International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(3): 3201-3204

Received: 07-03-2019
Accepted: 09-04-2019

M Priyanga
PG Scholar, Department of Agronomy, AC & RI, Madurai, Tamil Nadu, India

T Ragavan
Professor and Head, Agricultural Research Station, TNAU, Paramakudi, Tamil Nadu. India

R Durai Singh
Professor (Agronomy), Regional Research Station, TNAU, Aruppukottai, Tamil Nadu, India

J Prabhaharan
Assistant Professor, Department of Agronomy, AC & RI, Madurai, Tamil Nadu, India

Correspondence
T Ragavan
Professor and Head, Agricultural Research Station, TNAU, Paramakudi, Tamil Nadu, India

Effect of establishment methods and weed management practices on weed control in barnyard millet under irrigated condition

M Priyanga, T Ragavan, R Durai Singh and J Prabhaharan

Abstract
A field experiment was conducted during the kharif'2018 at Agricultural College and Research Institute, Madurai to find the suitable weed management practices for barnyard millet under irrigated condition. The results of the experiment revealed that the establishment method of machine transplanting was found to be better in minimizing the weed population followed by manual transplanting. Among the weed management practices, pre emergence application of pendimethalin @0.75kg aiha^{-1} at 3DAS/T *fb* one hand weeding at 30 DAS/T recorded lesser weed density, weed dry weight and weed index and higher weed control efficiency. Following this, the pre emergence application of pendimethalin @0.75kg aiha^{-1} at 3DAS/T *fb* one mechanical weeding using twin wheel hoe weeder at 30 DAS/T. The higher weed control efficiency(88.2%) and low weed index was registered with the pre emergence application of pendimethalin @0.75kg aiha^{-1} at 3DAS/T *fb* one hand weeding at 30 DAS/T under machine transplanted barnyard millet.

Keywords: Establishment methods, pendimethalin, twin wheel hoe weeder, weed control efficiency, weed density

Introduction
Barnyard millet **(***Echinochloa frumentacea***)** is one of the most important minor millet crop. Being a drought tolerant crop with short duration of 95-100 days mostly grown as a rain fed crop. It has been identified as a suitable choice for climate-resilient agriculture. It can also be grown successfully under partially water logged conditions. Barnyard millet is mainly sown by broadcasting under rain fed condition. Because of poor germination and establishment under broadcast method of sowing, the productivity is very low. The crop can also be cultivated as irrigated crop by direct sowing or as transplanted crop. Line sowing ensures better germination, reduces seed requirement and facilitates intercultural operations as compared to broadcast method of sowing Sikandhar, (2003) [2]. The practice of transplanting is also common under irrigated condition. It has many advantages like improved germination of seeds in the nursery compared to direct sown field, increased grain yield and straw yield and also improved crop establishment reduces the need for gap filling and thinning (Dileep *et al.* 2018) [3]. Scarcity of labour at peak demand period results an increased cost of operation and delays transplanting operations. Under this circumstance, adoption of machine transplanting may ensure timely transplanting and maintain optimum plant population and also can reduce cost of cultivation (Vasudevan et al. 2014) [4].

In irrigated condition, the weed is a big menace which creates considerable yield loss. The critical period weed competition is 25-30 days after sowing and effective weed management during this period is needed for achieving higher yield. Effective management of weeds by herbicides also receiving attention among the farmers due to labour scarcity and higher cost involved in the manual weeding. The present study was aimed to figure out the most suitable weed management practice for barnyard millet under irrigated condition.

