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Bioefficacy of Metamifop in Wet Seeded Rice

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ABSTRACT

An experiment was conducted to test the bio efficacy of Metamifop for control of graminaceous weeds in wet seeded rice during 2008-2009. The treatments consisted of four rates of application of Metamifop 10 % EC formulation (Metamifop 50g, 75g, 100g and 125 g ha^{-1}) at two growth stages of weed *i.e*; 2-3 leaf stage (10 -12 DAS) and 5-6 leaf stage (15 -18 DAS). Cyhalofop butyl @100g/ha was included as standard check for comparison. Application of Metamifop 10 EC showed better control of *Echinochloa* when applied at 2-3 leaf stage than at 5-6 leaf stage of the grass weed. Metamifop 10 EC @ 125 g ha^{-1} applied at 2-3 leaf stage and 5-6 leaf stage and Metamifop 10 EC @ 100 g ha^{-1} at 2-3 leaf stage gave complete control of *Echinochloa* and remained on par with the weed free and cyhalofop butyl 10EC @ 100 g ha^{-1} in weed control and resulted in higher grain and straw yields.

Key words : Metamifop, Rice, Weed control

Major weeds of concern in wet seeded rice are the graminaceous weeds, mainly *Echinochloa* spp in lowland ecosystems (Michael, 1983). The *Echinchloa* species includes several annual and perennial plants that are well adapted to wet conditions. Differential sensitivity of these weed species to herbicides is related to differences in morphology and growth rate (Damlas *et al.,*2008). Variability in herbicide efficacy against distinct *Echinochloa* species or biotypes has been previously observed with various herbicides (Damlas *et al.,*2008). Cyhalofop is a common herbicide used for *Echinochloa* control as early post emergence application (2-4 leaf stage). Damlas *et al.,* (2008) studied the morphological and physiological variations among the species of *Echinochloa* and reported the variations in susceptibility to herbicides.

Metamifop is a new aryl oxy phenoxy propionate (AOPP) post emergence herbicide. It shows exclusive whole plant safety to rice, with high control efficiency of *Echinochloa* spp. (Kim *et al*., 2003). It is also reported that this herbicide at 90-200 g a.i ha^{-1} gave excellent control of a wide range of annual grass weeds and that the selectivity of metamifop between rice and barnyard grass could be due to both differential foliar absorption rate and differential Acetyl- CoA Carboxylase sensitivity (Kim *et al*., 2003). WSSA(2007) reported that the same mechanism of inhibition of Acetyl CoA Carboxylase is responsible for selectivity of cyhalofop. Hence there is need to develop and evaluate alternative chemicals for control of Echinochloa species in wetseeded rice.

MATERIAL AND METHODS

Experiments were conducted during the second crop (rabi) season of 2008 and 2009 at Kerala Agricultural University, Thrissur, to test the bio efficacy of Metamifop for control of graminaceous weeds in wet seeded rice. The rice variety Jyothi was used for the trial and there were 11 treatments. The treatments consisted of four rates of application of Metamifop 10 % EC formulation supplied by M/s FMC India Pvt. Ltd.(Metamifop 50g, 75g, 100g and 125 g/ha) at two growth stages of weed *i.e*; 2-3 leaf stage (10 -12 DAS) and 5-6 leaf stage (15 -18 DAS). The herbicide commonly used by the farmers for *Echinochloa* control, Cyhalofop butyl @100 g ha^{-1} was included as standard check for comparison. Weed free and control treatments were also included. Design was RBD and replications three. Plot size was 8m x 5 m.

RESULTS AND DISCUSSION

Weed Flora

The major weeds were *Echinochloa crusgalli* and *Echinichloa stagnina* which accounted for more than 65 percent of weed population. Sedges like *Cyperus iria, Cyperus difformis and Fimbristylis miliacea* and broad leaved weeds like *Ludwigia parviflora, Monochoria vaginalis, Sphenoclea zeylanica* were also present at lesser densities.

Pytotoxicity

No phytotoxicity to rice was observed from both the herbicides and even the highest dose of Metamifop 10 EC @125 g ai/ha was not toxic to

Table 1. Effect of Metamifop on density of *Echinochloa* at 30, 60 DAS and harvest.

