International Journal of Forestry and Crop Improvement
Volume 7 | Issue 1 | June, 2016 | 14-18 | ■Visit us : *www.researchjournal.co.in*
e ISSN-2230-9411

RESEARCH ARTICLE

DOI: 10.15740/HAS/IJFCI/7.1/14-18

Strategies for weed management in drum seeded rice under puddled condition (*Oryza sativa* L.)

T. PARTHIPAN

ABSTRACT : Wet seeding holds special significance in the present day production systems by saving time, labour and energy. Drum seeded rice in puddled land becoming popular as lowland rice establishment method. Yield losses caused by weeds will become greater in direct seeding because of simultaneous growth of both rice and weed seedlings from the beginning. Weeds pose serious threat to sustainability and viability of direct seeded rice system. In this context, field experiments were conducted at Tamil Nadu Rice Research Institute, Aduthurai during wet seasons of 2011-12 and 2012-13 to evaluate the integrated weed management practices for lowland drum seeded rice in Cauvery Delta Zone. A total of 12 treatments were evaluated in a Randomized Block Design with three replications. The treatments consisted of post emergence application of metamifop (75, 100, 125 g ai ha^{-1}), pre-emergence application of pretilachlor plus safener @ 0.45 kg ai ha^{-1} alone and in combination with one hand weeding on 45 DAS; Post emergence metamifop 200 g ai ha^{-1}; post emergence cyhalofop butyl 100 g ai ha^{-1} and two hand weeding on 25 and 45 DAS and unweeded control. The results revealed that the pre-emergence application of pretilachlor + safener at 0.45 kg ai ha^{-1} followed by one hand weeding at 45 DAS was effective in controlling all weeds and registered higher yield attributes and yield in drum seeded rice. Further, the post emergence herbicide metamifop 100 g ai ha^{-1} was found to be superior in controlling grassy weeds as compared to other herbicides and doses. No doubt, the results of two hand weeding are significantly better, but as it is time consuming and laborious, it cannot be recommended at large scale. Hence, pre-emergence application of pretilachlor + safener at 0.45 kg ai ha^{-1} followed by one hand weeding at 45 DAS was found to be the best weed management practice in terms of higher weed control efficiency and yield in drum seeded rice cultivation.

KEY WORDS : Herbicides, Weed density, Weed dry weight, Yield, Drum seeded rice

HOW TO CITE THIS ARTICLE : Parthipan, T. (2016). Strategies for weed management in drum seeded rice under puddled condition (*Oryza sativa* L.). *Internat. J. Forestry & Crop Improv.*, **7** (1) : 14-18, **DOI: 10.15740/HAS/IJFCI/7.1/14-18.**

ARTICLE CHRONICAL : Received : *15.02.2016;* Revised : *04.04.2016;* Accepted : *05.05.2016*

INTRODUCTION

Rice (*Oryza sativa* L.) plays a vital role in feeding more than 3 billion people, including most of the world's one billion poor and any significant negative effect on rice production would be devastating for efforts to achieve global food security and address poverty. Transplanting of rice has been the traditional system of rice establishment but cultivation of direct seeded rice (DSR) is gaining momentum in India due to the demand of labour during peak season of transplanting and availability of water for shorter periods. Wet seeding holds special significance in the present day production systems by saving time, labour, energy and profitability to increase

AUTHOR FOR CORRESPONDENCE

T. PARTHIPAN, Agricultural College and Research Institute (T.N.A.U.), Eachangkottai, THANJAVUR (T.N.) INDIA

Email: parthiagri@yahoo.co.in

cropping intensity by reducing turn around period and to avoid arduous operations like nursery preparation and manual transplanting (Subramanian *et al*., 2011). The productivity of rice in India is declining due to an array of biotic and abiotic factors. Weeds are the prime yield-limiting biotic constraints that compete with rice for moisture, nutrients, and light.

