

Crop-Weed Competition in Tomato *

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In a study on crop-weed competition in tomato the effect of different weed free periods was evaluated. The flora comprised mainly of seed germinating dicotyledonous and monocotyledonous weeds. Weeds almost smothered the crop in unweeded control and in the treatment where weed free condition was provided only for 15 days. Growth characters and yield attributes were adversely effected in these two treatments. Weed free environment for more than 30 days did not improve the yield of marketable fruits. The critical weed free period for tomato was upto 30 days from transplanting.

Crop-weed competition is a complex phenomenon determined by varied situations of environment. In view of the important role of environment, crop-weed competition evaluation is needed for every region. Weed control methods including chemical weed control depend on the critical weed free period of a crop. William and Warren (1975) reported that crop loss due to competition by *Cyperus rotundus* during the entire cropping season was 53 per cent in tomato and the critical period of its competition occurred between three and four weeks. The aim of this study was to evaluate the critical weed free period for tomato (Cultivar, Co. 1)

MATERIAL AND METHODS

Crop-weed competition studies were conducted in the Agronomy department of Tamil Nadu Agricultural University in two consecutive monsoon

seasons of 1975 and 1976. The following were the treatments: Unweeded control (W₀), weed free period for 15 days after transplanting (W₁), weed free period for 30 days (W₂), weed free period for 45 days (W₃), weed free period for 60 days (W₄), weed free period for 75 days (W₅), hand hoeing on 15th and 45th day and earthing up on 30th day (Farmers' method) (W₆), and hand hoeing on 15th 30th and 45th days (W₇). The soils of the experimental fields were of loam and clay loam types. The soils were analysed for fertility status and were found to be low in available nitrogen high in available phosphorus and potassium. The organic carbon content was low and the soil reaction was normal. The experimental design adopted was randomized block design with three replications. The gross plot size was 4.5 × 3.6 m and the net plot size was 4.5 × 1.8 m. The seedlings were

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planted on the sides of the ridges with a spacing of 60 × 45 cm. A basal dressing of 75 kg nitrogen, 180 kg P₂O₅ and 200 kg K₂O/ha were applied. Nitrogen at 75 kg/ha was top dressed on 30th day after transplanting. All the recommended package of practices were adopted. Data were collected on the weed flora, dry weight of weeds, leaf area of index, crop dry matter, fruit yield per plant, yield of non-marketable and marketable fruits. Fourth leaf from the tip was chosen as the

Index leaf for estimating leaf area. The leaf area was arrived at from maximum length and breadth using a factor of 0.336. The factor was worked out by correlating the sum of products of maximum length and breadth with the actual leaf area measured from the leaf area metre (model LI-3000 of Lambda Instrument Corporation) using 36 leaf samples. The fruits weighing more than 30 g were considered to be the marketable ones (Mallick, 1976).

TABLE I Weed flora of the field.

Botanical Name	Nature of weed	Weed infestation level (per cent)	
		Monsoon '75	Monsoon '76
<i>Trianthema portulacastrum</i> L.	Annual	88.8	53.3
<i>Dactyloctenium aegyptium</i> Beauv.	Annual	3.4	31.7
<i>Cyperus rotundus</i> L.	Perennial	2.9	7.6
<i>Gynandropsis pentaphylla</i> D. C.	Annual	4.9	
<i>Flaveria australasica</i> Hook	Annual		
<i>Amaranthus viridis</i> L.	Annual		
<i>Portulaca oleraceae</i> L.	Annual		
<i>Digera aevensis</i> Forsk	Annual		
<i>Euphorbia prostrata</i> Ait	Annual		
<i>Chloris barbata</i> Swartz	Annual		
<i>Echinochloa colonum</i> Link.	Annual		

RESULTS AND DISCUSSIONS

The weed flora found in the experimental fields are presented in Table I.

The most dominant weed species in the weed flora was *Trianthema portulacastrum* accounting for 88.8 and 53.3 per cent infestation during monsoon 1975 and monsoon 1976 respectively.

Dactyloctenium aegyptium ranked second with 3.4 and 31.7 per cent infestation in monsoon 1975 and 1976 respectively. *Cyperus rotundus* recorded a population of 2.9 and 7.6 per cent during the first and second year. Other weeds listed in Table I were of minor importance. It was also observed that *Euphorbia prostrata* appeared in small members in plots which received two or three weed-

ings. As such this weed was not recorded in the early stage and was observed only in the later stages, when the dominant weeds were controlled.

