EFFECT OF POST EMERGENCE HERBICIDE FOR WEED MANAGEMENT IN FINGER MILLET

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Abstract: There were thirteen treatments which comprised single application of different post-emergence herbicides either alone or in combination and hand weeding was conducted on Clayey *Vertisols* soil of College of Agriculture, Raipur during *kharif* season of 2012. *Echinochloa colona* among grasses, *Cyperus iria* among sedges and *Alternanthera triandra, Eclipta alba* and *Phyllanthus urinaria* among broad leaf weeds were dominant. Application of metsulfuron methyl + chlorimuron ethyl and ethoxysulfuron alone was found most suitable for weed control without any harm to the crop. There was complete control of broad leaf weeds *viz. Alternanthera triandra, Eclipta alba* and *Phyllanthus urinaria* and sedges *i.e. Cyperus iria* by the application of metsulfuron methyl + chlorimuron ethyl and ethoxysulfuron, where as grassy weed *i.e. Echinochloa colona* was completely killed by the application of fenoxaprop-p-ethyl. Hand weeding twice recorded the highest grain yield and net return. Application of ethoxysulfuron registered the highest B:C ratio which was at par with metsulfuron methyl + chlorimuron ethyl and hand weeding twice.

Keywords: Weed management, Finger millet

INTRODUCTION

Finger millet (*Eleusine indica*) is an important small millet crop that is hardy and grows well in dry zones as rain-fed crops. It is used both as medicinal and traditional purposes. Finger millet is a high statue crop with slower initial growth which remains under smothering due to the infestation of weeds at early stages of growth. This situation causes higher competition and may result in drastic reduction in yield (Kushwaha *et al*. 2002). The production and productivity of the country is lower because of weeds pose one of the major constraints in the production of finger millet. Owing to initial slow growth of the finger millet favours weed growth, which cause more competition for sunlight, nutrient and water in early stages of growth lead in lowering productivity (Kumara *et al*. 2007). The critical period of crop weed competition for the finger millet varies from 25-45 days after sowing (Lall and Yadav, 1982). Weeds compete with crop plants for water, nutrients, space and solar radiations by reduction of yield upto 20 to 50 per cent. (Kushwaha *et al*. 2002) reported that weeds caused an appreciable reduction in density, dry weight and depletion of nutrients. Manual weed management, which is the most prevalent method for weed management in finger millet, requires a lot of labour. Now a day, due to the scarcity of labours, chemical weed management is considered as better option than the hand weeding. Chemical weed management practices might be an answer to achieve greater weed control efficiency, which in turn, may increase over all benefit of finger millet cultivation. The work on effect of post emergence herbicides in weed management of finger millet is very limited; therefore, keeping these points in view the present investigation was carried out to evaluation of post-emergence herbicides for weed management in direct sown finger millet.

MATERIAL AND METHOD

The present investigation entitled "Evaluation of post-emergence herbicides for weed management in direct sown Finger millet." was carried out at Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) India, during the *kharif* season (July-November) 2012. The soil of experimental field was Clayey *(Vertisols)*, which was low in nitrogen, medium in phosphorus and high in potassium contents with neutral in pH. The experiment was laid out in randomized block design (RBD) with three replications. There were thirteen treatments of post-emergence herbicides along with two hand weeding and untreated control. The finger millet cultivar "GPU-28" was sown and harvested on 11th July, 2012 and 20th November, 2012 respectively, using seed rate of 10 kg ha^{-1} at 25 cm distance and gaps were maintained by thinning to obtain proper plant population. Sowing was performed by manually and crop was fertilized with 60:40:40 N: P_2O_5:K_2O kg ha^{-1}. Half dose of nitrogen (30 kg/ha) and full dose of P and K (40 and 20 Kg/ha respectively) were applied as basal and remaining half of nitrogen (30 kg/ha) was top dressed one month later. Plant protection measures were followed as per recommendation. The treatments were *viz.* T_1- Fenoxaprop-p-ethyl (37.5 g ha^{-1}), T_2- Fenoxaprop-p-ethyl (45.0 g ha^{-1}), T_3- Metsulfuron methyl + Chlorimuron ethyl, T_4- Ethoxysulfuron, T_5 – Cyhalofop-butyl, T_6- Fenoxaprop-p-ethyl (37.5 g ha^{-1}) + metsulfuron methyl + chlorimuron ethyl, T_7- Fenoxaprop-p-ethyl (45.0 g ha^{-1}) + metsulfuron methyl + chlorimuron ethyl, T_8- Fenoxaprop-p-ethyl (37.5 g ha^{-1}) + ethoxysulfuron, T_9- Fenoxaprop-p-ethyl (45.0 g ha^{-1}) + ethoxysulfuron, T_{10}- Cyhalofop-butyl + metsulfuron methyl + chlorimuron ethyl, T_{11}- Cyhalofop-butyl + ethoxysulfuron, T_{12}- Hand weeding twice and T_{13}- Weedy check. Weed counts (number m^{-2}) and dry weight (g m^{-2}) were recorded by putting a quadrate (0.25 m^{-2}) at random spots in

