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Evaluation of weed management practices on weed control and yield of transplanted finger millet

P Shanmugapriya, S Rathika, T Ramesh and P Janaki

Abstract
Field experiment was conducted at Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirapalli during *Kharif*, 2018 to evaluate the weed management practices in transplanted finger millet under sodic soil. The weed management practices *viz.*, pre emergence (PE) application of pendimethalin 30 EC at 750 g/ha, oxyfluorfen 23.5 EC at 50 g/ha, bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha, early post emergence (EPOE) application of bispyribac sodium 10 SC at 25 g/ha, PE pendimethalin 30 EC at 750 g/ha *fb* EPOE bispyribac sodium 10 SC at 25 g/ha, PE oxyfluorfen 23.5 EC at 50 g/ha *fb* EPOE bispyribac sodium 10 SC at 25 g/ha, PE bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha *fb* EPOE bispyribac sodium 10 SC at 25 g/ha, PE oxyfluorfen 23.5 EC at 50 g/ha *fb* hand weeding on 30 DAT, Hand weeding on 15 and 30 DAT and unweeded control. The results revealed that the lowest total weed density, total weed dry weight and higher WCE were registered in PE application of bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha *fb* EPOE application of bispyribac sodium 10 SC at 25 g/ha and it was followed by hand weeding on 15 and 30 DAT. The highest grain and straw yield were also registered in PE application of bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha *fb* EPOE application of bispyribac sodium 10 SC at 25 g/ha and it was on par with hand weeding on 15 and 30 DAT.

Keywords: Transplanted finger millet, weed management, total weed density, total weed dry weight, weed control efficiency, yield

Introduction
Finger millet (*Eleusine coracana* (L.) Gaertn.) is grown as transplanted crop under irrigated condition and as drill sown crop under rainfed conditions. In India, it is important small millet crop ranked third in area, production and productivity next to sorghum and pearl millet. The area under finger millet cultivation in India is 1.02 million hectares with the production of 1.39 million tonnes and the average productivity of 1.36 tonnes/ha ("Indiastat.com," 2016-2017). Weeds are the prime yield-limiting biotic constraints that compete with finger millet for moisture, nutrients and light. The weeds cause varying yield loss of about 34 to 61 per cent in finger millet (Ramachandra Prasad *et al.*, 1991) [11].

The critical period of weed competition is 2 to 6 weeks after transplanting in finger millet (Nanjappa *et al.*, 1987) [8]. Initial growth period of finger millet is subjected to heavy weed infestation resulting into higher competition and drastic reduction in yield (Adikant Pradhan *et al.*, 2012; Patil *et al.*, 2013) [1, 9]. Effective weed management practices is more important, otherwise the weeds can make use of the costly inputs and benefit more from it than the crops. Therefore, appropriate weed management practices are important in improving the productivity and input use-efficiency of the finger millet. The mechanical and cultural methods are the most commonly used and efficient weed control methods but the non-availability of labour and ever increasing labour wages have made the farmers to seek alternate method of weed management.

Use of herbicides has been proved to be an economically viable option in controlling weeds. Using post emergence herbicides for weed control have reduced the labour requirement (21%) compared to intercultural operation (Rathore *et al.*, 2010) [12]. Kumara *et al.* (2007) [6] reported that the herbicides are economical and cost effective in managing weeds during initial stages as compared to hand weeding. This indicated that the advantages of using herbicides are many folds which are effective in controlling wide range of weed flora. Hence, the present investigation has been carried out to evaluate different weed management practices on weed control efficiency, grain and straw yield of transplanted finger millet under sodic soil.

Materials and methods

A field experiment was conducted at Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirappalli, Tamil Nadu during *Kharif*, 2018. The experimental site was located at 10^0 45'N latitude, 78^0 36'E longitude and at an altitude of 85 m above MSL. A total of 177.8 mm of rainfall was received during the cropping period. The mean maximum and minimum temperature recorded during the cropping season were 36.6 ºC and 26.3 ºC and the mean relative humidity ranged from 75.1 and 40.4 per cent.

The soil of the experiment field was sandy clay loam in texture, moderately drained and classified as *Vetric Ustropept* with pH of 8.9 and EC of 0.94 dS/m. The experimental soil was low in available nitrogen (196.0 kg/ha), medium in available phosphorus (11.4 kg/ha) and medium in available potassium (242.7 kg/ha). The field experiment was laid out in randomized block design (RBD) with three replications and ten treatments. The finger millet variety TRY 1 was grown during the course of investigation.

