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Integrated weed management practices in barnyard millet-(*Echinochloa frumentacea*) under irrigated condition

Blessy Thambi, KR Latha, P Murali Arthanari and M Djanaguiraman

Abstract
A field experiment was conducted to assess the integrated weed management practices in barnyard millet under irrigated condition during *Summer*, 2021 at Tamil Nadu Agricultural University, Coimbatore. There were ten treatments and replicated thrice in a Randomized Block Design (RBD). The treatments comprised of two herbicides (Pendimethalin and Bensulfuron + Pretilachlor) with or without hand weeding and mechanical weeding. Weed flora observed in experimental field consists of *Cynodon dactylon, Dactyloctenium aegyptium, Echinochloa colona* under grasses, *Cyperus rotundus* under sedge and *Datura stramonium*, *Trianthema portulacastrum, Parthenium hysterophorus, Amaranthus viridis, Portulaca oleracea, Digera arvensis* and *Desmanthus virgatus* under broad leaved weeds. Significantly lower total weed density (4.05, 3.03 and 4.03 No. m^{-2}), weed dry weight (2.94, 2.69 and 4.87 g m^{-2}) and weed index (2.66%) were lower and higher weed control efficiency (91.64, 97.24 and 91.11%) was observed with PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G 495 g a.i. ha^{-1} on 3 DAS followed by one hand weeding on 20 DAS.

Keywords: Barnyard millet, Weed density, Weed dry weight, Weed control efficiency and Weed index

Introduction
Barnyard millet (*Echinochloa frumentacea*) also called Kuthiravali is one of the most important millet crops in the world agricultural economy as food, feed and industrial products. Easy cultivation, wider adaptation, free from major pests and diseases, better tolerance to abiotic stresses like drought and water logging have made this crop an indispensible for both rainfed and irrigated farming. It is a store house of nutrients also. Ugare *et al.* (2014) [1] reported that the barnyard millet comprised of 10.5% protein, 12.6% dietary fibre, 4.4% ash content, calcium 11 mg 100 g^{-1} and iron content 15.2 mg 100 g^{-1}. The dehulled grains can be cooked just like rice. Its stover is also an important source of fodder for animals.

In recent days the demand for barnyard millet has risen drastically due to its nutritional quality and better adoptability but the productivity of barnyard millet is relatively low due to high weed infestation. Weeds compete with crop plants for moisture, space, nutrients and light and reduce the crop yield as well as quality of the produce. In addition, slow initial growth of barnyard millet is conducive for high weed multiplication. The critical period for weed competition is 25-30 days after sowing and weed management at this time is crucial for increasing yields.

Generally, barnyard millet is adopted with hand weeding, hoeing and animal drawn implements for weed control. But these methods are time consuming, labour intensive and costly. The alternate solution for weed management in such situations is use of herbicides. But the complete control of weeds in barnyard millet is very hard to achieve by using any single weed management technique *viz.*, manual, mechanical or chemical. The integrated approach *i.e*. the combination of chemical along with physical or mechanical method, is the best way to control the weeds and cost effective weed management strategy in barnyard millet. So, the present study aimed to identify a suitable integrated weed management practice for barnyard millet under irrigated condition.

Materials and Methods
Experimental details
Field investigation was carried out at Agricultural College and Research Institute, Coimbatore, Tamil Nadu during *Summer* 2021 with an objective of evolving suitable integrated weed