each plot at 15 days after sowing (DAS) and every 15 days interval till harvesting stage of crop. Weed control efficiency (WCE) was also calculated on the basis of dry matter production of weeds. The experimental data recorded for growth, yield and economics were statistically analyzed. Data on weed density and dry weight of weeds were transformed using square root transformation *i.e.* X+0.5 before statistical analysis (Gomez and Gomez, 1984).

RESULT AND DISCUSSION

Weeds

The major weed flora of experimental field consisted of *Echinochloa colona, Phyllanthus urinaria, Eclipta alba, Alternanthera triandra and Cyperus iria* and other weed species like *Commelina benghalensis, Cynodon dactylon, Cynotis axillari, Cyperus rotundus, Euphorbia hirta, Euphorbia geniculata, Fimbristylis miliacaea etc*. were also observed in the experiment field in negligible quantum. Irrespective of weed management practices density and dry weight of weeds decreased due to application of different post emergence herbicides. *Echinochloa colona* was effectively controlled with application of fenoxaprop-p-ethyl at higher dose (45.0 g ha^{-1}) and the combination of other herbicide with it reduced its toxicity. Moreover, combined application of fenoxaprop-p-ethyl with ethoxysulfuron was detrimental to *Echinochloa colona* but the effect was seen very late *i.e.* 40 days after spraying. Reddy *et al.* (2000) also reported the similar findings. Metsulfuron methyl + chlorimuron ethyl exhibited detrimental effect on *Cyperus iria* 10 days after spraying and no any plant was alive till maturity of the crop. Similar finding was also reported by Singh *et al.* (2004). Ethoxysulfuron was also detrimental on it but its effect was visible late *i.e.* 25 days after application and continued up to harvesting of the crop. Control of sedges by ethoxysulfuron was also observed by Sharifi (2003) and Ashraf *et al.* (2006). The weed was completely controlled by the application of metsulfuron methyl + chlorimuron ethyl and ethoxysulfuron after 10 days of spraying and further no any plant was observed in this treatment. Better control of *Alternanthera triandra* by application of ethoxysulfuron followed by metsulfuron methyl + chlorimuron ethyl was also reported by Saini and Angiras (2002). Complete control of *Eclipta alba* by the application of ethoxysulfuron and metsulfuron methyl + chlorimuron ethyl was observed and no any plant was noticed live up to harvesting. Control of broad leaf weed by ethoxysulfuron and metsulfuron methyl + chlorimuron ethyl was recorded by many workers (Singh *et al.*, 2004, Narwal *et al.*, 2002, Sharifi, 2003 and Ashraf *et al.*, 2006). Metsulfuron methyl + chlorimuron ethyl completely killed the *Phyllanthus urinaria*. Ethoxysulfuron also showed slight effect on weed but plants were not killed completely. Chlorimuron-ethyl + metsulfuron-methyl controlled broad leaf weeds as reported by Singh *et al*. (2004), Singh and Tiwari (2005) and Prasad *et al*. (2010). Minimum weed density of other weed species was observed in hand weeding twice. This was equivalent to combined application of fenoxaprop-p-ethyl at higher level combined with metsulfuron methyl + chlorimuron ethyl which may be due to control of all categories of weeds by these two herbicides. The crop experienced severe weed competition in cyhalofop-butyl followed by fenoxaprop-p-ethyl at both levels which might be due to unfavourable conditions leading to vigorous growth of weeds. The highest weed density was recorded in weedy check. All the weed management practices caused significant reduction in density, dry weight of weeds in comparison to weedy check plot (Table 1 and 2). Weedy check recorded the highest density and dry weight by weeds owing to their greater competitive ability than crop plant put under highest biomass of weedy check.

