Madras Agric. J., 98 (4-6): 165-168, June 2011
https://doi.org/10.29321/MAJ.10.100267

Evaluation of Pendimethalin 38.7 EC on Weed Management in Winter Irrigated Cotton

K. Nalini*, P. Muthukrishnan and C. Chinnusamy
Department of Agronomy
Tamil Nadu Agricultural University, Coimbatore - 641 003

Field experiments were conducted during winter 2008-09 and 2009-10 at Eastern Block, Tamil Nadu Agricultural University, Coimbatore, to evaluate the efficiency of pre-emergence application of pendimethalin 38.7% EC on weed management in cotton. The results revealed that the pre-emergence application of pendimethalin (38.7% EC) at 2.0 kg ha^{-1} on 30 DAS followed by hand weeding and earthing up on 45 DAS did not show any phytotoxic effect on cotton and recorded the weed density and dry weight reasonably at a lower level and increased the yield and net returns in cotton under irrigated condition.

Key words: Pendimethalin 38.7%EC, Weed density & dry weight, Irrigated cotton

Cotton the "*white gold or the king of fibres*" is one of the most important commercial crops in India. Cotton is known for the fibre and oil from seed, which plays a prominent role in the national and international economy. In India, cotton cultivation provides livelihood for over 4 million farming families. India produces only 3.95 million bales of lint every year with a productivity of 567 kg ha^{-1} (Anonymous, 2008). The key role that cotton plays in our country can be gauged from the fact that nearly 15 million farmers spread out in more than 10 states are dependent on cotton cultivation (Prasad and Prasad, 2009). Cotton hybrids are cultivated at wider plant spacing with heavy fertilizer application, which in turn invites multiple weed species infestation. Due to increased scarcity for labourers, manual weeding is not economical even if it has higher weed control efficiency. Thus, we rely on herbicides to manage weeds efficiently. Cotton with minimal weed competition during the initial phase would yield better. Thus, there is need for selection of new molecules of pre-emergence to control weeds during initial crop period.

Materials and Methods

Field investigations were carried out at Tamil Nadu Agricultural University, Coimbatore during winter, 2008-09 and 2009-10. Field trials were laid out in randomized block design with treatments replicated thrice. The weed management practices evaluated in the present study consisted of chemical weed control (application of pre-emergence and early post-emergence herbicides), cultural practices (mulching with straw) and manual weeding (hand weeding once and twice) and weed free situation (hand weeding 10 times) and unweeded control.

*Corresponding author

The various weed management practices *viz.*, pre-emergence pendimethalin 38.7% EC at 1.5, 2.0, 2.5 and 4.0 kg ha^{-1} + HW, pendimethalin 30% EC at 1.0 kg ha^{-1} + HW, EPOE trifloxysulfuron at 10g ha^{-1} + HW, PE pendimethalin 30% EC at 1.0 kg ha^{-1} + PWW, pendimethalin 30% EC at 1.0 kg ha^{-1} + CRM + HW, PWW on 25 and 45 DAS, hand weeding twice, weed free and unweeded checks were included. The soils of the experimental sites were sandy clay loam in texture with low in available nitrogen, medium in available phosphorus and high in available potassium. Cotton (*Gossypium hirsutum* L.) variety MCU 13 was raised during winter 2008-09 and Bunny Bt during 2009-10.

Results and Discussion

Weed flora

Weed flora of the experimental field was taken at 30 DAS in the control plot. Seventeen weeds were observed in the experimental fields and out of the 17 weeds observed, *Cynodon dactylon* and *Dactyloctenium aegypticum* were the dominant grasses, *Cyperus rotundus* was the only sedge and T*rianthema portulacastrum, Digera arvensis* and *Parthenium hysterophorus* were the predominant broad leaved weeds.

Weeds

The density of grasses, sedges and broad leaved weeds increased upto 45 DAS, then there was a decline in weed density. Similar results were observed by Kumar, (2004), who found that hand weeding and earthing up of cotton had smothering effect on weeds at later stages. The weed control methods reduced the density of all the weeds at different stages of crop growth as compared with unweeded control (Table 1).