Treatment	Rabi 2008			Rabi 2009		
	30DAS (No./m^2)	60DAS (No./m^2)	Harvest (No./m^2)	30DAS (No./m^2)	60DAS (No./m^2)	Harvest (No./m^2)
Metamifop 2-3 leaf stage(10 -12 DAS)						
Metamifop 50 g ha^{-1}	*5.02(24.33)**	4.76(21.67)	4.86(22.67)	*2.49(5.33)**	2.49(5.33)	2.49(5.33)
Metamifop 75 g ha^{-1}	4.39(18.33)	4.03(15.33)	3.95(14.67)	2.24(4.00)	2.49(5.33)	2.75(6.67)
Metamifop 100 g ha^{-1}	1.00 (0.00)	1.00(0.00)	2.37(4.67)	1.00(0.00)	1.00(0.00)	1.00(0.00)
Metamifop 125 g ha^{-1}	1.00(0.0)	1.00(0.00)	1.82(2.33)	1.00(0.00)	1.00(0.00)	1.00(0.00)
Metamifop 5-6 leaf stage(15 -18 DAS)						
Metamifop 50 g ha^{-1}	5.62(30.67)	5.60(30.33)	5.22(26.33)	2.75(6.67	2.45(6.67)	2.75(6.67)
Metamifop 75 g ha^{-1}	4.92(23.33)	4.79(22.0)	4.94(23.67)	2.49(5.33)	2.75(6.67)	2.74(6.67)
Metamifop 100 g ha^{-1}	2.88(7.00)	3.31(10.0)	3.60(12.0)	1.00(0.00)	1.00(0.00)	1.00(0.00)
Metamifop 125 g ha^{-1}	1.00(0.00)	1.82(2.33)	2.24(4.00)	1.00(0.00)	1.00(0.00)	1.00(0.00)
Cyhalofop 100 g	1.000(0.00)	1.00(0.00)	1.000(0.00)	1.00(0.00)	1.00(0.00)	1.00(0.00)
Weed free	1.000(0.00)	1.00 (0.00)	1.000(0.00)	1.00(0.00)	1.00(0.00)	1.00(0.00)
Control	9.21(84.0)	8.88 (78.0)	8.77(76.0)	7.08(49.33)	7.87(61.33)	8.69(74.67)
SEM +-	0.47	0.37	0.50	0.46	0.54	0.44
CDat 5 %	0.133	0.105	0.142	0.131	0.153	0.125

* "x+1 Transformed values
** The values in the parenthesis are original values.
DAS: Days After Sowing

rice. Kim *et al.,* (2003) reported that Metamifop applied post emergence at 90-200g a.i/ha shows robust safety on rice.

Plant height

Height of rice plants did not differ much between the herbicide treatments and hand weeding(Table 4). However herbicide treatments produced significantly taller plants than the unweeded control due to favourable growth condition resulting from less weed competition.

Weed population and dry weight

The data on the weed count (Table 1) and weed biomass (Table 3)at both 30 and 60 DAS revealed that Metamifop 10 EC applied at 2-3 leaf stage of the grasses has given better control than the application at 5-6 leaf stage, in both years of study. This is may be due to the fact that at an early growth stage, the plant parts are tender and absorption and translocation are more effective.

Metamifop 10 EC @ 125 g ai/ha applied at 2-3 leaf stage and 5-6 leaf stage has and Metamifop 10 EC @ 100 g ai/ha at 2-3 leaf stage gave complete control up to 60 DAS and remained on par with the weed free and Cyhalofop butyl 10EC @ 100 g ha^{-1} (Table 3). Kim et al., (2003) reported that Metamifop at 90-200 g/ha as post-emergence application gave effective control on annual grass weeds including *Echinochloa* spp. *Leptochloa chinensis*, *Digitaria* spp., *Eleusine indica*, etc

The weed dry matter production of Echichnocloa at 60 DAS was significantly lower when Metamifop 10 EC applied at 100g at 2-3 leaf stage and 125 g at both the stages, and were comparable with the weed free as well as Cyhalofop butyl 10 EC @ 100 g ai/ha.

The data on weed count (Table 1) showed that Metamifop at 125g at both stages of application and Cyhalofop butyl 100g resulted in complete control of *Echinochloa* up to the harvest stage. Metamifop 100g also gave cent percent control when applied at 3-4 leaf stage, where as during 2008, some Echinochloa plants survived when the application was done at 5-6 leaf stage. Lower doses of 50 and 75 g ha^{-1} were inferior to the higher doses (100 & 125 g ha^{-1}) at both the stages of application.