Materials and methods
The field trial was carried out in Agricultural College and Research Institute, Madurai during Kharif'2018. The soil type of the experimental site was sandy clay loam and it was medium in available N (282 kg/ha), medium in available P (17.6kg/ha) and medium available K (237kg/ha) and medium in organic carbon content (0.34 per cent). The pH of the field soil was

neutral with 7.6. The experiment was laid out in a split plot design with three replication. The treatments comprised of three establishment methods in main plot viz., direct sowing(M_1), manual transplanting (M_2) and machine transplanting (M_3) and four weed management practices in sub plot viz., hand weeding twice at 15 and 30 DAS/DAT(W_1), hand weeding at 15 DAS/DAT *fb* one mechanical weeding by twin wheel hoe at 30 DAS/DAT (W_2), PE(Pre emergence) application of Pendimethalin @ 0.75kg aiha^{-1} at 3DAS/DAT *fb* one hand weeding at 30 DAS/DAT (W_3) and PE application of Pendimethalin @ 0.75kg aiha^{-1} at 3 DAS/DAT *fb* one mechanical weeding by twin wheel hoe at 30 DAS/DAT(W_4).

Weed species present in the experimental field were recorded from the weedy control which was kept outside the treatment for comparison. Weed density was recorded by using 0.5m x 0.5m quadrate at four random places and expressed in No. m^{-2}. The collected weed samples were air dried and then over dried at 80± 5 ºC. Then the weed dry weight was expressed in g m^{-2}.

Weed control efficiency was worked out on the basis of weed dry weight recorded in each treatment at 15, 30, 45 DAS/DAT using the formula suggested by Sankaran and Mani (1974) [5] and expressed in percentage.

$$WCE = \frac{DWC - DWT}{DWC} X\ 100$$

Where,

WCE- Weed control efficiency in percentage
DWC- Dry weight of weeds in un-weeded check (g/m^2)
DWT- Dry weight of weeds in treatment plots (g/m^2)

Weed index is the index expressing the reduction in yield compared to weed free situation due to the presence of weeds and it is expressed in percentage Gill and Vijay kumar 1969.

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

Where,

X – Yield from weed free plot
Y – Yield from treated plot

Instead of weed free plot, the plot which registered maximum yield was taken into consideration for working out the weed index (Kumari mannan, 2018).

Data on weed density, weed dry weight were subjected to square root transformation (√X) and statistically analysed using the method suggested by Gomez & Gomez. (1984) whereas, weed control efficiency and weed index were not statistically analysed.

Results and discussion

The predominant weed flora present in the experimental field was identified from the weedy check. The weed species viz., *Echinochloa colona*, *Dactyloctenium aegyptium*, *Cynodan dactylon* under grasses, *Cyperus rotundus* L. under sedges and *Trianthema portulacastrum*, *Digera arvensis*, *Portulacaoleracea*, *Convolvulus arvensis*, *Eclipta alba* and *Ammannia baccifera*, under broad leaved weeds were observed.

Total weed density

The results of the experiment revealed that, the density of total weeds was significantly affected by establishment methods and weed management practices. Lower total density of 45.28, 36.39 and 12.41 No.m^{-2} was noticed under machine transplanting (M_3) followed by M_2 (Manual transplanting) at 15, 30 and 45 DAT respectively and higher weed density (64.33, 64.08 and 18.88 No.m^{-2}) was recorded in direct sown plot (M_1) at all the stages of observation. It corroborates with the findings of Samar singh *et al*., (2007) and reported that greatest weed pressure and crop weed competition occur in direct seeded condition and it is least in transplanted condition. With regard to weed management practices, PE application of pendimethalin @ 0.75 kg aiha^{-1} at 3 DAS/T *fb* one hand weeding at 30 DAS/T (W_3) recorded poor density of total weeds (30.49 No m^{-2}) at 15 and 45DAS/T and it was on par with W_4. At 30 DAS/T, hand weeding twice at 15 and 30 DAT (W_1) registered lower total density of 30.99 No.m^{-2}, which was on par with W_2.This was in line with the findings of Sharma and Bhunia (1999) [13]. Under interaction effect, machine transplanting with PE application of pendimethalin @ 0.75 kg aiha^{-1} at 3 DAT *fb* one hand weeding at 30 DAT (M_3W_3) recorded low total weed density (20.91 No.m^{-2}) followed by M_3W_4 at 15 and 45 DAT. At 30 DAT machine transplanting with hand weeding twice at 15 and 30 DAT (M_3W_1) recorded lower total density (13.12) followed by M_3W_2 (15.60 No.m^{-2}).