Dry weight of weeds :

The data on dry matter production (Table II) of weeds on 15th day showed that W_1 treatment was free from weeds and no dry matter could be estimated and the control (WO) gave a dry matter yield of 35.0 to 38.9 g/m². On 30th day W_1 gave minimum dry weight of weeds compared to WO and W_2 was free from weeds. The treatments W_1 , W_6 and W_7 gave comparable dry weights of weeds. The data on dry weight of weeds on 45th day showed that in W_1 , W_6 and W_7 weed infestation was less but in WO significantly higher dry weight of weeds was observed.

On 60th day the treatments W_2 , W_3 , W_4 , W_6 and W_7 did not produce any appreciable dry weight of weeds though there was considerable weed population in monsoon, 1975. The weeds were just germinating. During 1976, the treatments W_3 , W_6 and W_7 produced comparable dry weight of weeds. The treatment WO recorded maximum dry weight of weeds followed by W_1 . On 75th day the weed dry weight was at low level in W_2 , W_3 , W_4 , W_6 and W_7 . The treatment W_1 gave higher dry weight of weeds which was ranking next only to WO. The dry weight of weeds at various stages of crop growth was influenced by the intensity of weeding and crop growth. It was clearly

seen from the data on 60th and 75th day that lower dry matter of weeds was produced in treatments receiving higher number of weedings. The dry weight of weeds was greater under unweeded control followed by the treatment of weed free condition upto 15 days. The dry matter of weeds was low in the treatments which were weed free for 30 days and more.

Yield attributes and yield

Leaf area: The leaf area of the index leaf at different stages of crop growth on the 30th day was not influence due to any of the treatments. On 45th day, maximum leaf area was recorded by W_7 (163.8 to 177.8 cm²) which was comparable with W_6 , W_3 and W_2 in both the years. The treatments W_0 and W_1 recorded minimum leaf area in 1975 and 1976, but these treatments were on a par. There was a trend of reduced leaf area in W_0 and W_1 . W_0 continued to record minimum leaf area in 1976, though W_1 gave slightly higher value. The significant reduction in leaf area in 1976, though W_1 gave slightly higher value. The significant reduction in leaf area in W_0 and W_1 was due to weed competition for nutrients and light resulting in the production of smaller leaves

Crop dry matter

The data on dry matter production of crop on 30th day showed that it was higher in treatments W_6 and W_7 than in W_1 and W_2 . W_6

TABLE III Leaf area of index leaf and crop dry matter.

Weeding Treatments	Leaf area (Cm ²)						Crop dry matter (kg per ha)					
	30 days		45 days		60 days		30 days		45 days		60 days	
	M. '75	M. '76	M. '75	M. '76	M. '75	M. '76	M. '75	M. '76	M. '75	M. '76	M. '75	M. '76
W ₀	148.3	95.7	148.3	106.1	129.1	112.4	481	547	2041	1106	3918	2575
W ₁	170.9	106.2	152.9	105.2	154.4	130.7	468	608	2491	1783	4852	4028
W ₂	159.1	121.0	165.5	132.0	164.7	144.7	427	720	2793	1962	6860	5886
W ₃	N. I.	N. I.	174.4	131.0	150.6	143.2	N. I.	N. I.	2730	2195	7434	5926
W ₄	N. I.	N. I.	N. I.	N. I.	167.8	147.4	N. I.	N. I.	N. I.	N. I.	7522	6170
W ₅	N. I.	N. I.	N. I.	N. I.	N. I.	N. I.	N. I.	N. I.	N. I.	N. I.	N. I.	N. I.
W ₆	168.3	110.7	163.8	129.6	166.6	138.2	618	712	2599	2439	7252	6761
W ₇	159.1	114.8	177.8	137.4	169.7	144.6	561	712	2925	2307	7363	6165
S. E.	9.69	7.47	5.29	4.14	10.26	5.01	33.50	48.69	108.38	129.71	316.86	487.66
C. D.	N. S.	N. S.	16.7	13.0	N. S.	15.4	109.2	N. S.	341.5	408.6	998.2	1536.3

N. I.: Treatments not imposed.

M: Monsoon.