Both Metamifop and Cyhalofop could not result in control of sedge and dicot weeds (Table 2) indicating that these herbicides are affective against grass weeds only.

Table 2. Effect of Metamifop on density of dicots and sedges at 30 days after spraying (DAS).

Treatment	Rabi 2008		Rabi 2009	
	Dicots at 30DAS (No./m^2)	Sedges at 30DAS (No./m^2)	Dicots at 30DAS (No./m^2)	Sedges 30 DAS (No./m^2)
Metamifop 2-3 leaf stage(10 -12 DAS)				
Metamifop 50 g ha^{-1}	*7.16(51.33)**	5.85(35.66)	*1.79(4.00)**	1.82(2.33)
Metamifop 75 g ha^{-1}	8.47(71.00)	5.25(27.33)	1.82(4.00)	2.24(2.67)
Metamifop 100 g ha^{-1}	7.98(63.33)	5.53(30.67)	1.87(12.00)	3.48(2.67)
Metamifop 125 g ha^{-1}	8.14(66.00)	4.90(23.33)	2.75(8.00)	3.00(6.67)
Metamifop 5-6 leaf stage(15 -18 DAS)				
Metamifop 50 g ha^{-1}	7.88(62.33)	5.30(28.00)	2.37(4.00)	2.24(4.67)
Metamifop 75 g ha^{-1}	7.14(50.00)	7.43(54.67)	2.49(13.33)	3.78(5.33)
Metamifop 100 g ha^{-1}	7.88(61.67)	6.96(48.00)	2.36(10.67)	3.40(4.67)
Metamifop 125 g ha^{-1}	7.92(62.33)	6.50(41.33)	2.75(14.67)	3.90(6.67)
Cyhalofop 100 g	7.90(61.67)	6.43(40.33)	2.21(10.67)	3.40(4.00)
Weed free	1.00(0.00)	1.00 (0.00)	1.00(0.00)	1.00(0.00)
Control	7.83(60.67)	6.27(38.33)	2.95(13.33)	3.73(8.00)
SEM +-	1.31	1.65	0.83	0.98
CDat 5 %	0.372	0.468		0.2784

* "x+1 Transformed values
** The values in the parenthesis are original values.

Table 3. Effect of Metamifop on dry weight of *Echinochloa* spp at 60 DASand harvest.

Treatment	Dry weight at 60DAS (g)		Dry weight at harvest (g)	
	Rabi 2008	Rabi 2009	Rabi 2008	Rabi 2009
Metamifop 2-3 leaf stage(10 -12 DAS)				
Metamifop 50 g ha^{-1}	9.50(91.17)	9.30(86.67)	10.59(92)	9.53(90.0)
Metamifop 75 g ha^{-1}	8.77(75.93)	8.58 (72.60)	9.48(72)	9.07(81.33)
Metamifop 100 g ha^{-1}	1.00(0.00)	1.00(0.00)	8.42(55)	1.00(0.00)
Metamifop 125 g ha^{-1}	1.00(0.00)	1.00(0.00)	2.73(3.0)	1.00(0.00)
Metamifop 5-6 leaf stage(15 -18 DAS)				
Metamifop 50 g ha^{-1}	9.07(84.53)	10.24(104.0)	9.94(80)	8.85(77.33)
Metamifop 75 g ha^{-1}	9.03(80.67)	10.18(102.93)	9.89(79)	9.78(94.67)
Metamifop 100 g ha^{-1}	5.23(27.47)	1.00(0.00)	6.66(32)	1.00(0.00)
Metamifop 125 g ha^{-1}	1.69(1.86)	1.00(0.00)	2.48(2.2)	1.00(0.00)
Cyhalofop 100 g	1.00(0.00)	1.00	1.00(0.0)	1.00(0.00)
Weed free	1.00(0.00)	1.00	1.00(0.0)	1.00(0.00)
Control	14.07(197.33)	15.98	16.85(284)	23.38(546.67)
SEM +-	1.64	0.90	1.33	0.75
CDat 5 %	0.466	0.2257	0.3778	0.213

* "x+1 Transformed values
** The values in the parenthesis are original values.

Table 4. Effect of Metamifop on of wet yield attributes seeded rice.

