There is a wide range of planting time, which may affect its yield and quality due to varying climatic conditions at different stages of crop. The variation in planting time also affects the plant vigour and spread, which further affect the yield and quality of fruits. If planting time coincides with optimum ecological conditions for better germination, it may lead to better development of plants and ultimately higher yield of good quality fruits. Temperature and light intensity played a vital role in tomato plant growth, fruit set and shape of the fruits. The crop is sensitive to low and high temperature. At transplanting, low temperature leads to poor stand of crop, whereas, high temperature above 35°C affects fruit set and other important quality characteristics.

In North Indian plains and hills, transplanting of seedlings has generally done from November to February. Cold winter and danger of frost are the main hindrances in getting an early spring summer crop. In Haryana, the crop has limited period of growth from December to mid May because higher temperature during the end of May interferes with fruit set due to excessive flower drop. It has become very essential to find out the optimum date of transplanting so that the plants may be exposed to most conducive atmosphere during their growth period for fruit set and higher total yield.

Mulching is a most advantageous practice to conserve the soil moisture, organic matter to the soil where plant wastes used of mulch. Mulching tomato crops has been studied in sub-humid areas with clayey soils in India; in that environment the application of straw mulch increased tomato yields by 30% compared to un-mulched controls (Shrivastava *et al.,* 1994). A similar experiment in another sub-humid Indian region with finely textured soils found that rice straw mulch positively affects barley yields. Experiments from other countries in East Africa report similar results; the addition of mulch to shallow tillage systems improves soil conditions and yields of a variety of crops (Baijukya et al., 2006). To ensure the moisture supply mulch should be applied before the end of rainfall. This practice may increase the infiltration of rainwater and suppress the growth of weeds. Planting time also can play a vital role in producing tomato in winter season.

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MATERIALS AND METHODS

The treatment combinations consist of different dates of transplanting and types of mulches. The study was consisted for four different dates of transplanting (D_1-15th October, D_2-31st October, D_3-15th November and D_4-30th November) and four treatments of mulches (M_1-Black polyethylene, M_2- White polyethylene, M_3- Bio-Mulch (Paddy straw) and M_4-control) the experiments were laid out in Factorial Randomized Block Design.

RESULTS AND DISCUSSION

The marketable fruit yield, un-marketable and total fruit yield per hectare was influenced significantly by different planting dates (Table 1.0). The crop transplanted on 30th October produced the maximum marketable fruit yield (306.10 and 314.18 q ha^{-1}), un-marketable fruit yield (34.00 and 34.90 q ha^{-1}) and total yield (340.11 and 349.08 q ha^{-1}) as compared to late planted crop, which might be due to the availability of long period for vegetative growth and reproduction in early planted crop, as the plants accumulated more assimilates. In late transplanted crop, the temperature at flowering stage exceeded 35ºC, which impaired fruit set in tomato due to elongation of style, poor pollen production, poor pollen germination, slow pollen tube growth, lack of anthers dehiscence due to absence of endothesium layer and lack of pollination and fertilization, which led to poor fruit set and finally lower fruit yield. The results of present study confirm the findings of earlier research workers (SKadam *et al*., 1991; Hooda *et al*., 1999; Peyvast *et al*., 2001; Singh and Kumar, 2005; Singh *et al*., 2005; Hossain *et al*., 2014).

The marketable fruit yield, un-marketable and total fruit per hectare were influenced significantly by different treatments of mulch during both the years (Table 1.0).

The crop grown with bio mulch produced the maximum marketable fruit yield (295.69 and 303.54 q ha^{-1}), un-marketable fruit yield (32.85 and 33.72 q ha^{-1}) and total yield (328.54 and 337.26 q ha^{-1}) as compared to without mulch. The increased fruit yield with the application of bio mulch was probably associated with conservation of moisture and improved microclimate both beneath and above the soil surface. The suitable condition enhanced the plant growth and development and produced increased fruit bearing nodes compared to the control thereby, resulting in more fruits per plant. Gandhi and Bains (2006) reported that higher tomato fruit weight under straw mulch as compared to no mulch treatment. Norman *et al*. (2011) recorded the higher mean fruit weight of okra under dry grass mulch and the maximum mean fruit weight of pepper under sawdust mulch than the control. Dzomeku *et al*. (2009) indicated that straw mulch increased the fruit yield in both pepper and tomato.