Table 1. : Density (m^{-2}) of different weed species at 30 DAS as influenced by different herbicidal treatments in finger millet

Treatment	Dose (g ha^{-1})	*Echinochloa colona*	*Cyperus iria*	*Alternanthera triandra*	*Eclipta alba*	*Phyllanthus urinaria*	*Phyllanthus urinaria*
T_1 : Fenox	37.5	3.38 (11.33)	4.26 (17.67)	3.02 (8.67)	3.89 (14.67)	4.60 (20.67)	4.80 (22.67)
T_2 : Fenox	45.0	0.71 (0.00)	3.89 (14.67)	2.91 (8.00)	4.26 (17.67)	4.91 (23.67)	4.49 (19.67)
T_3 : MSM+CME	2.0+2.0	5.98 (35.33)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	3.81 (14.33)
T_4 : Ethox	15.0	5.69 (32.00)	1.74 (2.67)	0.71 (0.00)	0.71 (0.00)	4.26 (17.67)	4.21 (17.33)
T_5 : Cyhalo	62.5	3.54 (12.33)	2.47 (5.67)	2.97 (8.33)	3.98 (15.33)	4.45 (19.33)	4.36 (18.67)
T_6 : Fenox+MSM+ CME	37.5+2.0+2.0	3.55 (12.33)	1.05 (0.67)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	3.15 (9.67)
T_7 : Fenox+MSM+	45.0+2.0+2.0	1.46 (1.67)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	2.45 (5.67)

CME							
T_8 : Fenox+Ethox	37.5+15.0	3.12 (9.33)	1.74 (2.67)	0.71 (0.00)	0.71 (0.00)	5.17 (26.33)	3.95 (15.33)
T_9 : Fenox+Ethox	45.0+15.0	1.81 (3.00)	1.56 (2.00)	0.71 (0.00)	0.71 (0.00)	4.70 (21.67)	3.71 (13.33)
T_{10} : Cyhalo+MSM+ CME	62.5+2.0+2.0	1.17 (1.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	1.72 (2.67)
T_{11} : Cyhalo+Ethox	62.5+15.0	1.39 (1.67)	1.93 (3.33)	0.71 (0.00)	0.71 (0.00)	4.63 (21.00)	3.33 (10.67)
T_{12} : Weed free (HW at 20 and 40 DAS)		1.46 (1.67)	1.46 (1.67)	1.22 (1.00)	1.46 (1.67)	1.34 (1.33)	1.46 (1.67)
T_{13}: Weedy check		9.24 (85.00)	4.30 (18.00)	3.13 (9.33)	4.33 (18.33)	5.52 (30.33)	5.01 (24.67)
SEm ±		**0.26**	**0.15**	**0.05**	**0.10**	**0.18**	**0.26**
CD at 5 %		**0.78**	**0.46**	**0.16**	**0.29**	**0.53**	**0.78**

The observations are square root transformed. Figures in parentheses indicate the original value. Fenox = Fenoxaprop-p-ethyl, MSM = Metsulfuron methyl,
CME = Chlorimuron ethyl, Ethox = Ethoxysulfuron, Cyhalo = Cyhalofop–butyl, HW = Hand weeding

Table2. : Dry weight (g m^{-2}) of different weed species at 30 DAS as influenced by different herbicidal treatments in finger millet