Weed infestation and competition are severe in puddled drum seeded rice as compared to transplanted rice because of the simultaneous growth of both crops and weeds. Reduction in yield to the tune of 34 per cent in transplanted rice, 45 per cent in direct seeded low land rice and 67 per cent in upland rice due to weeds were reported by Muthukrishnan *et al.* (2010). Though manual weeding is considered to be the best, the undependable labour availability coupled with escalation on wage in many cases has given impetus to the development and use of new chemicals for weed control. At present, no herbicide is available which may provide effective wide spectrum control of grasses, sedges and broad leaved weeds as pre or post emergence application. Therefore, there is necessity that herbicides either pre-emergence or post emergence has to be supplemented with one hand weeding for effective control of weeds in DSR. Herbicides are considered to be alternative supplement for hand weeding, not a substitute (Rajendra Kumar, 2003). Hence, an attempt was made to study the integrated weed management packages for weed control efficiency and productivity in drum seeded rice under puddled conditions.

EXPERIMENTAL METHODS

Field investigations were carried out at Tamil Nadu Rice Research Institute (Tamil Nadu Agricultural University), Aduthurai during wet seasons of 2011-12 and 2012-13 to evaluate the integrated weed management practices for drum seeded rice in Cauvery Delta Zone of Tamil Nadu. The soil of the experimental field was clay with slightly alkaline pH (8.2), medium in organic carbon (0.52 %), low in available nitrogen (161 kg ha^{-1}), high in available phosphorus (54.5 kg ha^{-1}) and medium in available potassium (206 kg ha^{-1}). A total of 12 treatments were evaluated in a Randomized Block Design with three replications. The treatments consisted of post emergence application of metamifop (75, 100, 125 g ai ha^{-1}), pre-emergence application of pretilachlor plus safener @ 0.45 kg ai ha^{-1} alone and in combination with one hand weeding on 45 DAS. Post emergence metamifop 200 g ai ha^{-1} and post emergence cyhalofop butyl 100 g ai ha^{-1} was also tested and compared with two hand weeding on 25 and 45 DAS and unweeded control for the weed control efficiency and productivity.

Long duration (155 days), high yielding paddy variety CR 1009 was sown during 11.08.2011 and 15.08.2012 with pre-germinated paddy seeds by using drum seeder with inter and intra row spacings of 20 and 10 cm, respectively. The crop was fertilized with recommended dose of 150: 50: 50 kg NPK ha^{-1}. Entire dose of phosphorus along with zinc sulphate 25 kg ha^{-1} and gypsum 500 kg ha^{-1} were applied as basal. Nitrogen and potassium were applied in four equal splits at 21 DAS, active tillering, panicle initiation and heading stages. Pre-emergence herbicide was mixed with sand at the rate of 50 kg ha^{-1} and applied uniformly in the field on 3 DAS. The post emergence herbicides were mixed with water at the rate of 500 lit. ha^{-1} and sprayed at 2-3 leaf stage of weeds by using knapsack sprayer fitted with deflector nozzle. A thin film of water was maintained at the time of herbicide application. Hand weeding was carried out as per the treatment schedule. All other agronomic and plant protection measures were adopted as per the recommended packages.

The data on weed density and weed dry weight were recorded on 60 DAS with the help of a quadrate (0.25 m^2) at 4 places and then converted into per square metre. These values were subjected to square root transformation ($\sqrt{x+0.5}$) prior to statistical analysis to normalize their distribution. Grain yield of rice along with yield attributing characters were recorded at harvest.

EXPERIMENTAL RESULTS AND ANALYSIS

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads :

Weed flora and density :

Weed species in the experimental fields consisted of *Echinochloa crusgalli, Echinochloa colonum, Leptochloa chinensis* and *Panicum repens* among grasses, *Cyperus difformis, Cyperus iria, Cyperus rotundus* and *Fimbristylis miliacea* among sedges and *Marselia quadrifolia, Eclipta alba, Ammania*

baccifera, Bergia capensis and *Ludwigia parviflora* among broad leaved weeds.