management practices for irrigated barnyard millet. The soil of the experimental plot was sandy clay loam in texture, alkaline in pH (8.2) and medium in organic carbon (0.73%) and low in available nitrogen (263 kg/ha), medium in available phosphorus (14.6 kg/ha) and available potassium (325 kg/ha). The experiment consisted of ten treatments replicated thrice in a Randomized Block Design (RBD). The treatments tested were, T_1: PE Pendimethalin 30 EC @ 500 g a.i. ha^{-1} on 3 DAS *fb* one hand weeding on 20 DAS, T_2: PE Pendimethalin 30 EC @ 375 g a.i. ha^{-1}on 3 DAS *fb* one hand weeding on 20 DAS, T_3: PE Pendimethalin 30 EC @ 500 g a.i. ha^{-1} on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS, T_4: PE Pendimethalin 30 EC @ 375 g a.i. ha^{-1} on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS, T_5: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 495 g a.i. ha^{-1} (RM) on 3 DAS *fb* one hand weeding on 20 DAS, T_6: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 330 g a.i. ha^{-1} (RM) on 3 DAS *fb* one hand weeding on 20 DAS, T_7: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 495 g a.i. ha^{-1} (RM) on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS, T_8: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 330 g a.i. ha^{-1} (RM) on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS, T_9: Two hand weedings on 20 and 40 DAS and T_{10}: Unweeded control.

The barnyard millet variety MDU 1 was used for the study and sown at a spacing of 25cm x 10cm. Weed counts (No. m^{-2}) and dry weight (g m^{-2}) were recorded by placing a quadrate (50cm x 50cm) at four random spots in each plot at 20 DAS, 40 DAS and 60 DAS of the crop.

Weed control efficiency (WCE) was calculated on the basis of dry matter production of weeds. The collected weed samples were air dried and then oven dried at 60 ± 5 °C. Weed control efficiency worked out by using the formula suggested by Mani *et al*. (1973) [2].

$$WCE = \frac{(DWC - DWT)}{DWC} \times 100$$

Where

WCE: Weed control efficiency

DWC: Dry weight of weeds in unweeded check (g m^{-2})

DWT: Dry weight of weeds in treated plot (g m^{-2})

Weed index is the index which expresses the yield reduction in the treated plots compared to the weed free plot due to the presence of weeds. Instead of weed free plot, the plot which registered maximum yield was taken into consideration for working out weed index. It is calculated by using the formula suggested by Gill and Vijayakumar (1969) [3]**.**

$$WI = \frac{X-Y}{X} \times 100$$

Where

WI: Weed index

X: Yield in weed free plot

Y: Yield in treated plot

The data on various characters studied during the course of investigation were statistically analysed as suggested by Dhamu and Ramamoorthy (2007) [4]. The data on weed density (No. m^{-2}) and weed dry weight (g m^{-2}) were transformed by using square root transformation $\sqrt{(X+0.05)}$ and analyzed statistically

Results and Discussion

Weed Flora

The weed flora documented in experimental field primarily composed of grasses, sedges and broad leaved weeds. The weed flora include *Cynodon dactylon, Dactyloctenium aegyptium, Echinochloa colona* under grasses, *Cyperus rotundus* under sedge and *Datura stramonium, Trianthema portulacastrum, Parthenium hysterophorus, Amaranthus viridis, Portulaca oleracea, Digera arvensis* and *Desmanthus virgatus* under broad leaved weeds. Among the weeds, broad leaved weeds were predominant and constituted about 83.63 per cent. Among the broad leaved weeds, *Datura stramonium* was the dominant species followed by *Trianthema portulacastrum*. Next to broad leaved weeds, grassy weeds accounted for 6.6 per cent in which *Echinochloa colona* was the dominant species than other grass species.

Weed density and weed dry weight

The density and dry weight of weeds was remarkably affected by integrated weed management practices in barnyard millet under irrigated condition (Table 1-3). Sparse weeds with high biomass might be more competitive for crops than dense weeds with lesser dry matter. Significantly lower total weed density and total dry weight were noticed in PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 495 g a.i. ha^{-1} (RM) on 3 DAS *fb* one hand weeding on 20 DAS (T_5) and however this was on par with two hand weedings on 20 and 40 DAS (T_9). Pre emergence application of Bensulfuron + Pretilachlor reduced the weed density which may be due to inhibition of acetolactate synthase (ALS) which is an important enzyme involved in the synthesis of three branched chain amino acids (valine, isoleucine and leusine) and thereby no protein synthesis takes place and weeds will be killed at initial stage and weeding at 20 DAS helps in controlling weeds at later stage. These findings are in accordance with the results obtained by Teja *et al*. (2015) [5]. Lower weed density and weed dry weight in two hand weedings at 20 and 40 DAS plot is due to physical uprooting of both above and below ground parts of weeds and thereby effectively control the weeds. Whereas the total weed density and dry weight were highest in unweeded control due to the non interruption for growth of the weeds.