Total weed dry weight

The total weed dry weight was significantly affected by different establishment methods and weed management treatments in barnyard millet at all the stages of observation. Machine transplanting recorded the less total weed dry weight followed by manual transplanting and direct sowing with more weed density at all the stages of observation due to more foliage cover in the transplanting compared to direct sowing. This in line with the findings of Sanjay et al. (2006b) [9]. Further, PE application of pendimethalin @ 0.75 kg aiha^{-1} at 3 DAS/T *fb* one hand weeding at 30 DAS/T (W_3) recorded lesser total dry weight of weeds at 15 and 45 DAS/T (20.12 and 23.06gm^{-2}) respectively. It is in accordance with Jayakumar et al. (1991) [8]. At 30 DAS/T, one hand weeding at 15 DAS/T *fb* one mechanical weeding by twin wheel hoe weeder at 30 DAS/T (W_2) registered lower total dry weight of 37.1gm^{-2}, which was at par with W_1. However, the interaction effect was non-significant at 15 DAS/T between the establishment methods and weed management methods. Lower total dry weight of 24.98gm^{-2} was observed under machine transplanting with one hand weeding at 15 DAT *fb* one mechanical weeding at 30 DAT (M_3W_2), which was followed by M_3W_1 and higher weed density was noticed in M_3W_4 and which was on par with M_3W_3.However, the observation at 45 DAS/T showed that the machine transplanting with PE application of pendimethalin @ 0.75 kg aiha^{-1} at 3 DAT *fb* one hand weeding at 30 DAT (M_3W_3) recorded low total weed dry weight (20.2gm^{-2}) which was followed by M_3W_4.

Table 1: Effect of establishment methods and weed management practices in barnyard millet on total weed density, weed dry weight, weed control efficiency (%) and weed iexnd

Treatments	15 DAS/T		30 DAS/T			45 DAS/T			Weed index
	Weed density (No./m^2)	Weed dry weight (g/m$^{2)}$	Weed density (No./m^2)	Weed dry weight (g/m$^{2)}$	Weed Control Efficiency (%)	Weed density (No./m^2)	Weed dry weight (g/m$^{2)}$	Weed Control Efficiency (%)	
Establishment methods (M)									
M_1	7.93 (65.16)	8.15 (74.97)	7.90 (64.08)	8.06 (66.55)	69.12	4.32 (18.88)	5.76 (33.59)	76.76	25.78
M_2	7.24(55.60)	7.61(66.73)	7.28 (54.31)	7.38 (55.64)	74.18	4.11 (17.19)	5.47 (30.60)	78.83	16.78
M_3	6.50 (45.28)	6.65 (54.29)	5.43 (36.39)	6.28 (40.72)	81.11	3.51(12.41)	4.68(22.08)	84.57	8.01
S Ed	0.20	0.16	0.11	0.12	-	0.06	0.10	-	-
CD(P=0.05)	0.57	0.46	0.41	0.34	-	0.18	0.28	-	-
Weed Management practices (W)									
W_1	8.91 (79.54)	10.46 (109.90)	5.41 (30.99)	6.00 (36.67)	82.78	4.16 (17.49)	5.55 (29.01)	78.46	18.54
W_2	8.86 (79.06)	10.50 (110.47)	5.65 (33.38)	6.15 (38.23)	82.46	4.92 (21.23)	6.11 (35.30)	73.65	23.76
W_3	5.47 (30.49)	4.44 (20.12)	8.02 (65.22)	8.36 (70.42)	67.33	3.09 (11.75)	4.56 (23.06)	85.52	9.12
W_4	5.65 (32.30)	4.48 (20.82)	8.40 (71.22)	8.3 (71.89)	66.65	3.74 (14.13)	4.99 (27.66)	82.59	15.96
S Ed	0.16	0.16	0.14	0.08	-	0.07	0.10	-	-
CD(P=0.05)	0.34	0.34	0.19	0.18	-	0.16	0.21	-	-
Interaction (MXW)									
S Ed	0.32	0.29	0.24	0.18	-	0.13	0.18	-	-
CD(P=0.05)	0.76	NS	0.50	0.43	-	0.30	0.41	-	-

Data's were subjected to square root transformation (√X). Figures in the parenthesis are means of original value.

