

Impact of seedling age and planting time on yield performance of tomato (*Lycopersicon lycopersicum*) in upland rice (*Oryza sativa*)-based cropping system

SANJOY SAHA AND K.P. JHA

Division of Agronomy, Central Rice Research Institute, Cuttack, Orissa 753 006

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ABSTRACT

A study was conducted during the winter season of 1994–95 and 1995–96 in upland rice (*Oryza sativa* L.) fallows to evaluate the impact of seedling age and planting time on the fruit yield performance of different varieties ('BT 18', 'BT 12', 'BT 10', 'BT 2' and 'MIX ENT') of tomato (*Lycopersicon lycopersicum* Mill.). All the varieties performed well when planted early, i.e. 16 November, with 15-day-old seedlings and showed a declining trend in fruit yield and other yield-attributing characters when planted late with aged seedlings. Among the tomato varieties, a remarkably good fruit yield of 60.7 and 47.0 tonnes/ha was recorded with 'BT 18' during 1994–95 and 1995–96 respectively when planted on 16 November with 15 day-old-seedlings, followed by 'BT 12' (59.7 and 41.9 tonnes/ha during 1994–95 and 1995–96) respectively. The economics of different tomato varieties also showed the same trend. The gross return, net return and net return/ rupee invested were always recorded highest with 'BT 18', followed by 'BT 12' irrespective of seedling age and planting time.

Key words : Tomato, Rice-based cropping, Seedling age, Economics

One of the major advantages of growing tomato is its suitability for a wide range of agroclimatic conditions. The climatic condition of coastal Orissa is particularly suited for this crop, as the minimum temperature never goes down too low (below 10°C) during the winter season and frost-free situation also helps in better fruit setting. The light to heavy soil with pH 6.0–6.7 of coastal areas is also suitable for its successful cultivation. The vast upland areas of this region can effectively be

utilized for growing tomato in sequence with rice. Hence the present investigation was undertaken to study the performance of tomato varieties under different dates of planting and age of seedlings in upland rice fallows.

MATERIALS AND METHODS

The field experiment was conducted during the winter season of 1994–95 and 1995–96 at Cuttack, in a typical upland rice ecosystem with 5 varieties of tomato ('BT

18', 'BT 12', 'BT 10', 'BT 2' and 'MIX ENT') with 15- and 30-day-old seedlings in factorial randomized complete-block design. Planting was done on 16 November and 16 December during both the years. During the rainy (*kharif*) season of both the years the rice 'cv. Annada' was grown. The soil was well drained, sandy loam, having pH 6.7, organic carbon 0.5%, N 0.05% available P 9 ppm and exchangeable K 0.14 meq. The fertilizer dose used for the crop was 80, 40, and 40 kg N, P_2O_5 and K_2O /ha. Half of the N and K_2O with full dose of P_2O_5 was applied at the time of planting in bands. The rest of the N and K_2O was applied 21 days after planting, followed by earthing up and irrigation on the next day. The second earthing up was done 45 days after planting, followed by 1 light irrigation. At about 70–80 days after planting, the fruits started ripening. The harvesting was done in several pickings (4–7), depending on the varieties. Marketable tomato was harvested and the fruit weight

was recorded accordingly.

RESULTS AND DISCUSSION

Yield performance

The yield of rice was 3.28 and 3.10 tonnes/ha during the *kharif* season of 1994 and 1995 respectively.

In tomato, the maximum fruits/plant were obtained from 'BT 2' when planting was done on 16 November with 15-day-old seedlings. However, the fruit number showed a declining trend with advanced age of seedlings (30 days old) and delayed planting (16 December) irrespective of varieties (Tables 1, 2). 'BT 12' had the highest fruit weight when planting was done early with 15-day-old seedlings. There was also a declining trend in fruit weight with aged seedlings (Table 1) as well as with delayed planting (Table 2) irrespective of varieties. Further, the highest fruit yield was recorded with 'BT 18'. It was obviously due to more fruits/plant coupled with better fruit weight.

Table 1. Yield performance of tomato varieties in sequence with rice in uplands (planted on 16 November)

Variety	Fruits/plant				Weight/fruit (g)				Fruit yield (tonnes/ha)			
	1994–95		1995–96		1994–95		1995–96		1994–95		1995–96	
	*15	30	15	30	15	30	15	30	15	30	15	30
'BT 18'	41	34	34	28	75	68	73	57	60.7	40.0	47.0	37.1
'BT 12'	33	25	26	20	100	85	90	74	59.7	31.8	41.9	28.0
'BT 10'	37	32	33	23	83	70	78	61	49.9	27.8	35.5	25.0
'BT 2'	43	36	37	32	50	43	51	43	34.3	23.3	24.8	19.3
'MIX ENT'	32	27	32	21	85	75	80	60	40.8	28.8	35.8	26.1
<i>CD (P = 0.05)</i>												
Variety × seedling age	4.6		6.3		3.7		3.6		4.3		2.8	

*Seedling age in days

Table 2. Yield performance of different tomato varieties in sequence with rice in uplands (planted on 16 December)