Weed control efficiency

Weed control efficiency reflects the degree to which weed dry weight is significantly reduced by different weed control treatments throughout the crop period. Among the weed management practices imposed, PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 495g a.i. ha^{-1} (RM) on 3 DAS *fb* one hand weeding on 20 DAS (T_5) showed higher weed control efficiency (91.64, 97.94 and 91.11%) (Figure 1) and this might be due to the control of broad spectrum of weeds including grasses, sedges and broad leaved weeds. This treatment was on par with two hand weedings on 20 and 40 DAS (T_9) (Table 4) and this might be due to the highest efficiency of human labour in removing the weeds. Similar observations were made by Meghana *et al*. (2020) [6].

Weed index

Weed index in barnyard millet was influenced by different integrated weed management practices (Table 4 and Figure 2). Two hand weedings on 20 and 40 DAS treatment was

considered as a base to compute weed index as it recorded the maximum yield compared to other weed control treatments. Because of this reason, the weed index was zero in the above treatment. The lowest weed index was noticed in PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 495 g a.i. ha^{-1} (RM) on 3 DAS *fb* one hand weeding on 20 DAS (T_5) (2.66%) followed by PE Pendimethalin 30 EC @ 500 g a.i. ha^{-1}on 3 DAS *fb* one hand weeding on 20 DAS (T_1) (9.48%). The highest weed index was recorded with unweeded control (T_{10}) (66.18%). The lowest weed index is the result of effective control of weeds and this enabled the crop to utilize applied inputs and natural resources resulting in higher yield.

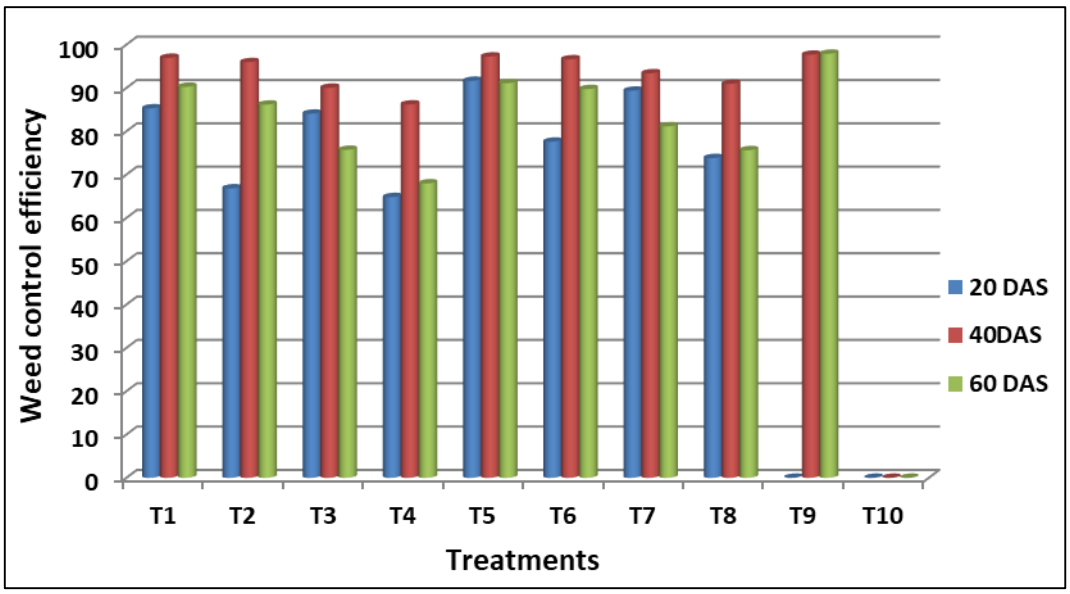

Fig 1: Effect of integrated weed management practices on weed control efficiency (%) in irrigated barnyard millet

