

Effect of soil solarization, herbicides and cultural practices on weed control and seedling growth in chilli (*Capsicum annum* L.) nursery

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SUMMARY

An experiment was conducted during 2006 on loamy sand soil of Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar to study "Effect of soil solarization, herbicides and cultural practices on weed control and seedling growth in chilli (*Capsicum annum* L.) nursery". Treatments consisted of soil solarization (SS) with TPE (0.025 mm and 0.050 mm) and BPE (0.125 mm) for 30 days in conjunction with one hand weeding at 20 DAS; Pendimethalin @ 0.5 kg ha⁻¹. Fluchloralin @ 0.5 kg ha⁻¹, Rabbing with bajara husk @ 6 kg m⁻². Pre – sowing irrigation followed by cultivation (stale cultivation), Weed free and Weedy check as control were studied in Randomized Block Design with four replications. Weed free treatment showed significant effect with recording lower number of weeds, dry weight of weeds and higher weed control efficiency. The other two best treatments were SS with 0.025 mm TPE for 30 days with one hand weeding at 20 DAS which recorded higher soil temperature at both 15 days interval at 5 and 10 cm depths of soil and rabbing. The higher plant height (25 and 35 DAS) was observed in rabbing followed by SS with 0.025 mm TPE for 30 days with one hand weeding at 20 days. The higher root length (15 and 35 DAS) and maximum number of transplantable chilli seedlings at first pulling were recorded in SS with 0.025 mm TPE for 30 days with one hand weeding at 20 DAS. Rabbing had given the highest net realization of Rs. 7,86,179 ha⁻¹ with BCR of 4.27, next in line was SS with 0.025 mm TPE for 30 days with one hand weeding at 20 DAS recorded net realization of Rs. 7,85,271 ha⁻¹ with BCR of 4.12. Based on the results, it can be indicated that the treatment of rabbing and soil solarization with 0.025 mm TPE for 30 days with one hand weeding at 20 DAS effectively controlled weeds and produced higher number of transplantable chilli seedlings and higher net realization.

Key words :

Chilli (*Capsicum annum* L.) being a rainy season crop is seriously invaded by luxuriant growth of varieties of weeds. The severe crop weed competition results in reduction of yield to the tune of 60-70 % due to the initial slow growth. There were mostly curative methods of weed control in chilli. Soil solarization was a preventive method of weed control. Hence, it can be best practiced for efficient weed control. Soil solarization was a non hazardous and non chemical technique of controlling many soil borne pathogens and pest including weeds to the users as well as environment. It is a method of hydrothermal disinfection accomplished by covering moist soil with transparent polyethylene film during the hot summer months. The possible mechanisms of weed control by soil solarization are breaking dormancy of weed seeds and solar scorching of emerged weeds, direct killing of weed seeds by heat and indirect microbial killing of weed seeds weakened by heating. The present experiment was

conducted to study the effect of different weed control measures on weeds and seedling growth in chilli nursery under Agro-climate of North Gujarat.

MATERIALS AND METHODS

A field experiment was conducted on loamy sand soil at Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *Kharif* 2006. The treatments included were transparent polyethylene (TPE) 0.025, 0.050 and (BPE) 0.125 mm for 30 days and in combinations with one hand weeding at 20 DAS, Pendimethalin @ 0.5 kg ha⁻¹ as a pre emergence, Fluchloralin @ 0.5 kg ha⁻¹ as a pre emergence, Rabbing, Stale cultivation, weed free and Weedy check. The experiment was laid out in Randomized Block Design with four replications. The respective plots, which received soil solarization, were irrigated before two days and dug out manually with the help of spade at vapsa conditions. The polyethylene films were then spread on these plots and sealed along the borders by burying then the soil, with object to check the leakage of heat and to prevent blowing of film due to wind. The polyethylene sheets were removed after 30 days from soil solarization treatments to prepare seed beds for nursery seedlings of chilli (cv.

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GC 2). Herbicides were spread @ 500 L ha⁻¹ spray volume using knapsack sprayer fitted with flat fan nozzle. Rabbing with bajara husk @ 6 kg m⁻² before two weeks of sowing in respective plots, Pre sowing irrigation 10 days prior to sowing followed by cultivation and respective plots are free from weeds by labour. Recommended package of practices other than weed control was adopted to grow the chilli seedlings.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been presented under following heads :

Effect of soil solarization on soil temperature:

Treatments T₁ and T₄ (SS with 0.025 mm TPE for 30 days) recorded significantly higher mean soil temperature at 15 days interval as compared to rest of

the treatments (Table 1). The higher mean soil temperature under thin TPE (0.025 mm) could be attributed to favourable properties such as higher transmission, lower reflection and absorption of solar radiation. This findings is in accordance with those reported by Sudha *et al.*, (1999) and Kumar *et al.* (2003).