Variety	Fruits/plant				Weight/fruit (g)				Fruit yield (tonnes/ha)			
	1994-95		1995-96		1994-95		1995-96		1994-95		1995-96	
	*15	30	15	30	15	30	15	30	15	30	15	30
'BT 18'	27	19	18	14*	54	46	40	36	32.8	20.6	21.5	18.7
'BT 12'	22	13	12	10	64	52	48	42	24.6	18.5	18.8	15.8
'BT 10'	25	17	16	12	52	40	39	28	23.7	17.0	17.6	13.5
'BT 2'	30	23	23	22	36	31	32	27	18.0	14.5	16.0	13.5
MIX ENT	24	13	16	13	46	42	38	30	20.8	15.1	16.8	12.6
<i>CD (P = 0.05)</i>												
Variety × seedling age	3.5		1.7		5.0		1.7		2.9		1.0	

*Seedling age in days

Though the variety 'BT 2' showed significantly more fruits/plant irrespective of planting date or seedling age, but due to less weight of individual fruit, the total fruit yield was ultimately lower than 'BT 18' (Tables 1, 2). It was found that the reduction in final fruit yield due to aged seedlings was about 38% and 27% during 1994-95 and 1995-96 respectively in early-planted tomato and it was 29% and 18% in late-planted tomato. The interaction effect of variety × seedling age was significant in all the cases which clearly indicated that the age of the seedlings has major impact on the yield performance of tomato irrespective of varieties. This might be due to suppressed growth of the seedlings when kept for longer periods in the seed-bed. Ultimately, they failed to recoup their growth when planted in the main field. Further the reduction in number of fruits/plant, individual fruit weight and

fruit yield in late-planted crop was mostly owing to increase in atmospheric temperature from February onwards. The vegetative growth was remarkably reduced and the fruit setting was also hindered which resulted in less fruit/plant with small fruit size irrespective of varieties. The reduction in fruit yield due to delayed planting was 51% during both the years when planting was done with 15-day-old seedlings and it was 44% and 45% during 1994-95 and 1995-96 when planting was done with 30-day-old seedlings. Due to the same reason of relatively higher temperature, the final fruit yield of different tomato varieties was lower during 1995-96 in comparison to 1994-95.

Economics

The highest gross return, net return and net return/rupee invested were recorded with 'BT 18' (Table 3). The gross return, net

Table 3. Economics of tomato varieties grown in sequence with rice in uplands (planted on 16 November)

Variety	Gross return (Rs '000/ha)				Net return (Rs '000/ha)				Net return/rupee invested			
	1994-95		1995-96		1994-95		1995-96		1994-95		1995-96	
	*15	30	15	30	15	30	15	30	15	30	15	30
'BT 18'	60.7	40.0	47.0	37.1	55.1	34.3	41.4	31.5	9.8	6.1	7.4	5.6
'BT 12'	59.7	31.8	41.9	28.0	54.1	26.2	36.3	22.4	9.7	4.7	6.5	4.40
'BT 10'	49.9	27.8	35.5	25.0	44.3	22.2	29.9	19.4	7.9	4.0	5.3	3.5
'BT 2'	34.3	23.3	24.8	19.3	28.7	17.7	19.2	13.7	5.1	3.2	3.4	2.4
'MIX ENT'	40.8	28.8	35.8	26.1	35.2	23.2	30.2	20.5	6.3	4.1	5.4	3.7

*Seedling age in days

Table 4. Economics of tomato varieties grown in sequence with rice in uplands (planted on 16 December)

Variety	Gross return (Rs '000/ha)				Net return (Rs '000/ha)				Net return/rupee invested			
	1994-95		1995-96		1994-95		1995-96		1994-95		1995-96	
	*15	30	15	30	15	30	15	30	15	30	15	30
'BT 18'	32.8	20.6	21.5	18.7	27.2	15.0	15.9	13.1	4.9	2.7	2.8	2.3
'BT 12'	24.6	18.5	18.8	15.8	19.0	12.9	13.2	10.2	3.4	2.4	2.4	1.8
'BT 10'	23.7	17.0	17.6	13.5	18.1	11.4	12.0	8.3	3.2	2.0	2.1	1.5
'BT 2'	18.0	14.5	16.0	13.5	12.4	8.9	10.4	7.9	2.2	1.6	1.9	1.4
'MIX ENT'	20.8	15.1	16.8	12.6	15.2	9.5	11.2	9.6	2.7	1.7	2.0	1.7

*Seedling age in days

Cost of cultivation, Rs 5,600/ha; price of tomato, Rs 1,000/tonne

return and net return/rupee invested were remarkably reduced when planting was done with aged seedlings (30 days old) as well as on 16 December in all the varieties (Tables 3, 4). Jha *et al.* (1996) also got the similar information from rice-tomato sequence.

Among the varieties, 'BT 18' and 'BT 12' were found most promising ones, particularly suited to the agroclimatic situation of coastal Orissa. Tomato is one of the most

profitable crops to be grown in uplands of coastal Orissa. Thus, a good crop of tomato could be harvested from uplands by choosing appropriate varieties with better management practices after *kharif* rice.

REFERENCE

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