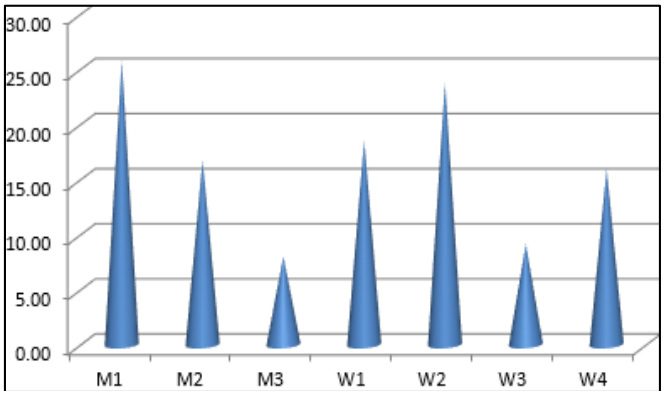

Fig 1: Effect of establishment methods and weed management practices on weed index (%) in barnyard millet under irrigated condition

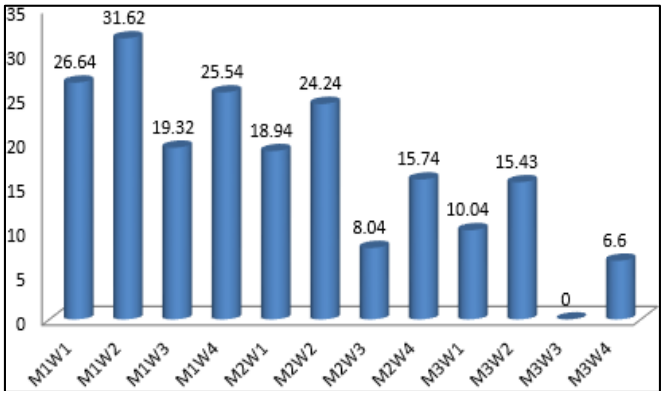

Fig 2: Interaction effect of establishment methods and weed management practices on weed index (%) in barnyard millet under irrigated condition

Weed control efficiency

The efficiency of treatments on control of weeds in terms of dry weight in comparison to un-weeded control plot was worked out. Under the establishment methods, machine transplanting (M_3) registered higher WCE of 81.1 and 84.5 per cent respectively at 30 and 45 DAT followed by manual transplanting (M_2). Lower WCE of 69.1 and 76.7 per cent was registered in direct sowing (M_1) at 30 and 45 DAS respectively. At 30 DAS/T, hand weeding at 15 DAS/T + one mechanical weeding by twin wheel hoe weeder at 30 DAS/T (W_2) registered WCE of 88.41 per cent followed by W_1. At 45 DAS/T, W_3 registered higher WCE (85.52%) than other treatments followed by W_4 and W_2 recorded lower weed control efficiency of 73.65%. Pre emergence application herbicide reduced the weed seed reserves in the soil to a considerable level and this led to reduced weed emergence in the later stages compared to hand weeded plots. It confirms the findings of Anwesh Rai et al. (2018) [11]. Under the interaction effect, machine transplanting with one hand weeding at 15 DAS/T + one mechanical weeding at 30 DAS/T (M_3W_2) recorded higher WCE of 88.41 per cent which was followed by M_3W_1 (86.84%) at 30 DAT. M_3W_3 recorded greater WCE of 88.2 per cent and lower WCE of 73.6 per cent with M_3W_2 at 45 DAT.