Weed control treatments significantly reduced population of weeds over weedy check during both years of study (Table 1). However, weed population was reduced greatly under two hand weeding on 25 and 45 DAS (26.33 and 17.00 m^{-2}) as compared to unweeded check (232.00 and 284.33 m^{-2}). These findings are in conformity with Rekha *et al.* (2002). No doubt, the results of two hand weeding are significantly better in terms of weed control and rice grain yield, but as it is time consuming and laborious, it cannot be recommended at large scale. Among herbicides tried, pre-emergence application of pretilachlor plus safener at 0.45 kg ai ha^{-1} on 3 DAS followed by one hand weeding at 45 DAS gave the highest reduction in weed density during both years of study. This may be due to the fact that pretilachlor + safener effectively controlled early flushes of weeds and hand weeding controlled later flushes of weeds. These results are in agreement with the findings of Nandal and Hari (1998) and Sangeetha (2006). In general, applications of herbicides supplemented with hand weeding on 45 DAS were found effective in lowering the weed density of grasses, sedges and BLW at 60 DAS. Application of pretilachor + safener showed greater reduction in sedges and broad leaved weeds; whereas grass weed population was markedly reduced under metamifop application with increasing doses. Similar findings were reported by Chinnusamy *et al.* (2010). The results further revealed that maximum weed density was noticed in untreated plots during both years. It means that if weeds were not controlled, their density continuously remained increasing that may adversely affect the crop growth.

Table 1 : Influence of weed management on weed density (No. m^{-2}) in drum seeded rice on 60 DAS

Treatments	Grasses		Sedges		BLW		Total	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
Metamifop 75 g ai/ha.	4.33 (18.33)	5.08 (25.33)	7.80 (60.67)	10.99 (120.67)	9.09 (82.33)	7.86 (61.33)	12.71 (161.33)	14.40 (207.33)
Metamifop 100 g ai/ha.	3.61 (12.67)	3.80 (14.00)	7.85 (61.33)	10.08 (101.33)	9.06 (82.00)	7.77 (60.00)	12.51 (156.00)	13.25 (175.33)
Metamifop 125 g ai/ha.	3.34 (10.67)	3.47 (11.67)	7.69 (58.67)	10.27 (105.33)	8.93 (79.33)	7.71 (59.00)	12.21 (148.67)	13.28 (176.00)
Metamifop 200 g ai/ha.	3.23 (10.00)	3.38 (11.00)	7.38 (54.33)	10.19 (104.00)	8.87 (78.33)	7.40 (54.33)	11.95 (142.67)	13.01 (169.33)
Pretilachlor + safener 450 g ai/ha.	4.13 (16.67)	4.41 (19.00)	6.82 (46.33)	8.20 (67.00)	7.44 (55.00)	6.51 (42.00)	10.87 (118.00)	11.33 (128.00)
Cyhalofop butyl 100 g ai/ha.	3.58 (12.33)	4.98 (24.33)	7.94 (62.67)	10.88 (118.00)	9.44 (88.67)	7.82 (60.67)	12.81 (163.67)	14.26 (203.00)
Metamifop 75 g ai/ha.+ HW 45 DAS	1.76 (2.67)	1.81 (3.00)	2.85 (7.67)	3.61 (12.67)	4.37 (18.67)	3.61 (12.67)	5.43 (29.00)	5.36 (28.33)
Metamifop 100 g ai/ha.+ HW 45 DAS	1.58 (2.00)	1.64 (2.33)	3.08 (9.00)	3.53 (12.00)	4.44 (19.33)	3.08 (9.00)	5.54 (30.33)	4.88 (23.33)
Metamifop 125 g ai/ha.+ HW 45 DAS	1.58 (2.00)	1.76 (2.67)	2.96 (8.33)	3.38 (11.00)	4.33 (18.33)	2.96 (8.33)	5.39 (28.67)	4.74 (22.00)
Pretilachlor + safener 450 g ai/ha.+ HW 45 DAS	1.64 (2.33)	1.76 (2.67)	2.68 (7.33)	3.44 (11.33)	4.30 (18.00)	2.91 (8.00)	5.28 (27.67)	4.73 (22.00)
Hand weeding twice - 25 and 45 DAS	1.46 (1.67)	1.34 (1.33)	2.49 (6.00)	2.90 (8.00)	4.35 (18.67)	2.84 (7.67)	5.16 (26.33)	4.17 (17.00)
Unweeded control	6.19 (38.00)	6.95 (48.00)	9.21 (84.67)	12.36 (152.67)	10.47 (109.33)	9.17 (83.67)	15.24 (232.00)	16.87 (284.33)
S.E.±	0.24	0.31	0.40	0.47	0.39	0.26	0.43	0.43
C.D. (P=0.05)	0.49	0.65	0.84	0.97	0.80	0.53	0.90	0.89