Total weed density and weed dry weight were recorded at 20, 40 and 60 days after transplanting (DAT) by adopting standard procedure. Weed control efficiency was worked out on the basis of weed dry matter recorded in each treatment by using formula as suggested by Mani *et al.* (1973) [7]. The grain and straw yield were recorded from the net plot at harvest stage.

Results and discussion

Effect on weeds

Weed flora of the experimental field was composite in nature comprising of grasses, sedges and broad leaved weeds (BLW). The major grass weeds were *Brachiaria mutica* (L.), *Cynodon dactylon* (L.), *Dactyloctenium aegyptium* (L.), *Echinochloa colona* (L.) and common sedges include *Cyperus iria* (L.) and *Cyperus rotundus* (L.) and broad leaved weeds include *Eclipta alba* (L.) and *Trianthema portulacastrum* (L.) were the dominant species in transplanted finger millet ecosystem. Such broad spectrum of weeds in transplanted finger millet ecosystem was also reported by Afsari Banu *et al.* (2016) [2].

Effect on total weed density and total weed dry weight

Adoption of different weed management practices has significantly influenced the total weed density and weed dry weight (Table 1). Hand weeding on 15 and 30 DAT recorded lower total weed density and weed dry weight followed by PE application of bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha *fb* EPOE application of bispyribac sodium 10 SC at 25 g/ha and PE application of bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha at 20 DAT. At 40 DAT, hand weeding on 15 and 30 DAT registered lower total weed density and weed dry weight and it was on par with PE application of oxyfluorfen 23.5 EC at 50 g/ha *fb* hand weeding on 30 DAT and PE application of bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha *fb* EPOE application of bispyribac sodium 10 SC at 25 g/ha. At 60 DAT, PE application of bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha *fb* EPOE application of bispyribac sodium 10 SC at 25 g/ha reduced the total weed density and weed dry weight followed by hand weeding on 15 and 30 DAT.

PE application of bensulfuron methyl + pretilachlor along with EPOE application of bispyribac sodium significantly reduced the total weed density and weed dry weight in transplanted finger millet. Unweeded control registered the higher total weed density and weed dry weight at all stages of observation. This is in line with the findings of Satish *et al.* (2018) [13] and Kujur *et al.* (2018) [5].

Effect on weed control efficiency

Adoption of different management practices had marked influence on weed control efficiency (Table 1). At 20 DAT, higher weed control efficiency (85.8 per cent) was witnessed in hand weeding on 15 and 30 DAT. At 40 DAT, higher weed control efficiency (87.1 per cent) was registered in hand weeding on 15 and 30 DAT. At 60 DAT, higher weed control efficiency (87.0 per cent) was noticed in PE application of bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha *fb* EPOE application of bispyribac sodium 10 SC at 25 g/ha. This might be due to reduced weed population and weed dry weight which resulted in increased weed control efficiency. Pre emergence herbicide along with post emergence herbicide effectively reduced the weed biomass. This is in agreement with the findings of Satish *et al.* (2018) [13].

Effect on finger millet

Effect on grain and straw yield

The highest grain and straw yield of 3560 and 6617 kg/ha, were recorded by PE application of bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha *fb* EPOE application of bispyribac sodium 10 SC at 25 g/ha and it was on par with hand weeding on 15 and 30 DAT (3443 and 6353 kg/ha). The effective control of weeds in these treatments resulted in lesser competition by weeds for nutrients, space and light ultimately resulting in increased grain and straw yields. Pre emergence herbicide application controlled weeds at early stage and supplemental early post emergence herbicide controlled weed growth at later stage which resulted in higher weed control efficiency and yield. This is in accordance with the findings of Channa Naik (2000) [3] and Prithvi (2015) [10].