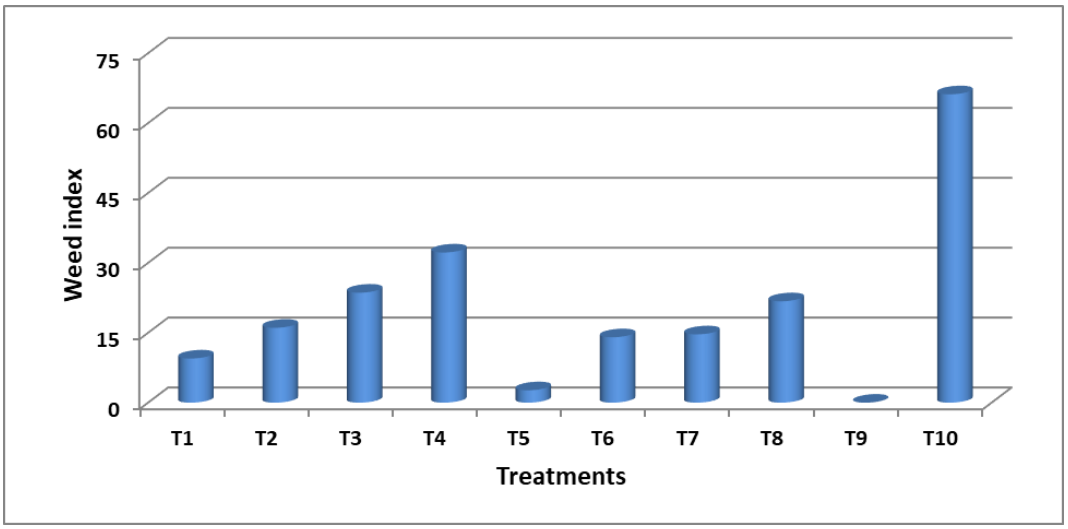

Fig 2: Effect of integrated weed management practices on weed index (%) in irrigated barnyard millet

Table 1: Effect of integrated weed management practices on total weed density, total dry weight and weed control efficiency at 20 DAS in irrigated barnyard millet

Treatments	Weed density (No.m^{-2})			Total	Weeds dry weight (g m^{-2})			Total
	Grasses	Sedges	BLWs		Grasses	Sedges	BLWs	
T_1: PE Pendimethalin 30 EC @ 500 g a.i. ha^{-1} on 3 DAS *fb* one hand weeding on 20 DAS	1.74 (2.66)	2.51 (5.91)	4.69 (16.87)	5.07 (25.44)	1.43 (1.63)	1.53 (1.88)	3.44 (11.47)	3.91 (14.98)
T_2: PE Pendimethalin 30 EC @ 375 g a.i. ha^{-1} on 3 DAS *fb* one hand weeding on 20 DAS	2.36 (5.20)	3.04 (8.84)	6.89 (48.16)	7.84 (62.20	1.90 (3.19)	1.81 (2.82)	5.23 (27.77)	5.77 (33.78)
T_3: PE Pendimethalin 30 EC @ 500 g a.i. ha^{-1} on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	1.9 (3.20)	2.63 (6.50)	4.82 (17.94)	5.29 (27.64)	1.55 (1.96)	1.59 (2.08)	3.55 (12.19)	4.07 (16.23)
T_4: PE Pendimethalin 30 EC @ 375 g a.i. ha^{-1} on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	2.63 (6.50)	3.14 (9.38)	7.07 (50.42)	8.13 (66.30)	2.11 (3.99)	1.86 (3.00)	5.38 (28.83)	6.00 (35.82)
T_5: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 495 g a.i. ha^{-1} (RM) on 3 DAS *fb* one hand weeding on 20 DAS	1.81 (2.91)	1.65 (2.26)	3.37 (11.30)	4.05 (16.47)	1.48 (1.78)	1.10 (0.73)	2.50 (5.99)	2.94 (8.50)
T_6: PEBensulfuron methyl 0.6 G + Pretilachlor 6 G @ 330 g a. i.ha^{-1} (RM) on 3 DAS *fb* one hand weeding on 20 DAS	2.19 (4.32)	2.25 (4.67)	5.90 (35.10)	6.62 (44.09)	1.77 (2.65)	1.40 (1.49)	4.32 (18.66)	4.77 (22.80)