Table 1. Effect of treatments on total weed density

Treatment	Total weed density (No. m^{-2})			
	Winter 2008-09		Winter 2009-10	
	25 DAS	45 DAS	25 DAS	45 DAS
Pendi. (38.7%) at 1.5 kg ha^{-1} + HW	10.14 (34.73)	14.28 (74.02)	9.81 (33.12)	13.79 (68.69)
Pendi. (38.7%) at 2.0 kg ha^{-1} + HW	8.27 (23.19)	12.12 (53.92)	7.91 (21.81)	11.32 (46.96)
Pendi. (38.7%) at 2.5 kg ha^{-1} + HW	8.26 (23.05)	12.05 (53.14)	7.79 (21.29)	11.19 (45.99)
Pendi. (38.7%) at 4.0 kg ha^{-1} + HW	7.98 (21.50)	12.49 (55.38)	7.65 (20.36)	11.34 (47.30)
Pendi. (30%) at 1.0 kg ha^{-1} + HW	10.44 (36.82)	14.84 (79.50)	10.04 (34.50)	14.28 (73.53)
EPOE Trifloxy. 10 g ha^{-1} + HW	11.83 (58.01)	13.52 (80.35)	11.36 (51.56)	12.74 (72.34)
Pendi. (30%) at 1 kg ha^{-1} + PWW	10.66 (38.63)	14.92 (80.72)	10.13 (35.31)	14.56 (76.59)
Pendi. (30%) at 1 kg ha^{-1} + CRM + HW	10.75 (39.29)	13.71 (66.70)	10.17 (35.76)	12.83 (59.30)
PWW on 25 and 45 DAS	17.25 (102.43)	16.82 (101.50)	17.03 (100.60)	16.23 (94.59)
HW on 25 and 45 DAS	17.53 (106.67)	12.17 (58.65)	16.52 (94.68)	12.11 (51.89)
Weed free check	6.52 (14.50)	6.69 (15.30)	6.48 (14.62)	6.16 (13.30)
Unweeded control	18.19 (114.52)	21.40 (159.72)	17.68 (108.65)	21.60 (165.72)
SEd	0.35	0.42	0.34	0.40
CD (P = 0.05)	0.73	0.87	0.70	0.83

Pendimethalin (38.7%) at 2.0 to 4.0 kg ha^{-1} followed by one hand weeding at 45 DAS resulted in effective control of grasses, broad leaved weeds and to some extent sedges due to its broad spectrum action. It enters grasses through the coleoptile and shoot of the seedling below the ground. Thus, grasses were effectively controlled with this herbicide. The left over weeds were controlled by manual weeding at 45 DAS. Application of pendimethalin at higher dose of 1.5 kg ha^{-1} recorded lesser population of weeds when compared to lower doses as was reported by Chander *et al.* (1997).

Weed dry weight depicted a similar response in line with the weed density in various treatments. The reduced weed density under pendimethalin (38.7%) at 2.0 to 4.0 kg ha^{-1} resulted in reduced weed dry weight at all the stages of crop growth (Table 2).This might be attributed to rapid depletion of carbohydrate reserve of the weeds through rapid respiration as pointed out by Prakash *et al.* (1999). The dry weight of grasses, sedges and broad leaved weeds were lesser due to different weed management practices. The dry weight of weeds showed an increasing trend from germination to 90 DAS.It might be due to early germination, establishment and quick growth of weeds than the crop.

Weed control efficiency (WCE)

Weed control efficiency showed the maximum value under pre-emergence application of pendimethalin (38.7%) at 4.0 kg ha^{-1} at 25 and 45 DAS. Pre-emergence application of pendimethalin registered higher WCE ranging between 93.45 and 65.8 per cent (Table 3). The results of the present study indicated that application of pendimethalin (38.7%) at different doses followed by hand weeding produced higher WCE throughout the crop period which was comparable with the conventional weeding at 45 DAS.The integrated weed management practice gave the broad spectrum weed control as a result of longer persistency in the soil profile. Manual weeding is difficult especially during the monsoon seasons due to intermittent rains and consequently the moisture content of the soil would be too high for mechanical manipulation. Hence, application of pendimethalin (38.7%) at 2.0 to 4.0 kg ha^{-1} followed by hand weeding is a quite suitable option to overcome the weed problem in