Effect on weeds:

The major weeds in the experimental plot were *Cenchrus biflorus*, *Dactyloctenium aegyptium*, *Cynadon dactylon*, *Digera arvensis*, *Digitaria sanguinalis*, *Phyllanthus niruri*, *Euphorbia hirta*, *Portulaca oleracea*, *Trianthema monogyna*, *Tribulus terrestris* and *Cyperus rotundus*.

The data on weed population, dry weight of weeds and weed control efficiency are presented in Table 2. Significant differences in weeds were observed due to application of weed control treatments. Treatment T₁₁

Table 1 : Influence of soil solarization treatments on soil temperature (°C) at 5 and 10 cm during soil solarization period

Treatments	Mean soil temperature (°C) at			
	1-15 days		16-30 days	
	5 cm	10 cm	5 cm	10 cm
Control	45.66	40.50	45.93	42.85
Solarization with 0.025 mm TPE for 30 days (T ₁ and T ₄)	54.30	51.95	55.87	50.83
Solarization with 0.050 mm TPE for 30 days (T ₂ and T ₅)	50.47	47.58	51.54	47.15
Solarization with 0.125 mm BPE for 30 days (T ₃ and T ₆)	46.84	44.15	48.15	45.40
S. E.±	0.62	0.65	0.75	1.09
C. D. (P=0.05)	2.06	1.95	2.27	3.28
C. V.%	2.62	2.65	2.83	4.41

Table 2: Effect of different treatments on weed population, dry weight and weed control efficiency

Treatments	Weed population m ⁻²	Dry weight of weeds g m ⁻²	Weed control efficiency (%)
T ₁ - SS with 0.025 mm TPE for 30 days	6.242 (37.959)	7.18 (50.552)	70.37
T ₂ - SS with 0.050 mm TPE for 30 days	7.726 (58.694)	8.87 (77.677)	54.47
T ₃ - SS with 0.125 mm BPE for 30 days	9.198 (83.596)	10.33 (105.709)	38.04
T ₄ - T ₁ + Hand weeding at 20 DAS	5.010 (24.105)	5.68 (31.262)	81.67
T ₅ - T ₂ + Hand weeding at 20 DAS	6.561 (42.050)	6.96 (47.442)	72.19
T ₆ - T ₃ + Hand weeding at 20 DAS	7.323 (52.629)	9.04 (80.721)	52.69
T ₇ - Pendimethalin 0.5 kg ha ⁻¹ (PE)	8.325 (68.306)	8.00 (63.00)	63.07
T ₈ - Fluchloralin @ 0.5 kg ha ⁻¹ (PE)	7.621 (57.083)	7.71 (58.444)	65.74
T ₉ - Rabbing	4.799 (22.028)	6.60 (42.560)	75.05
T ₁₀ - Stale cultivation	9.378 (86.943)	11.73 (136.593)	19.94
T ₁₁ - Weed free	1.00 (0.000)	1.00 (0.000)	100.0
T ₁₂ - Weedy check	10.379 (106.726)	13.10 (170.61)	00.00
S. E.±	0.956	0.400	-
C. D. (P=0.05)	2.755	1.202	-
C. V.%	27.471	10.412	-

Figures in the parenthesis indicate original values, (x) data were transformed to $\sqrt{x + 1}$

(weed free) showed significant effect with recording lower number of weeds (1.000). The next best treatment was T₉ (rabbing). However, it remained at par with T₄, T₁, T₅ and T₆. Whereas, higher number of weeds (10.379) was recorded under T₁₂ (weedy check). The lowest number of weeds through soil solarization with thin TPE (0.025 mm) as compared to thick (0.050 and 0.125 mm).

Effect on dry weight of weed and weed control efficiency:

Treatment T₁₁ (weed free) recorded significantly the lower dry weight (1.000) of weeds (Table 2). The next best treatment was T₄ (SS with 0.025 mm TPE for 30 days with one hand weeding at 20 DAS). However, it was found at par with T₉ (rabbing). Treatment T₁₂ (weedy check) accounted for significantly higher dry weight of weeds. Soil solarization treatments in general, had the lowest count of weeds resulting lower dry weight of weeds, due to killing of weed seeds. In case of weed control efficiency (Table 2), T₁₁ (weed free) had the highest weed control efficiency (100 per cent) followed by T₄ (81.68 %), T₉ (75.05 %), T₅ (72.19 %) and T₁ (70.37 %). The higher weed control efficiency recorded under these treatments was primarily due to appreciably lower dry weight of weeds. The findings are in agreement with Kumar *et al.* (2003).

