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Crop-Weed Competition Studies in Tomato (*Lycopersicon esculentum*) under Mid-Hills of North-West Himalayas

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ABSTRACT

The highest values of all yield attributes were recorded under the plots kept weed-free upto harvest and minimum in the plots which remained weedy upto harvest. Weed dry weight and weed competition index increased with the increase in the duration of weedy period and decreased with the increase in duration of weed-free condition. Weed-free conditions beyonçl 45 days after transplanting could not bring significant improvement in fruit yield of tomato which indicated that the critical period of crop-weed competition was found to be first 45 days after transplanting.

INTRODUCTION

In North-West Himalayan region, tomato is one of the main cash crops grown during March to November as an off-season vegetable which is marketed in the plains to fetch higher prices owing to its great demand and scarcity in the market. Weeds pose serious problem in its successful cultivation. Conducive agro-climatic conditions prevailing in the region, wider spacing, frequent irrigation and liberal use of fertilizers and manure encourage luxuriant weed growth. Singh and Tripathi (1988) and Singh and Singh (1992) have reported reduction in tomato yield upto 70.5% due to weeds. The magnitude of loss in tomato yield due to weeds depends upon their density, type of weeds and duration of crop-weed competition. Removing weeds manually throughout the crop season may not be beneficial and economical. Information on the critical period of crop-weed competition is essential to optimize herbicide use as well as stage of manual/mechanical weeding. Information on critical period of crop-weed competition in tomato under the agro-climatic conditions of mid-hills of North-West Himalayas is meagre. Hence, the present study was undertaken to find out the critical period of crop-weed competition in tomato.

MATERIALS AND METHODS

The field experiment was conducted during **kharif** 1999 to 2001 at experimental farm Hawalbagh (29°36'N latitude, 79°40' E longitude and 1250 m amsl). During **kharif** 2000, however, the crop failed completely due to severe infestation of diseases and insect-pests. Therefore, the data for 1999 and 2001 are presented and discussed. The soil of the experimental field was sandy loam in texture, neutral in reaction and medium in fertility status. Treatments consisted of weed-free initially upto 15, 30, 45, 60, 75 days after transplanting (DAT) and upto harvest and weedy for the initial 15, 30, 45, 60, 75 days of transplanting and upto harvest. The experiment was laid out in randomized block design with three replications. Seeds of tomato variety 'Rupali' were sown in well prepared nursery beds. Thirty days old seedlings were transplanted in third week of April during both the years in the geometry of 60 x 45 cm. Twenty tonnes of FYM ha^{-1} was applied at the time of field preparation. In addition, the crop was fertilized with 100 kg N, 50 kg P_2O_5 and 50 kg K_2O ha^{-1} through urea, single super phosphate and muriate of potash, respectively. Half dose of N and full dose of phosphorus and potash were applied as basal and the remaining N was top-dressed 40 days after transplanting. Weed removal as per treatment was done with the help of local hand weeding tool '*Kutla*'. Repeated manual weeding as and when required was done to maintain weed-free conditions as per treatment. The weed dry matter from each plot was recorded by using a quadrate of 0.25 m^2. In

case of initial weed-free treatments, total dry matter accumulation of weeds was recorded only at harvest. However, in the plots kept weedy initially, weed dry weight was recorded at the end of their respective period of competition.

RESULTS AND DISCUSSION

Effect on Weeds

The major weeds in the experimental field were : *Galinsoga parviflora* (36.6%), *Ageratum conyzoides* (26.3%), *Echinochloa crusgalli* (20.2%), *Commelina benghalensis* (6.8%), *Cyperus* spp. (5.0%), *Oxalis latifolia* (3.1%) and *Eleusine indica* (2.0%). Weed dry weight was influenced markedly due to different durations of crop-weed competition. Weed dry weight decreased with increase in duration of weed-free condition, whereas the weed dry matter accumulation increased with increase in weedy duration (Table 1). The lowest weed dry weight was noted in the plots kept weed-free upto harvest and was similar to that plots kept weed-free upto 75, 60, 45 DAT and weedy till 15 DAT. This was attributed to repeated weeding. Weed dry weight increased progressively when the weedy period extended from 15 to 45 DAT due to continued dry matter accumulation in weeds. Weedy condition beyond 45 DAT till harvest produced less weed dry weight significantly.