TABLE II Dry weight of weeds (g per m²) at 15, 30, 45, 60 and 75 days.

Weeding treatments		15 days		30 days		45 days		60 days		75 days	
		M. '75	M. '76	M. '75	M. '76	M. '75	M. '76	M. '75	M. '76	M. '75	M. '76
	T	6.3	6.0	14.5	14.1	16.6	16.6	19.7	23.5	16.9	23.3
W ₀	O	38.9	35.0	209.9	197.3	274.9	274.3	387.3	556.3	285.7	545.3
	T	1.0	1.0	4.4	4.3	4.6	12.5	9.2	19.1	10.1	21.5
W ₁	O	0	0	18.8	17.7	20.0	156.2	85.3	375.2	121.7	463.0
	T	N. I.	N. I.	N. I.	1.0	1.0	5.3	1.0	7.4	2.8	9.6
W ₂	O				0	0	27.8	0	55.3	8.3	90.5
	T	N. I.	N. I.	N. I.	N. I.	1.0	1.0	1.0	2.4	2.6	7.3
W ₃	O					0	0	0	5.0	7.1	54.3
	T	N. I.	N. I.	N. I.	N. I.	N. I.	N. I.		1.0	2.3	3.6
W ₄	O								0	5.7	12.3
	T	N. I.	N. I.	N. I.	N. I.	N. I.	N. I.	N. I.	N. I.	1.0	1.0
W ₅	O									0	0
	T	6.9	5.2	6.1	5.8	4.3	4.5	1.0	2.6	3.9	12.9
W ₆	O	47.5	32.3	36.0	33.0	17.0	19.6	0	6.3	15.3	166.9
	T	6.2	5.7	5.3	5.9	4.0	5.4	1.0	2.7	3.5	12.2
W ₇	O	37.7	32.4	27.7	33.5	15.0	28.1	0	6.7	12.8	152.4
S. E.		0.12	0.38	0.77	0.25	0.41	0.43	0.35	0.86	0.43	0.66
C. D. (T)		0.4	1.3	2.5	0.8	1.3	1.3	1.1	2.7	1.3	2.0

(P=0.05)

N. I.: Treatments were not imposed. T: Transformed values. O: Original values.

recorded a dry matter of 618 kg/ha followed by W₇ (561 kg) during monsoon season of 1975. In 1976, there was a decreasing trend in dry matter production in W₁ and W₀. On 45th day the dry matter production of the crop was at the higher level in W₇, W₂, W₃ and W₆ ranging from 2599 to 2925 kg/ha in 1975. Similar trend was seen in 1976 also with treatments W₂, W₃, W₆ and W₇: these treatments were comparable and dry matter ranged from 1783 to 2439 kg/ha. In both the years W₀ recorded significantly lower dry matter. W₁ recorded higher dry matter as compared to W₀. The data on dry matter production of

crop at 60th day revealed that the treatments W₀ and W₁ gave significantly lower dry matter yield compared to rest of the treatments. The dry matter production in W₀ was 3918 and 2575 kg/ha for 1975 and 1976 respectively. The results of crop dry matter at 30, 45 and 60 days have clearly brought out the fact that it was significantly reduced due to greater weed infestation resulting in competition for nutrients, moisture and light. The treatments which provided weed free condition for 30 days and more gave higher dry matter yield of crop. Cultural methods also gave higher dry matter yield of crops, than un-

weeded control and weed free condition for 15 days.

Single plant yield

The results on individual plant yield showed that the treatments W₂, W₇, W₆, W₄ and W₅ gave comparable yield of fruits/plant followed by W₃. The treatments of weed free condition upto 15 days (W₁) and control (W₀) gave significantly lower yield in 1975. During 1976 also W₁ and W₀ recorded lower fruit yield and other treatments were on par. The yield of single plant from unweeded control (W₀) were 0.703 and 0.593 kg for 1975 and 1976 respectively. In the case of W₁ the yields were 1.126 and 0.970 kg/plant for 1975 and 1976 respectively. The treatments with 15 days weed free condition (W₁) and unweeded control (W₀) gave lower yield per plant due to weed competition.