T_7: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 495 g a.i. ha^{-1} (RM) on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	1.94 (3.33)	1.81 (2.82)	3.74 (13.59)	4.49 (19.74)	1.58 (2.04)	1.17 (0.90)	2.89 (7.88)	3.35 (10.82)
T_8: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 330 g a.i. ha^{-1} (RM) on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	2.36 (5.10)	2.4 (5.32)	6.06 (36.30)	6.87 (46.72)	1.90 (3.13)	1.47 (1.70)	4.72 (21.83)	5.20 (26.65)
T_9: Two hand weedings on 20and 40 DAS	2.67 (6.70)	3.32 (10.56)	13.34 (178.64)	13.98 (195.90)	2.13 (4.12)	1.96 (3.35)	9.16 (88.96)	9.56 (91.43)
T_{10}: Unweeded control	2.88 (8.03)	3.75 (13.63)	13.90 (193.70)	14.66 (215.36)	2.30 (4.93)	2.18 (4.32)	9.62 (92.53)	10.08 (101.78)
SEd	0.1229	0.2467	0.4663	0.4195	0.0936	0.1289	0.3385	0.3114
CD (p=0.05)	0.2582	0.5183	0.9796	0.8814	0.1967	0.2709	0.7112	0.6542

Data within parentheses are original values; data analyzed using square root transformation
BLWs: Broad leaved weeds, *fb*: Followed by, DAS: Days after sowing, PE: Pre emergence, RM: Ready mix

Table 2: Effect of integrated weed management practices on total weed density, total dry weight and weed control efficiency at 40 DAS in irrigated barnyard millet