Treatment	**Dose (g ha^{-1})**	***Echinochloa colona***	***Cyperus iria***	***Alternanthera triandra***	***Eclipta alba***	***Phyllanthus urinaria***	**other weed**
T_1 : Fenox	37.5	1.77 (2.72)	2.97 (8.33)	1.51 (1.87)	1.38 (1.39)	1.13 (0.78)	2.72 (6.97)
T_2 : Fenox	45.0	0.71 (0.00)	2.75 (7.04)	1.70 (2.40)	1.46 (1.63)	0.98 (0.47)	2.62 (6.37)
T_3 : MSM+CME	2.0+2.0	2.15 (4.15)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	2.19 (4.32)
T_4 : Ethox	15.0	1.76 (2.60)	1.32 (1.25)	0.71 (0.00)	0.71 (0.00)	0.85 (0.23)	2.23 (4.52)
T_5 : Cyhalo	62.5	1.73 (2.52)	1.07 (0.65)	1.44 (1.58)	1.27 (1.13)	0.96 (0.42)	2.65 (6.52)
T_6 : Fenox+MSM+ CME	37.5+2.0+2.0	1.81 (2.85)	0.86 (0.25)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	1.88 (3.09)
T_7 : Fenox+MSM+ CME	45.0+2.0+2.0	2.06 (3.73)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	2.23 (4.49)
T_8 : Fenox+Ethox	37.5+15.0	1.28 (1.16)	0.82 (0.17)	0.71 (0.00)	0.71 (0.00)	0.92 (0.35)	1.60 (2.12)
T_9 : Fenox+Ethox	45.0+15.0	2.05 (3.71)	1.07 (0.65)	0.71 (0.00)	0.71 (0.00)	0.91 (0.33)	2.37 (5.14)
T_{10} : Cyhalo+MSM+ CME	62.5+2.0+2.0	2.10 (3.94)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	2.12 (4.03)
T_{11} : Cyhalo+Ethox	62.5+15.0	1.96 (3.35)	1.33 (1.26)	0.71 (0.00)	0.71 (0.00)	0.92 (0.35)	2.51 (5.84)
T_{12} : Weed free (HW at 20 and 40 DAS)		1.32 (1.23)	1.14 (0.80)	1.48 (1.68)	1.23 (1.02)	0.84 (0.20)	1.40 (1.49)
T_{13}: Weedy check		2.96 (8.33)	3.48 (11.67)	1.72 (2.45)	1.98 (3.46)	1.34 (1.33)	2.91 (8.33)
SEm ±		**0.10**	**0.05**	**0.05**	**0.05**	**0.04**	**0.14**
CD at 5 %		**0.29**	**0.14**	**0.05**	**0.15**	**0.14**	**0.41**

The observations are square root transformed. Figures in parentheses indicate the original value. Fenox = Fenoxaprop-p-ethyl, MSM = Metsulfuron methyl,
CME = Chlorimuron ethyl, Ethox = Ethoxysulfuron, Cyhalo = Cyhalofop–butyl, HW = Hand weeding

Table 4 .29: Economics of different post emergence herbicides for weed management in finger millet

Treatments	Grain yield (Kg ha^{-1})	Total Cost of Cultivation (Rs ha^{-1})	Gross Return (Rs ha^{-1})	Net Return (Rs ha^{-1})	B:C Ratio
T_1 : Fenox	140		2863	-9165	0.24
T_2 : Fenox	77	12162	1551	-10611	0.13
T_3 : MSM+CME	771	11662	15417	3755	1.32
T_4 : Ethox	794	11795	15662	3867	1.33
T_5 : Cyhalo	188	12706	3682	-9023	0.29
T_6 : Fenox+MSM+ CME	191	12328	3801	-8527	0.31
T_7 : Fenox+MSM+ CME	188	12462	3689	-8773	0.30
T_8 : Fenox+Ethox	180	12548	3488	-9060	0.28
T_9 : Fenox+Ethox	165	12682	3199	-9483	0.25
T_{10} : Cyhalo+MSM+ CME	163	13006	3260	-9746	0.25
T_{11} : Cyhalo+Ethox	119	13226	2467	-10759	0.19
T_{12} : Weed free (HW at 20 and 40 DAS)	1210	18370	23377	5007	1.27
T_{13}: Weedy check	540	11070	10648	-422	0.96
SEm ± **CD at 5 %**	**21.58** **63.00**		**451.39** **1317.5**	**451.39** **1317.5**	**0.03** **0.10**

Fenox = Fenoxaprop-p-ethyl, MSM = Metsulfuron methyl, CME = Chlorimuron ethyl, Ethox = Ethoxysulfuron, Cyhalo = Cyhalofop–butyl, HW = Hand weeding

Economics

Hand weeding twice recorded the highest gross return. Among herbicides ethoxysulfuron gave maximum gross return which was at par with that of metsulfuron methyl + chlorimuron ethyl. Fenoxaprop-p-ethyl (45.0 g ha^{-1}) gave minimum gross return. The maximum net return was observed in hand weeding twice which was at par with application of ethoxysulfuron and metsulfuron methyl + chlorimuron ethyl and B:C ratio was observed with ethoxysulfuron which was at par with that of metsulfuron methyl + chlorimuron ethyl and hand weeding twice.

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