Weed index

Data on weed index was computed based on the maximum grain yield recorded. M_3W_3 was taken as a control as it recorded the higher grain yield. In main field, the lowest weed index was recorded in machine transplanting with 8.01% yield reduction when compared to control and direct sowing registered high weed index as it produced less tillers compared to machine and manual transplanted plot (Manjunatha *et al.*, 2009) [12]. In sub plot treatments, higher weed index was recorded in one hand weeding at 15 DAS/T *fb* one mechanical weeding at 30 DAS/T and less weed index was noticed with PE application of pendimethalin @0.75kg aiha *fb* one hand weeding at 30 DAS/T. Similar results were proposed by Shendage *et al.*(2017) [10]. With regard to

interaction, the maximum weed index was observed with M_1W_2 whereas M_3W_3 registered no weed index.

Economics

The higher gross (Rs.72725 ha^{-1}) and net income (Rs.46042 ha^{-}) was noted under machine transplanting with the pre emergence application of pendimethalin @0.75kg $aiha^{-1}$ at 3DAT *fb* one hand weeding at 30 DAT(M_3W_3). This was mainly due to the increase in the economic yield under machine transplanting as well as reduction in the cost weeding by the use of pre emergence herbicide. The same treatment also recorded higher B: C ratio of 2.73.

Conclusion

From the above results it was concluded that under machine transplanted condition, pre emergence application of pendimethalin @0.75 kg $aiha^{-1}$ at 3 DAT *fb* one hand weeding at 30 DAT has shown better weed control efficiency, lower weed density, weed dry weight and weed index.

Reference

1. Gomez KA, Gomez AA. John Wiley and Sons, New York, 1984, 680.
2. Sikander K, Tanveer Imtiaz Hussain Sohail M, Kissana NS, Abbas SG. Effects of Different Planting Methods on Yield and Yield Components of Wheat. Asian Journal of Plant Sciences. 2003; 2:811-813.
3. Dileep K, Pasupalak S, Baliarsingh A. Effect of establishment methods and sowing time on growth and yield of rice varieties *Oryza sativa* L. The Pharma Innovation Journal. 2018; 7(4):904-907.
4. Vasudevan SN, Basangouda, Mathad RC, Doddagoudar SR, Shakuntala NM. Standardization of Seedling Characteristics for Paddy Transplanter. Journal of Advanced Agricultural Technologies. 2014; 1(2):141-146.
5. Sankaran S, Mani VS. Comparative efficiency of physical, chemical and combination methods of weed control in grain sorghum. Madras Agric. J. 1974; 61(4):244-252.
6. Gill VS, Vijayakumar M. Weed index: A new method for reporting weed control trials. Indian J Agron. 1966; 14(1):96-98.
7. Samar Singha, Ladhab JK, Guptaa RK, Lav Bhushana, Raob AN. Weed management in aerobic rice systems under varying establishment methods. Crop Protection. 2008; 27(3-7):660--671
8. Jayakumar R, Asokaraja N, Kempuchetty N, Sankaran S. Studies on weed management in finger millet *Eleusine coracana* Gaertn. Madras Agricultural Journal. 1991; 78:9-12.
9. Sanjay MT *et al.* Influence of weed management practices on nutrient uptake and productivity of rice under different methods of crop establishment. Crop Res. 2006b; 32(2):131-136.
10. Shendage GB, Kanade VM, Bheru Lal Kumhar, Sarawale PP, Raut SD. Response of Different Weed Management Practices on Yield, Quality and Nutrient Uptake of Kharif Drilled Rice *Oryza sativa* L. Int. J Curr. Micro biol. App. Sci. 2017; 6(4):1274-1279.
11. Anwesh Rai, Debasis Mahata, Everest Lepcha, Kousik Nandi, Pijush Kanti Mukherjee. A Review on Management of Weeds in Maize Zea mays L. Int. J Curr. Micro biol. App. Sci. 2018; 7(08):2906-2922.
12. Manjunatha MV, Reddy BGM, Shashidhar SD, Joshi VR. Studies on the performance of self-propelled rice transplanter and its effect on crop yield, Karnataka Journal of Agricultural Sciences. 2009; 22(2):385-387.
13. Sharma SK, Bhunia SR. Weed management in transplanted rice *Oryza sativa* under Ghaggar flood plains of north-west Rajasthan. Indian J of Agron. 1999; 44(3):543-547.