Treatment	Rabi 2008			Rabi 2009		
	Pl height (cm)	Total number of tillers/plant	Productive tillers/plant	Pl height (cm)	Total number of tillers/plant	Productive tillers/plant
Metamifop 2-3 leaf stage(10 -12 DAS)						
Metamifop 50 g ha^{-1}	96.33	4.33	3.667	102.70	3.80	3.80
Metamifop 75 g ha^{-1}	97.00	4.67	4.33	97.67	3.80	3.80
Metamifop 100 g ha^{-1}	95.33	5.00	4.67	102.70	4.00	4.00
Metamifop 125 g ha^{-1}	97.00	5.33	5.00	105.00	4.30	4.30
Metamifop 5-6 leaf stage(15 -18 DAS)						
Metamifop 50 g ha^{-1}	94.33	3.67	3.67	97.33	3.60	3.20
Metamifop 75 g ha^{-1}	96.00	4.33	4.00	96.67	3.80	3.60
Metamifop 100 g ha^{-1}	95.67	4.67	4.33	97.67	4.10	3.80
Metamifop 125 g ha^{-1}	96.67	5.30	4.67	97.00	4.30	4.00
Cyhalofop 100 g	96.67	5.00	4.53	97.67	4.00	3.90
Weed free	101.0	5.33	5.00	98.33	4.60	4.50
Control	89.33	3.67	3.00	93.67	2.80	2.50
SEM +-	3.32	1.02	0.69	5.17	1.10	1.19
CDat 5 %	0.94	0.28	0.19	1.46	0.31	0.33

Table 5. Effect of Metamifop on grain and straw yield of met seeded rice.

Treatment	Rabi 2008		Rabi 2009	
	Grain yield (kg/ha)	Straw Yield (kg/ha)	Grain yield (kg/ha)	Straw Yield (kg/ha)
Metamifop 2-3 leaf stage(10 -12 DAS)				
Metamifop 50 g ha^{-1}	4085	4983	3811	4612
Metamifop 75 g ha^{-1}	4431	5361	4056	4989
Metamifop 100 g ha^{-1}	5140	6517	4364	5717
Metamifop 125 g ha^{-1}	5316	6485	4483	5738
Metamifop 5-6 leaf stage(15 -18 DAS)				
Metamifop 50 g ha^{-1}	3910	5240	3604	4505
Metamifop 75 g ha^{-1}	4137	5089	3792	5308
Metamifop 100 g ha^{-1}	4651	5768	4138	5131
Metamifop 125 g ha^{-1}	5132	6121	4362	6010
Cyhalofop 100 g	5100	6137	4151	5645
Weed free	5385	6570	4512	5550
Control	2696	3616	2697	3263
SEM +-	304.3	499.0	318.6	274.1
CDat 5 %	86.44	141.76	90.51	77.869

Earlier workers have reported that Cyhalofop and Metamifop are effective as graminicides only. In this trial, after taking the observation at 30 DAS, 2, 4-D was sprayed to control the sedges and dicots, so that the results would not be vitiated by their competition to rice.

Total tillers and productive tillers

The higher total tiller numbers were observed in the weed free, Metamifop 10 EC @ 100 and 125 g/ha, at both the stages of application and cyhalofop @100 g ha^{-1} have remained comparable with the hand weeded check (Table 4). The number of productive tillers per plant also showed the same trend. It is well documented that the productivity of plants will be severely affected due to competition from weeds for growth factors.

Grain and straw yield

Metamifop 10 EC @ 125 g ai/ha applied at both the stages and weed free treatments have resulted in higher grain yields which remained on par with Metamifop 10 EC @ 100 g /ha applied at 2-3 leaf stage and Cyhalofop butyl 10 EC @ 100 g ha^{-1} (Table 5). Metamifop 10 EC @ 100 and 125 g ha^{-1} applied at both the stages have resulted in higher straw yields and remained comparable with the weed free and Cyhalofop butyl 10 EC @ 100 g ha^{-1}. Samui *et al., (* 2003)have reported higher grain and straw yield of rice and reduced weed density in cyhalofop butyl applied plots.

CONCLUSION

From this study it was found that metamifop 10 EC @ 125 g ha^{-1} applied at 2-3 leaf stage and 5-6 leaf stage and Metamifop 10 EC @ 100 g ha^{-1} at 2-3 leaf stage gave complete control of *Echinochloa* and remained on par with the weed free and Cyhalofop butyl 10EC @ 100 g ha^{-1} in weed control and resulted in higher grain and straw yields.

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