Non-marketable fruits

The data on non-marketable fruits revealed that the treatments W₀ and W₁ gave significantly higher yield of non-marketable fruits than the rest of the treatments. The yield of non-marketable fruits was 17.6 to 21.2 and 14.4 to 18.8 per cent of the total yield respectively for W₀ and W₁. The increased non-marketable fruits in W₀ and W₁ may be attributed to weed competition for nutrients as evidenced from reduced leaf area and dry matter which adversely affected the fruit development.

Marketable fruits

The results on the yield of marketable fruits are presented in Table IV. The data on the marketable fruit yield/ha revealed that during 1975 the treatments W₅ gave highest yield of

TABLE IV Fruit yield per plant, yield of marketable and non-marketable fruits.

Weeding treatments	Yield per plant (kg) Marketable fruits yield (t/ha)				Non-marketable yield (per cent)			
	M. '75		M. '76		M. '75		M. '76	
	T	O	T	O	T	O	T	O
W ₀	0.703	0.593	12.4	16.8	24.8	17.6	27.4	21.2
W ₁	1.126	0.970	19.4	18.6	22.3	14.4	25.6	18.8
W ₂	2.126	1.456	32.9	28.4	20.5	12.3	21.1	13.1
W ₃	1.843	1.603	35.1	29.9	20.6	12.4	20.7	12.5
W ₄	2.063	1.433	36.7	29.4	21.0	12.9	21.3	13.4
W ₅	2.053	1.530	39.7	29.9	20.0	11.8	21.2	13.1
W ₆	2.090	1.506	33.5	29.4	20.0	11.4	21.5	13.5
W ₇	2.103	1.483	36.4	30.1	20.0	11.7	21.2	14.1
SE	0.13	0.10	1.36	0.73	0.36		1.11	
CD	0.3	0.3	4.1	2.5	1.1		3.4	

(P=0.05)

T: Transformed values; O: Original values; M: Monsoon.

39.7 t/ha followed by W_4 (36.7t) and W_7 (36.4t) which were on par. The treatments W_3 , W_6 and W_2 gave yields in the order of 35.1, 33.5 and 32.9t/ha. The treatments W_1 and W_0 recorded yields of 19.4 and 12.4t/ha respectively. The yield of W_1 and W_0 was significantly lower than the rest of the treatments. In 1976 also, a similar trend was observed. The treatments W_7 , W_6 , W_3 , W_6 , W_4 and W_2 gave yield in the order of 30.1, 29.9, 29.9, 29.4 and 28.4t/ha which were comparable. The treatments W_1 and W_0 recorded significantly lower yield of 18.6 and 16.5t/ha respectively. The lower yield in W_1 and W_0 could be attributed to the weed competition from the early stage. Although there was a weed free environment for 15 days in W_1 , accomplished by one hand weeding, weed growth subsequently smothered the crop as seen from the gradual increase in number of weeds and increased dry matter of weeds at 45, 60 and 75 days. Further, weed competition under unweeded control adversely affected the normal growth and development of tomato crop resulting in reduction in dry matter production, single plant yield and increased per cent non-marketable fruits as compared to farmers method. Under the treatment of weed free condition for 15 days similar trends were seen, though to a lesser magnitude. It is also interesting to note that the treatments W_6 and W_7 gave comparable yields (33.5 to 36.4 and 29.4 to 30.1 t/ha) indicating that earthing up the crop, which is considered to be

an important inter-cultural operation, gave no additional benefit over hand hoeings. Weed free condition upto 75 days (W_5) did not result in increased yield except providing slightly better weed free condition at the harvesting stage. Improvement in yield with increased weed free condition upto 30 days was significant though there was only numerical increase of yield due to weed free condition, beyond 30 days and upto 75 days in 1975. In 1976 there was no increase in the yield of marketable fruits for the treatments which received weed free condition beyond 30 days as compared to weed free condition for 30 days. Thus from the stand point of yield of marketable fruits a weed free environment of 30 days under a spacing of 60×45 cm was found sufficient. Hence it could be seen that the critical weed free period for tomato was upto 30 days from transplanting under the spacing of 60×45 cm.

The present finding falls in line with Kasasian and Seeyave (1969) that a weed free environment upto 30 days which formed about one third of the crop duration was sufficient for higher yields of tomatoes. Bhan and Sodan Singh (1975) also found that weed free condition from 30 to 90 days had no significant effect on the yield with a spacing of 63×27 cm in tomato.

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