Table 2. Total weed dry weight as influenced by weed management practices in cotton

Treatment	Dry weight of total weeds (kg ha^{-1})			
	Winter 2008-09		Winter 2009-10	
	25 DAS	45 DAS	25 DAS	45 DAS
Pendi. (38.7%) at 1.5 kg ha^{-1} + HW	10.54 (111.1)	20.75 (430.5)	8.16 (66.67)	20.99 (440.6)
Pendi. (38.7%) at 2.0 kg ha^{-1} + HW	8.34 (69.53)	17.51 (306.6)	5.71 (32.59)	17.41 (303.1)
Pendi. (38.7%) at 2.5 kg ha^{-1} + HW	8.31 (68.98)	16.90 (285.7)	5.45 (29.69)	16.62 (276.3)
Pendi. (38.7%) at 4.0 kg ha^{-1} + HW	8.25 (68.14)	20.02 (400.8)	5.25 (27.54)	19.60 (384.0)
Pendi. (30%) at 1.0 kg ha^{-1} + HW	10.92 (119.3)	21.45 (460.1)	8.40 (70.56)	21.75 (473.2)
EPOE Trifloxy. 10 g ha^{-1} + HW	10.91 (118.9)	19.61 (384.5)	11.76 (138.2)	19.57 (383.1)
Pendi. (30%) at 1 kg ha^{-1} + PWW	11.05 (122.2)	5.23 (27.33)	8.56 (73.22)	23.87 (570.0)
Pendi. (30%) at 1 kg ha^{-1} + CRM + HW	10.88 (118.4)	18.06 (326.1)	8.55 (73.04)	17.22 (296.6)
PWW on 25 and 45 DAS	21.60 (466.6)	7.27 (52.90)	20.20 (408.0)	25.72 (661.6)
HW on 25 and 45 DAS	20.98 (440.3)	18.02 (324.9)	19.93 (397.1)	20.42 (417.1)
Weed free check	3.02 (9.12)	3.64 (13.27)	2.75 (7.58)	4.49 (20.20)
Unweeded control	22.38 (500.8)	28.97 (839.3)	20.51 (420.5)	28.42 (807.8)
SEd	0.70	1.00	0.57	0.97
CD (P = 0.05)	1.46	2.08	1.18	2.01

cotton. Similar finding was reported by Balasubramanian (1992) who found that the weed control efficiency was comparatively higher with the application of pendimethalin at 1.0 kg ha^{-1} as compared with 0.5 and 0.75 kg ha^{-1}.

Seed cotton yield

Pendimethalin (38.7%) at 2.0 kg ha^{-1} + hand weeding recorded higher seed cotton (Table 4) yield of 58 and 32 per cent during winter 2008-09 and 2009-10 seasons, respectively over unweeded control. The next best treatment was the pendimethalin (38.7%) at 2.5 kg ha^{-1} + hand weeding. Gnanavel and Babu, (2008) also reported maximum seed cotton yield with pendimethalin and fluchloralin combination coupled with hand weeding as compared with control. Hand weeding twice recorded lower seed cotton yield during winter season due to poor control of grasses and broad leaved weeds. Cotton being a wide spaced and slow

Table 3. Weed control efficiency (WCE) as influenced by weed management practices in cotton

Treatment	Weed control efficiency (%)			
	Winter 2008-09		Winter 2009-10	
	25 DAS	45 DAS	25 DAS	45 DAS
Pendi. (38.7%) at 1.5 kg ha^{-1} + HW	77.82	45.46	80.71	48.70
Pendi. (38.7%) at 2.0 kg ha^{-1} + HW	86.12	62.48	87.93	63.46
Pendi. (38.7%) at 2.5 kg ha^{-1} + HW	86.23	65.80	88.02	65.96
Pendi. (38.7%) at 4.0 kg ha^{-1} + HW	86.40	52.47	88.17	52.24
Pendi. (30%) at 1.0 kg ha^{-1} + HW	76.18	41.42	79.29	45.18
EPOE Trifloxy. 10 g ha^{-1} + HW	76.26	52.58	79.35	54.19
Pendi. (30%) at 1 kg ha^{-1} + PWW	75.61	29.44	75.31	34.74
Pendi. (30%) at 1 kg ha^{-1} +CRM+ HW	76.36	63.29	79.44	61.14
PWW on 25 and 45 DAS	6.85	18.10	7.85	33.69
HW on 25 and 45 DAS	12.10	48.37	13.65	61.28
Weed free check	98.18	97.50	98.42	98.41
Unweeded control	0.00	0.00	0.00	0.00