Treatments	Weed density (No. m^{-2})			Total	Weeds dry weight (g m^{-2})			Total
	Grasses	Sedges	BLWs		Grasses	Sedges	BLWs	
T_1: PE Pendimethalin 30 EC @ 500 g a.i. ha^{-1} on 3 DAS *fb* one hand weeding on 20 DAS	1.33 (1.30)	1.67 (2.33)	2.57 (6.17)	3.20 (9.80)	1.23 (1.04)	1.43 (1.58)	2.32 (4.93)	2.83 (7.55)
T_2: PE Pendimethalin 30 EC @ 375 g a.i. ha^{-1} on 3 DAS *fb* one hand weeding on 20 DAS	1.68 (2.41)	1.76 (2.67)	2.87 (7.80)	3.64 (12.88)	1.54 (1.92)	1.51 (1.81)	2.59 (6.23)	3.22 (9.96)
T_3: PE Pendimethalin 30 EC @ 500 g a.i. ha^{-1} on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	2.08 (3.90)	2.27 (4.70)	3.89 (14.73)	4.87 (23.33)	2.30 (4.91)	1.91 (3.18)	4.11 (16.50)	5.00 (24.59)
T_4: PE Pendimethalin 30 EC @ 375 g a.i. ha^{-1} on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	2.40 (5.32)	2.85 (7.80)	4.47 (19.59)	5.76 (32.71)	2.70 (6.91)	2.38 (5.30)	4.73 (21.94)	5.88 (34.14)
T_5: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 495 g a.i. ha^{-1} (RM) on 3 DAS *fb* one hand weeding on 20 DAS	1.40 (1.50)	1.33 (1.30)	2.52 (5.92)	3.03 (8.72)	1.29 (1.19)	1.16 (0.88)	2.28 (4.73)	2.69 (6.80)
T_6: PEBensulfuron methyl 0.6 G + Pretilachlor 6 G @ 330 g a. i.ha^{-1} (RM) on 3 DAS *fb* one hand weeding on 20 DAS	1.56 (2.01)	1.54 (1.93)	2.70 (6.85)	3.35 (10.79)	1.43 (1.61)	1.33 (1.31)	2.44 (5.47)	2.97 (8.39)
T_7: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 495 g a.i. ha^{-1} (RM) on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	2.01 (3.60)	1.74 (2.60)	3.30 (10.48)	4.14 (16.68)	1.83 (2.88)	1.48 (1.76)	3.48 (11.73)	4.10 (16.37)
T_8: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 330 g a.i. ha^{-1} (RM) on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	2.32 (5.00)	2.18 (4.32)	3.82 (14.13)	4.89 (23.45)	2.10 (4.00)	1.84 (2.93)	3.99 (15.49)	4.78 (22.42)
T_9: Two hand weedings on 20 and 40 DAS	1.18 (0.91)	1.16 (0.86)	1.87 (3.08)	2.30 (4.85)	1.10 (0.72)	1.03 (0.58)	2.21 (4.46)	2.49 (5.76)
T_{10}: Unweeded control	3.25 (10.10)	3.60 (12.50)	10.98 (121.00)	11.98 (143.60)	4.02 (15.72)	3.18 (9.65)	14.86 (221.67)	15.69 (247.04)
SEd	0.1880	0.2113	0.2528	0.2241	0.1827	0.1696	0.3330	0.2976
CD (p=0.05)	0.3950	0.4439	0.5312	0.4707	0.3839	0.3563	0.6996	0.6253

Data within parentheses are original values; data analyzed using square root transformation
BLWs: Broad leaved weeds, *fb*: Followed by, DAS: Days after sowing, PE: Pre emergence, RM: Ready mix

Table 3: Effect of integrated weed management practices on total weed density, total dry weight and weed control efficiency at 60 DAS in irrigated barnyard millet

Treatments	Weed density (No.m^{-2})			Total	Weeds dry weight (g m^{-2})		
	Grasses	Sedges	BLWs		Grasses	Sedges	BLWs
T_1: PE Pendimethalin 30 EC @ 500 g a.i. ha^{-1} on 3 DAS *fb* one hand weeding on 20 DAS	2.19 (4.50)	2.29 (4.82)	3.10 (9.15)	4.33 (18.47)	2.46 (5.84)	1.95 (3.37)	4.13 (16.65)
T_2: PE Pendimethalin 30 EC @ 375 g a i. ha^{-1} on 3 DAS *fb* one hand weeding on 20 DAS,	2.67 (6.74)	2.38 (5.21)	3.32 (10.62)	4.79 (22.57)	3.02 (8.75)	2.02 (3.64)	4.89 (24.38)
T_3: PE Pendimethalin 30 EC @ 500 g a.i. ha^{-1} on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	2.96 (8.30)	2.61 (6.41)	4.45 (19.37)	5.87 (34.08)	3.79 (13.94)	2.54 (6.02)	6.70 (44.55)
T_4: PE Pendimethalin 30 EC @ 375 g a. i.ha^{-1} on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	3.57 (12.39)	3.05 (9.01)	4.98 (24.40)	6.79 (45.80)	4.59 (20.81)	2.96 (8.46)	7.50 (55.81)
T_5: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 495 g a.i. ha^{-1} (RM) on 3 DAS *fb* one hand weeding on 20 DAS	2.27 (4.90)	1.74 (2.67)	2.98 (8.45)	4.03 (16.02)	2.56 (6.37)	1.51 (1.87)	3.97 (15.38)
T_6: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 330 g a.i. ha^{-1} (RM) on 3 DAS *fb* one hand weeding on 20 DAS	2.49 (5.81)	1.85 (3.03)	3.18 (9.66)	4.34 (18.50)	2.82 (7.55)	1.59 (2.12)	4.28 (17.58)
T_7: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 495 g a.i. ha^{-1} (RM) on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	2.85 (7.75)	2.07 (3.87)	3.91 (14.81)	5.18 (26.43)	3.56 (12.40)	2.02 (3.63)	5.87 (34.06)
T_8: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 330 g a.i. ha^{-1} (RM) on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	3.24 (10.09)	2.55 (6.09)	4.37 (18.64)	5.93 (34.82)	4.06 (16.14)	2.47 (5.72)	6.57 (42.87)
T_9: Two hand Weedings on 20 and 40 DAS	1.33 (1.30)	1.55 (1.89)	2.46 (5.63)	3.03 (8.82)	1.12 (0.79)	1.20 (0.97)	2.07 (3.82)
T_{10}: Unweeded control	3.82 (14.21)	3.59 (12.46)	9.47 (91.00)	10.78 (117.67)	5.30 (27.73)	3.53 (12.21)	14.89 (225.68)
SEd	0.2093	0.2554	0.3684	0.2775	0.2698	0.2842	0.6190
CD (p=0.05)	0.4398	0.5366	0.7739	0.5831	0.5669	0.5970	1.3004