Effect on Yield

The number of fruits plant^{-1}, fruit weight plant^{-1} and yield increased with increase in weed-free period and decreased when the weedy period extended till harvest (Table 1). However, the highest values of all yield attributes were recorded under the plots kept weed-free upto harvest. These values were statistically at par with the values obtained under weed-free upto 75, 60 and 45 DAT and weedy for the first 15 DAT which resulted in remarkable enhancement in fruit yield due to reduced crop-weed competition and better utilization of resources by the crop. Our results corroborate the findings of Nath and Sharma (2000). The minimum values of all yield attributes, however, were registered under the weedy plots till harvest due to season long crop-weed competition. Fruit weight plant^{-1} decreased significantly due to continued weedy condition till 45 DAT, which caused significant reduction in fruit yield.

Table 1. Effect of treatments on weeds and the crop

Treatment	Weed dry matter (g m^{-2})			Fruit yield (t ha^{-1})			No. of fruits plant^{-1}			Fruit weight plant^{-1} (g)		
	1999	2001	Mean	1999	2001	Mean	1999	2001	Mean	1999	2001	Mean
Weedy for the first												
15 DAT	4.5	6.3	5.4	30.6	26.1	28.4	9.5	8.0	63.4	709	652	8.8
30 DAT	85.4	98.5	92.0	23.6	20.2	21.7	7.5	6.0	56.0	547	505	6.8
45 DAT	200.6	210.8	205.7	18.6	13.5	16.0	5.5	4.4	54.6	400	336	5.0
60 DAT	215.4	230.2	222.8	18.2	12.5	15.4	5.4	4.3	54.3	385	314	4.9
75 DAT	230.2	244.5	237.4	17.8	11.3	14.6	5.2	4.2	54.1	364	283	4.7
Upto harvest	240.5	258.6	249.6	17.5	10.0	13.7	5.0	4.0	53.8	344	250	4.5
Weed-free for the first												
15 DAT	230.2	240.0	235.1	24.2	15.9	20.1	6.5	5.0	55.0	502	398	5.8
30 DAT	88.6	100.6	94.6	27.1	24.0	25.5	8.5	7.0	58.2	639	600	8.0
45 DAT	34.8	40.4	37.6	31.5	25.6	28.5	10.8	8.5	61.5	714	639	9.7
60 DAT	25.0	30.5	27.8	32.0	26.5	29.3	11.1	8.7	62.6	733	664	9.9
75 DAT	21.8	25.6	23.7	32.3	27.0	29.7	11.3	8.8	63.5	742	675	10.1
Upto harvest	0	0	0	32.6	27.3	29.9	11.5	9.0	64.0	749	683	10.3
LSD (P= 0.05)				3.8	3.6		2.2	2.0		120	140	

Reduction in fruit yield was significant only upto 45 DAT. Reduction in fruit yield with delayed weed removal was due to increased crop-weed competition. The fruit yield reduced by 5.3, 26.9, 46.9, 49.2, 52.0 and 54.9% due to uninterrupted weed growth upto 15, 30, 45, 60, 75 and at harvest, respectively, compared to the weed-free condition upto harvest, Singh and Singh (1992) and Ram *et al.* (1994) also reported yield loss upto 72.3% due to season long crop-weed competition. On the other hand, enhancement in fruit yield due to weed-free condition upto 15, 30, 45, 60, 75 DAT and at harvest compared to full season weedy condition was 49.0, 97.4, 118.0, 125.2 and 128.2%. Singh (1994) reported 38.5% yield enhancement in tomato under weed-free condition upto harvest compared to weedy check. On an average, weed competition index was maximum (54.9) when plots were kept weedy upto harvest and minimum (0) under weed-free condition remained till harvest.

Differences in fruit yield due to weed-free conditions between 45 and 60 DAT, 60 and 75 DAT and 75 DAT and upto harvest were non-significant. Maintaining weed-free conditions after 45 DAT proved unfruitful and could not produce significantly higher fruit yield than the weedy period upto harvest. Thus, first 45 DAT was the most crucial period from crop-weed competition point of view. The fruit yield was significantly reduced even if weeds were removed during the first 30 DAT. This could be because of emergence of large number of weeds which accumulated substantial dry matter and thus competed for the limited available resources.

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