Data not statistically analysed

growing crop is sensitive to weed competition at early stages of growth than at later stages. Due to heavy infestation of weeds under unweeded check, there was 32 to 58 per cent reduction in seed cotton

Table 4. Effect of weed management practices on seed cotton yield

Treatment	Seed cotton yield (kg ha^{-1})	
	Winter 2008-09	Winter 2009-10
Pendi. (38.7%) at 1.5 kg ha^{-1} + HW	1382	2599
Pendi. (38.7%) at 2.0 kg ha^{-1} + HW	1668	3271
Pendi. (38.7%) at 2.5 kg ha^{-1} + HW	1522	2940
Pendi. (38.7%) at 4.0 kg ha^{-1} +HW	1316	2471
Pendi. (30%) at 1.0 kg ha^{-1} + HW	1489	2834
EPOE Trifloxy. 10 g ha^{-1} + HW	1442	2793
Pendi. (30%) at 1 kg ha^{-1} + PWW	1342	2549
Pendi. (30%) at 1 kg ha^{-1} + CRM + HW	1332	2580
PWW on 25 and 45 DAS	1305	2329
HW on 25 and 45 DAS	1658	3236
Weed free check	1816	3498
Unweeded control	976	1622
SEd	69	107
CD (P = 0.05)	143	221

Data not statistically analysed

yield. Weeds compete with crop for light, nutrients and water. Hence, the crop under unweeded control may not be able to obtain the above growth factors in optimum quantity resulting in reduced leaf area, dry matter production and number of leaves. This would have reflected in poor yield under unweeded control. Presence of weeds throughout the growing season caused poor crop growth and caused yield reduction in unweeded check (Bhoi *et al.*, 2007).

From the above study, it could be concluded that pre-emergence application of pendimethalin (38.7%EC) at 2.0 kg ha^{-1} on 30 DAS followed by hand weeding and earthing up on 45 DAS can keep the weed density and dry weight reasonably at a lower level and increase the yield in cotton under irrigated condition.

References

Anonymous, 2008. Cotton Corporation of India. http:// cotcorp.gov.in/national_ cotton.asp.

Balasubramanian, K. 1992. Studies on chemical and tillage method of weed control in cotton and residual effect of herbicides on succeeding crops. Ph.D. Thesis, *Tamil Nadu Agric. Univ.*, Coimbatore, Tamil Nadu, India.

Bhoi, S., Lakpale, R., Nanda, H.C. and Shrivastava, G.K. 2007. Effect of weed management practices on productivity and economics of hybrid cotton in vertisols of Chhasttisgarh plains. *J. Agric. Issues,* **12**: 118-121.

Chander, S., Panwar, B.S., Katyal, S.K. and Mahendra Singh, 1997. Growth pattern of American cotton (*Gossypium hirsutum*) and weeds as affected by herbicides and fertility levels. *Indian J. Weed Sci.,* **29**: 185-188.

Gnanavel, I. and Babu, S. 2008. Integrated weed management in irrigated hybrid cotton. *Agric. Sci. Digest*. **28**: 93-96.

Kumar, G.P. 2004. Evaluation of early post-emergence herbicide for control of weeds in cotton and effect of its residue on crops grown in sequence. Ph.D. Thesis, *Tamil Nadu Agric. Univ., Coimbatore*, Tamil Nadu, India.

Prakash,V., Pandey, A.K., Singh, P., Chandra, S., Chauhan, V.S. and Singh, R.D. 1999. Integrated weed management in tomato under north-western Himalaya. *Crop Res.,* **17**: 345-350.

Prasad, V.R. and Prasad, Y.E. 2009. Study of economics of cotton and its competing crops in Guntur district of Andra Pradesh. *Mysore J. Agric. Sci.*, **43**:234-238.

Received: March 4, 2011; Accepted: June 20, 2011