Table 1: Effect of weed management practices on total weed density (No./m^2), total weed dry weight (g/m^2) and weed control efficiency (%) in transplanted finger millet

Treatments	Total weed density (No./m^2)			Total weed dry weight (g/m^2)			Weed control efficiency (%)		
	20 DAT	40 DAT	60 DAT	20 DAT	40 DAT	60 DAT	20 DAT	40 DAT	60 DAT
T_1 - PE Pendimethalin 30 EC at 750 g/ha	7.60 (57.21)	8.42 (70.48)	9.40 (87.80)	5.56 (30.37)	8.93 (79.22)	10.29 (105.30)	41.6	39.1	45.4
T_2 - PE Oxyfluorfen 23.5 EC at 50 g/ha	6.76 (45.26)	8.19 (66.61)	9.13 (82.80)	4.98 (24.28)	8.64 (74.15)	10.14 (102.22)	53.3	43.0	47.0
T_3 - PE Bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha	5.93 (34.61)	7.92 (62.30)	8.73 (75.72)	4.43 (19.14)	8.44 (70.76)	9.74 (94.31)	63.2	45.6	51.1
T_4 - EPOE Bispyribac sodium 10 SC at 25 g/ha	8.92 (79.02)	6.21 (38.06)	8.76 (76.29)	7.24 (51.9)	5.21 (26.67)	9.57 (91.03)	0.2	79.5	52.8

T_5 - PE Pendimethalin 30 EC at 750 g/ha *fb* EPOE Bispyribac sodium 10 SC at 25 g/ha	7.54 (56.34)	5.97 (35.10)	7.98 (63.24)	5.60 (30.89)	5.12 (25.76)	8.71 (75.41)	40.6	80.2	60.9
T_6 - PE Oxyfluorfen 23.5 EC at 50 g/ha *fb* EPOE Bispyribac sodium 10 SC at 25 g/ha	6.75 (45.03)	5.69 (31.88)	7.20 (51.41)	4.93 (23.82)	4.96 (24.06)	7.92 (62.29)	54.2	81.5	67.7
T_7 - PE Bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha *fb* EPOE Bispyribac sodium 10 SC at 25 g/ha	5.85 (33.76)	4.87 (23.17)	5.48 (29.54)	4.36 (18.51)	4.34 (18.34)	5.06 (25.07)	64.4	85.9	87.0
T_8 - PE Oxyfluorfen 23.5 EC at 50 g/ha *fb* hand weeding on 30 DAT	6.70 (44.35)	4.75 (22.11)	7.03 (48.91)	4.91 (23.56)	4.19 (17.04)	7.70 (58.82)	54.7	86.9	69.5
T_9 - Hand weeding on 15 and 30 DAT	3.39 (10.96)	4.46 (19.38)	6.23 (38.31)	2.81 (7.38)	4.16 (16.78)	6.36 (39.92)	85.8	87.1	79.3
T_{10} - Unweeded control	9.02 (80.79)	10.80 (115.36)	12.60 (158.48)	7.25 (52.00)	11.40 (130.08)	13.91 (192.86)	-	-	-
CD (P=0.05)	0.56	0.53	0.67	0.43	0.54	0.76	-	-	-

Figures in parentheses are original values

Table 2: Effect of weed management practices on grain and straw yield of transplanted finger millet

Treatments	Grain yield (kg/ha)	Straw yield (kg/ha)
T_1 - PE Pendimethalin 30 EC at 750 g/ha	2556	4796
T_2 - PE Oxyfluorfen 23.5 EC at 50 g/ha	2720	4924
T_3 - PE Bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha	2862	5065
T_4 - EPOE Bispyribac sodium 10 SC at 25 g/ha	2741	5160
T_5 - PE Pendimethalin 30 EC at 750 g/ha *fb* EPOE Bispyribac sodium 10 SC at 25 g/ha	3022	5727
T_6 - PE Oxyfluorfen 23.5 EC at 50 g/ha *fb* EPOE Bispyribac sodium 10 SC at 25 g/ha	3140	5838
T_7 - PE Bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha *fb* EPOE Bispyribac sodium 10 SC at 25 g/ha	3560	6617
T_8 - PE Oxyfluorfen 23.5 EC at 50 g/ha *fb* hand weeding on 30 DAT	3222	6137
T_9 - Hand weeding on 15 and 30 DAT	3443	6353
T_{10} - Unweeded control	1256	3144
CD (P=0.05)	256	469

Conclusion

From this field experiment, it could be concluded that PE application of bensulfuron methyl 0.6 G at 60 g/ha + pretilachlor 6 G at 600 g/ha *fb* EPOE application of bispyribac sodium 10 SC at 25 g/ha was best method for controlling weeds and increased yield in transplanted finger millet under sodic soil.

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