Effect on plant height:

Different weed control treatments failed to exert any effect on plant height at 15 DAS (Table 3). T₉ (rabbing) recorded significantly the higher plant height (12.00 cm and 25.10 cm) as compared to weedy check, followed by T₄ (SS with 0.025 mm TPE for 30 DAS + HW at 20 DAS) at 25 and 35 DAS. The increases in shoot vigour in soil solarization treatments was mainly due to several modes of action including thermal in activation of weed seeds and weakening of propagules which altered the plant root environment and resulted in better response in terms of increased plant growth. Similar results were reported by Hussaini *et al.* (2001).

Effect on root length:

Different weed control treatment significantly influence the mean root length at 15 and 35 DAS (Table 3). The higher root length (3.70 and 6.75 cm) was recorded under T₄ (SS with 0.025 mm TPE for 30 DAS + HW at 20 DAS) which was at par with T₁ and T₇ at 15 DAS and it was statistically at par with T₁, T₄, T₂, T₉, T₈, T₆, T₃ and T₇ at 35 DAS. This might be due to adequate control of weeds, which provide better rhizosphere effect under the soil solarization treatment. The results are

Table 3 : Effect of different treatments on plant height (cm), root length (cm), number of transplantable chilli seedlings m⁻², net realization and BCR

Treatments	Plant height (cm)			Root length (cm)		Number of chilli seedlings m ⁻²		Net realization (Rs. ha ⁻¹)	BCR
	15 DAS	25 DAS	35 DAS	15 DAS	35 DAS	I pulling at 35 DAS	II pulling at 45 DAS		
T ₁ - SS with 0.025 mm TPE for 30 days	3.90	10.87	21.00	3.65	6.70	728.00	81.00	703613	3.78
T ₂ - SS with 0.050 mm TPE for 30 days	3.85	10.76	20.70	3.00	6.42	650.00	121.00	632664	2.94
T ₃ - SS with 0.125 mm TPE for 30 days	3.80	10.71	20.10	2.90	5.65	630.00	108.50	548637	2.08
T ₄ - T ₁ + Hand weeding at 20 DAS	3.93	10.95	21.40	3.70	6.75	800.00	87.00	785271	4.12
T ₅ - T ₂ + Hand weeding at 20 DAS	3.87	10.82	20.95	3.03	6.50	675.00	105.00	623276	2.86
T ₆ - T ₃ + Hand weeding at 20 DAS	3.85	10.75	20.20	2.95	5.80	648.00	115.00	572741	2.15
T ₇ - Pendimethalin 0.5 kg ha ⁻¹ (PE)	3.25	8.51	19.90	3.30	5.50	615.00	100.00	639015	4.33
T ₈ - Fluchloralin @ 0.5 kg ha ⁻¹ (PE)	3.75	9.67	21.00	3.18	6.00	598.00	121.00	635828	4.10
T ₉ - Rabbing	3.65	12.00	25.10	3.15	6.10	795.00	87.00	786179	4.27
T ₁₀ - Stale cultivator	3.55	8.72	19.50	3.25	5.27	250.00	123.00	280379	2.14
T ₁₁ - Weed free	3.95	10.75	21.30	2.98	4.65	755.00	98.00	779343	4.90
T ₁₂ - Weedy check	3.90	8.45	19.40	2.75	4.90	211.75	101.75	217730	1.71
S. E.+	0.02	0.35	0.89	0.18	0.42	53.22	12.19	-	-
C. D. (P=0.05)	NS	1.02	2.56	0.53	1.25	159.05	NS	-	-
C. V.%	7.78	11.53	8.52	11.72	14.77	18.02	23.44	-	-

NS-Non significant

conformity with that of Sudha *et al.* (1999).

Effect on number of chilli seedlings:

Significantly higher number of chilli seedlings (Table 3) at first and second pulling (800 and 87) was recorded under treatment T₄ (SS with 0.025 mm TPE for 30 DAS + HW at 20 DAS) followed by T₉, T₁₁, T₁, T₅, T₂ and T₆ in first pulling and T₉, T₁₁, T₁, T₂, T₅, T₆ and T₃ in second pulling. The soil solarization with thin TPE has been found to enhance growth of seedlings, which could be attributed to chemical and biological changes in soil. These findings are broadly found in accordance with the findings of

Kumar *et al.* (1993) and Hussaini *et al.* (2001).

Economics:

The data on net realization and BCR are presented in Table 3. Maximum net realization of Rs. 7,86,179 ha⁻¹ with BCR of 4.27 was accrued from treatment T₉ (rabbing). The next in line was T₄ (SS with 0.025 mm TPE for 30 DAS + HW at 20 DAS) Rs. 7,85,271 ha⁻¹ with BCR of 4.12. The net realization was higher in rabbing compared to soil solarization because of higher cost of polythene sheet.

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