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Determination of Critical Period of Crop-Weed Competition in Hybrid Sunflower

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Sunflower is gaining importance due to its photo-insensitivity, short duration, low water requirement, drought tolerance and wide range of adaptability to various agro-climatic situations. Despite adoption of good management practices, the productivity of sunflower has been low. Among different production constraints that are limiting the productivity of sunflower, intensive weed competition is one of the major barriers to enhance the productivity. Sunflower, being initially slow growing crop, provides congenial environment for abundant weed growth. The loss in seed yield of sunflower due to full season of weed competition was upto 25% (Singh *et al*., 1997; Wanjari *et al*., 2000). Weed competition during entire crop season resulted in yield reduction of 55.8% (Tripathi and Vivek, 2001). Hence, the present study was conducted with an objective to determine the critical period of weed competition in sunflower.

A field experiment was conducted during **rabi,** 2004 at S.V. Agricultural College Farm, Tirupati Campus of Acharya N. G. Ranga Agricultural University, on sandy clay loam soil having pH 6.9, low in available nitrogen and medium in available phosphorus and potassium. The experiment was laid out in a randomized block design with three replications. The treatments (14) consisted of weed free condition for the first 10, 20, 30, 40, 50 and 60 DAS and weedy condition for 10, 20, 30, 40, 50 and 60 DAS alongwith weed free and weedy till harvest.

Sunflower cv. MSFH-17 was sown at 5 kg/ha seed at a spacing of 45 x 30 cm during second fortnight of November 2004. The recommended dose of 75 kg N, 90 kg P_2O_5 and 30 kg K_2O/ha was uniformly applied. The entire dose of P and K was applied as basal. N was applied in three equal splits i. e. one third as basal, one third at 30 DAS and the remaining one third at 55 DAS. Density and dry weight of weeds were periodically recorded by using two quadrates (0.5 m^2) in each plot randomly.

Weed flora of the experimental field consisted of three species of grasses, one species of sedge and six species of broad-leaved weeds. *Cyperus rotundus* was the only sedge and major weed in the experimental plot. The other predominant weed species found in the field were : *Cynodon dactylon, Commelina benghalensis, Euphorbia hirta, Celosia argentia, Leucas aspera* and *Phyllanthus niruri.*

Increased initial weed free condition led to decreased total weed density and dry weight (Table 1). Total weed density was high upto 40 DAS, due to initial slow growing habit of sunflower, which provided congenial environment for abundant weed growth and crop canopy did not cover the ground. Most of the weed species were suppressed during later stages, mainly due to smothering of late emerged weeds by crop canopy and some weeds completing their life cycle. However, highest weed density and dry weight were recorded in unweeded control. The results of present investigation are in conformity with the findings of Wanjari *et al.* (2001).

Consistent and significant reduction in the dry matter of weeds recorded with the increase in the duration of weed free condition upto harvest (Table 2). Rapid dry matter accumulation was upto 60 DAS but at harvest weed dry weight decreased. It might be due to suppression of weeds by crop canopy after 60 DAS. However, when weed free conditions were maintained for 10 or 20 days after sowing, most of the broad-leaved weeds reemerged and due to extensive underground system produced substantial dry matter.

Sunflower yield and yield attributes viz., head diameter, total and filled seeds per head and 1000-seed weight were significantly influenced due to different weed free and weedy periods. The maximum yield and yield attributes were observed in plots which were kept weed free till harvest. Harvest index was not influenced due to different weedy and weed free treatments. Similarly, oil content of sunflower did not differ significantly due to different weedy and weed free treatments, as the oil content is a genetical character (Table 3). The results are in line with the findings of Kumar *et al.* (1996) and Wanjari *et al.* (2000).

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Table 1. Weed density as influenced by weed free and weedy conditions of different intervals

Treatment	Weed density (No./m^2)						
	10 DAS	20 DAS	30 DAS	40 DAS	50 DAS	60 DAS	Harvest
T_1–Weed free condition (WFC) upto 10 DAS	0.00	26.00	36.66	42.00	46.00	60.00	51.00
	(0.71)	(5.15)	(6.09)	(6.51)	(6.82)	(7.78)	(7.17)
T_2–WFC upto 20 DAS	0.00	0.00	20.66	35.60	40.60	52.00	49.20
	(0.71)	(0.71)	(4.60)	(6.01)	(6.41)	(7.22)	(7.04)
T_3–WFC upto 30 DAS	0.00	0.00	0.00	20.60	34.60	50.00	41.34
	(0.71)	(0.71)	(0.71)	(4.60)	(5.92)	(7.25)	(6.47)
T_4–WFC upto 40 DAS	0.00	0.00	0.00	0.00	24.00	31.40	27.66
	(0.71)	(0.71)	(0.71)	(0.71)	(4.95)	(5.61)	(5.31)
T_5–WFC upto 50 DAS	0.00	0.00	0.00	0.00	0.00	30.32	24.66
	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(5.55)	(5.01)
T_6–WFC upto 60 DAS	0.00	0.00	0.00	0.00	0.00	0.00	21.22
	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(4.66)
T_7–Weed free check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)
T_8–Weed interference (WI) upto 10 DAS	36.66	0.00	0.00	0.00	0.00	0.00	0.00
	(6.09)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)
T_9–WI upto 20 DAS	40.00	62.66	0.00	0.00	0.00	0.00	0.00
	(6.36)	(7.95)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)
T_{10}–WI upto 30 DAS	44.00	67.20	78.66	0.00	0.00	0.00	0.00
	(6.67)	(8.23)	(8.89)	(0.71)	(0.71)	(0.71)	(0.71)
T_{11}–WI upto 40 DAS	44.66	68.20	88.00	94.60	0.00	0.00	0.00
	(6.72)	(8.28)	(9.39)	(9.75)	(0.71)	(0.71)	(0.71)
T_{12}–WI upto 50 DAS	48.00	72.00	88.66	98.00	161.30	0.00	0.00
	(6.92)	(8.51)	(9.44)	(9.92)	(12.72)	(0.71)	(0.71)
T_{13}–WI upto 60 DAS	48.66	74.00	98.66	103.50	171.00	195.30	0.00
	(6.97)	(8.63)	(9.96)	(10.20)	(13.09)	(13.99)	(0.71)
T_{14}–Unweeded check	48.66	80.66	110.00	112.00	180.30	197.60	178.67
	(6.97)	(9.01)	(10.51)	(10.60)	(13.74)	(14.07)	(13.38)
LSD (P=0.05)	1.71	0.56	0.89	0.63	0.76	0.79	0.65