Data within parentheses are original values; data analyzed using square root transformation

BLWs: Broad leaved weeds, *fb*: Followed by, DAS: Days after sowing, PE: Pre emergence, RM: Ready mix

Table 4: Effect of integrated weed management practices on weed control efficiency at 20, 40 and 60 DAS and weed index in irrigated barnyard millet

Treatments	WCE			WI
	20 DAS	40 DAS	60 DAS	
T_1: PE Pendimethalin 30 EC @ 500 g a.i. ha^{-1} on 3 DAS *fb* one hand weeding on 20 DAS	85.28	96.94	90.26	9.48
T_2: PE Pendimethalin 30 EC @ 375 g a.i. ha^{-1} on 3 DAS *fb* one hand weeding on 20 DAS,	66.81	95.96	86.15	16.07
T_3: PE Pendimethalin 30 EC @ 500 g a.i. ha^{-1} on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	84.05	90.04	75.71	23.61
T_4: PE Pendimethalin 30 EC @ 375 g a.i. ha^{-1} on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	64.80	86.18	67.96	32.23
T_5: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 495 g a.i. ha^{-1} (RM) on 3 DAS *fb* one hand weeding on 20 DAS	91.64	97.24	91.11	2.66
T_6: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 330 g a.i. ha^{-1} (RM) on 3 DAS *fb* one hand weeding on 20 DAS	77.59	96.60	89.74	14.04
T_7: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 495 g a.i. ha^{-1} (RM) on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	89.36	93.37	81.14	14.67
T_8: PE Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 330 g a.i. ha^{-1} (RM) on 3 DAS *fb* single tyne wheel hoe weeder weeding on 20 DAS	73.81	90.92	75.62	21.76
T_9: Two hand weedings on 20 and 40 DAS	-	97.66	97.89	0.00
T_{10}: Unweeded control		0.00	-	66.18

BLWs: Broad leaved weeds, *fb*: Followed by, DAS: Days after sowing, PE: Pre emergence, RM: Ready mix**,** WCE: Weed control efficiency, WI: Weed index

Conclusion

From this experiment, it was concluded that application of pre emergence Bensulfuron methyl 0.6 G + Pretilachlor 6 G @ 495 g a.i. ha^{-1} (RM) on 3 DAS *fb* one hand weeding on 20 DAS reduced the weed density, weed dry weight, weed index and showed higher weed control efficiency. Hence this treatment was found to be the suitable integrated weed management practices in barnyard millet under irrigated condition.

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