Table 1. Marketable, Unmarketable and Total yield (q/ha)

S. No.	Treatment	Marketable, Unmarketable and Total yield (q/ha)					
		Marketable Yield		Unmarketable Yield		Total Yield	
Factor A	**Date of Transplanting**	**2016-17**	**2017-18**	**2016-17**	**2017-18**	**2016-17**	**2017-18**
D_1	15 October	259.29	266.17	28.80	29.60	288.10	295.74
D_2	30 October	306.10	314.18	34.00	34.90	340.11	349.08
D_3	15 November	284.02	291.70	31.55	21.40	315.58	313.10
D_4	30 November	242.36	248.90	26.92	27.65	269.28	276.55
	SE (d)	**3.83**	**5.09**	**0.78**	**0.93**	**4.18**	**5.53**
	CD (P = 0.05)	**7.83**	**10.40**	**1.61**	**1.91**	**8.54**	**11.31**
Factor B	**Mulches**						
M_1	Black Polyethylene	279.01	286.40	30.99	31.85	310.01	318.22
M_2	White Polyethylene	266.91	274.08	29.65	30.45	296.56	304.53
M_3	Bio Mulch (Paddy straw)	295.69	303.54	32.85	33.72	328.54	337.26
M_4	Control (No Mulching)	250.16	256.92	27.79	28.54	277.95	285.46
	SE (d)	**3.83**	**5.09**	**0.78**	**0.93**	**4.18**	**5.53**
	CD (P = 0.05)	**7.83**	**10.40**	**1.61**	**1.91**	**8.54**	**11.31**

Gross return

Maximum gross return (Rs. 306102.50 and 314180.00 ha^{-1}) was computed under the treatment D_2 (30 October planted) followed by D_3 (15 November) and minimum gross return ha^{-1} (Rs. 242360.00 and 248902.50) was computed under the treatment D_4 (control) respectively during both the year of experimentation.

Among, different treatments of mulches, application of bio-mulch (Paddy straw) computed maximum gross return (295692.50 and 303547.50 Rs ha^{-1}) and minimum was recorded (250162.50 and 256927.50 Rs ha^{-1}) under the treatment D_4 (control) during both the years.

Net income

The highest net return (Rs. 219385.50 ha^{-1}) was computed under the treatment D_3 (15 November) in Y_1 and (Rs 249538.00 ha^{-1}) in D_2 (30 October) during Y_2. Minimum net return (Rs. 177717.83 and 183760.50 ha^{-1}) was calculated with in the treatment D_4 control during both the year of investigation.

Among mulching treatments maximum (Rs 211050.50 and 2389.5.50 ha^{-1}) net income computed with application of bio mulch (Paddy straw) (M_3) and minimum (Rs186520.50 and 193285.50 ha^{-1}) without application of mulch (M_4) during both the years, respectively.

Table 2. Economics of different treatments

S. No.	Treatment	Economics of different treatments						
		Cost of cultivation	Gross Income (Rs/ha)		Net Income (Rs/ha)		B:C Ratio	
Factor A	Date of Transplanting		2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
D_1	15 October	64417.00	259297.50	266177.50	194655.50	201535.50	3.01	3.11
D_2	30 October	64642.00	306102.50	314180.00	211460.50	249538.00	3.73	3.86
D_3	15 November	64642.00	284027.50	291702.50	219385.50	207060.50	3.39	3.51
D_4	30 November	64642.00	242360.00	248902.50	177717.83	183760.50	2.75	2.85
	SE (d)	**156.47**	**2141.17**	**2444.46**	**2207.64**	**2403.31**	**0.17**	**0.19**
	CD (P = 0.05)	**N.S.**	**4374.06**	**4993.66**	**4509.86**	**4909.58**	**0.34**	**0.39**
Factor B	**Mulches**							
M_1	Black Polyethylene	64917.00	279017.50	286405.00	213875.50	220762.50	3.28	3.39
M_2	White Polyethylene	65142.00	266915.00	274082.50	201773.00	208940.50	3.09	3.20
M_3	Bio Mulch (Paddy straw)	64642.00	295692.50	303547.50	211050.50	238905.50	3.57	3.69
M_4	Control (No Mulching)	63642.00	250162.50	256927.50	186520.50	193285.50	2.93	3.03
	SE (d)	**156.47**	**2141.17**	**2444.46**	**2207.64**	**2403.31**	**0.17**	**0.19**
	CD (P = 0.05)	**319.65**	**4374.06**	**4993.66**	**4509.86**	**4909.58**	**0.34**	**0.39**

Benefit cost ratio

Maximum benefit cost ratio (3.73 and 3.86) was computed under the treatment D_2 (30 October) followed by D_3 (15 November) during both the years, respectively. The minimum benefit cost ratio (2.75 and 2.85) was obtained under the treatment D_4 (30 November transplanting) during both the years.

Among mulches application of bio mulch (M_3) found economical with benefit cost ratio (3.57 and 3.69) and minimum (2.93 and 3.03) with M_4, without mulching during both the years, respectively.

The higher gross returns, net returns and B: C ratio with black polythene mulch which might be attributed to higher early and total yield. These results are in confirmity with the findings of Singh *et al*. (2009), Choudhary and Bhambri (2012), Bora and Babu (2014) and More *et al*. (2014).

CONCLUSION

Finally it may be concluded from the present investigation the crop planted on 30th October and application of bio-mulch found economic as compared to other treatments. Maximum benefit cost ratio was calculated with crop planted on 30th October and grown with bio-mulch during both the years.

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