Transformed values are given in parentheses.

Table 2. Weed dry weight as influenced by weed free and weedy conditions of different intervals

Treatment	Dry weight of weeds (g/m^2)						
	10 DAS	20 DAS	30 DAS	40 DAS	50 DAS	60 DAS	Harvest
T_1–Weed free condition (WFC) upto 10 DAS	0.00 (0.71)	6.03 (2.55)	10.30 (3.28)	18.92 (4.41)	19.24 (4.44)	22.40 (4.78)	18.45 (4.35)
T_2–WFC upto 20 DAS	0.00 (0.71)	0.00 (0.71)	3.00 (1.87)	10.71 (3.34)	15.97 (4.06)	21.12 (4.64)	18.36 (4.34)
T_3–WFC upto 30 DAS	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	3.10 (1.89)	7.07 (2.75)	16.38 (4.10)	13.69 (3.76)
T_4–WFC upto 40 DAS	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	3.95 (2.11)	9.79 (3.20)	6.60 (2.66)
T_5–WFC upto 50 DAS	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	5.89 (2.52)	4.56 (2.25)
T_6–WFC upto 60 DAS	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	4.11 (2.15)
T_7–Weed free check	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
T_8–Weed interference (WI) upto 10 DAS	10.11 (3.25)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
T_9–WI upto 20 DAS	11.66 (3.49)	13.75 (3.77)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
T_{10}–WI upto 30 DAS	11.90 (3.52)	20.11 (4.54)	24.11 (4.96)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
T_{11}–WI upto 40 DAS	12.90 (3.66)	22.03 (4.75)	26.69 (5.21)	43.84 (6.65)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
T_{12}–WI upto 50 DAS	12.97 (3.67)	22.06 (4.75)	32.17 (5.71)	43.90 (6.66)	52.17 (7.25)	0.00 (0.71)	0.00 (0.71)
T_{13}–WI upto 60 DAS	16.14 (4.07)	22.66 (4.81)	33.88 (5.86)	46.15 (6.83)	53.00 (7.31)	49.47 (7.06)	0.00 (0.71)
T_{14}–Unweeded check	21.08 (4.64)	29.65 (5.49)	33.94 (5.86)	55.28 (7.46)	58.62 (7.68)	62.67 (7.94)	54.74 (7.43)
LSD (P=0.05)	1.49	0.98	0.83	1.16	0.42	0.39	0.39

Transformed values are given in parentheses.

Table 3. Effect of different weed free and weedy periods on yield attributes and yield of sunflower

Treatment	Head diameter (cm)	Total no. of seeds/ head	1000-seed weight (g)	Seed yield (kg/ha)	Stalk yield (kg/ha)	Harvest index	Oil content (%)
T_1–WFC upto 10 DAS	13.43	732	38.06	1724	2811	38.01	34.00
T_2–WFC upto 20 DAS	13.57	794	39.04	1774	2888	38.02	34.40
T_3–WFC upto 30 DAS	13.80	865	42.00	2018	3283	38.06	35.00
T_4–WFC upto 40 DAS	15.87	1024	46.03	2478	4005	38.22	34.50
T_5–WFC upto 50 DAS	16.17	1045	46.80	2568	4133	38.32	35.30
T_6–WFC upto 60 DAS	16.53	1085	47.56	2680	4294	38.40	35.80
T_7–Weed free check	16.83	1090	48.25	2745	4347	38.70	35.30
T_8–WI upto 10 DAS	15.20	1019	44.60	2371	3838	38.18	35.10
T_9–WI upto 20 DAS	14.37	947	43.75	2296	3731	38.09	34.80
T_{10}–WI upto 30 DAS	13.70	825	41.22	2012	3274	38.06	34.50
T_{11}–WI upto 40 DAS	13.63	800	39.70	1780	2899	38.04	36.20
T_{12}–WI upto 50 DAS	13.43	722	38.62	1724	2824	37.90	35.60
T_{13}–WI upto 60 DAS	13.17	713	37.93	1692	2796	37.70	35.20
T_{14}–Unweeded check	12.70	700	37.10	1652	2721	37.70	35.40
LSD (P= 0.05)	0.98	83.00	1.50	186.00	340.00	NS	NS

NS–Not Significant.

Weedy condition during initial 40 DAS caused significant reduction in seed yield. Weed free condition upto 40 DAS and beyond caused significant increase in seed yield. Weed free condition beyond 40 DAS had no additional effect on seed yield. Seed yield was significantly reduced even though weeds were removed during the first 20 days. This might be due to re-emergence of weeds and compete with the crop for growth resources.

Response of sunflower crop with reference to varying periods of weed interference and weed free condition differed with reference to seed yield and it was clearly revealed from the present study that the critical period of weed competition was between 20 and 40 DAS.

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