Figures in parentheses are original values, which were subjected to square root transformation ($\sqrt{x} + 0.5$) before statistical analysis

Weed dry weight :

The lowest weed dry weight of 7.87 and 7.60 g m^{-2} recorded by two hand weeding followed by 8.53 and 8.13 g m^{-2} with application of pretilachlor + safener supplemented with hand weeding as compared to 246.87 and 248.80 g m^{-2} under unweeded check at 60 DAS during both years, respectively (Table 2). Hand weeding at 25 and 45 DAS being at par with pretilachlor + safener 0.45 kg ai ha^{-1} on 3 DAS supplemented with one hand weeding at 45 DAS in reducing weed dry weight at 60 DAS as compared to other herbicide treatments as well as weedy check. Maximum dry weight of weeds was recorded under unweeded control at 60 DAS during both years. At 60 DAS, two hand weeding on 25 and 45 DAS and integration of herbicides with a hand weeding on 45 DAS recorded higher weed control efficiency of 92 – 97 per cent compared to application of herbicides alone (53 – 68 %). This clearly indicated that, the pre or post-emergence application of herbicide during early stage followed by one hand weeding at later stage preferably

Table 2: Influence of weed management on weed dry weight and weed control efficiency (60 DAS) in drum seeded rice

Treatments	Weed dry weight (g m^{-2})		WCE (%)	
	2011-12	2012-13	2011-12	2012-13
Metamifop 75 g ai/ha.	10.19 (103.27)	10.78 (115.87)	58.17	53.43
Metamifop 100 g ai/ha.	9.60 (91.77)	10.08 (101.20)	62.83	59.32
Metamifop 125 g ai/ha.	9.35 (87.00)	9.96 (98.80)	64.76	60.29
Metamifop 200 g ai/ha.	9.17 (83.80)	9.43 (88.40)	66.05	64.47
Pretilachlor + safener 450 g ai/ha.	8.89 (78.53)	8.83 (77.67)	68.19	68.78
Cyhalofop butyl 100 g ai/ha.	10.51 (110.20)	10.64 (112.87)	55.36	54.64
Metamifop 75 g ai/ha.+ HW 45 DAS	3.81 (14.10)	4.39 (18.80)	94.29	92.44
Metamifop 100 g ai/ha.+ HW 45 DAS	3.65 (12.87)	3.98 (15.33)	94.79	93.84
Metamifop 125 g ai/ha.+ HW 45 DAS	3.56 (12.23)	4.01 (15.73)	95.04	93.68
Pretilachlor + safener 450 g ai/ha.+ HW 45 DAS	3.00 (8.53)	2.93 (8.13)	96.54	96.73
Hand weeding Twice - 25 and 45 DAS	2.87 (7.87)	2.84 (7.60)	96.81	96.95
Unweeded control	15.73 (246.87)	15.77 (248.80)	-	-
S.E.±	0.27	0.34	-	-
C.D. (P=0.05)	0.56	0.70	NA	NA

Figures in parentheses are original values, which were subjected to square root transformation ($\sqrt{x + 0.5}$) before statistical analysis NA – Not Analysed

Table 3 : Influence of weed management on yield attributes and yield of drum seeded rice

Treatments	Panicles m^{-2}		Grain yield (kg ha^{-1})		Straw yield (kg ha^{-1})	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
Metamifop 75 g ai/ha.	252	270	3125	3544	5154	4284
Metamifop 100 g ai/ha.	267	283	3521	3889	5647	5044
Metamifop 125 g ai/ha.	283	298	3655	4013	6119	5128
Metamifop 200 g ai/ha.	286	300	3791	4113	6439	5198
Pretilachlor + safener 450 g ai/ha.	293	306	3918	4254	6595	6048
Cyhalofop butyl 100 g ai/ha.	265	279	3337	3771	5409	5344
Metamifop 75 g ai/ha.+ HW 45 DAS	326	344	4767	6716	7076	9293
Metamifop 100 g ai/ha.+ HW 45 DAS	340	374	5186	7456	7310	9843
Metamifop 125 g ai/ha.+ HW 45 DAS	351	386	5211	7751	7523	10263
Pretilachlor + S 450 g ai/ha.+ HW 45 DAS	354	393	5479	7867	7565	10376
Hand weeding twice - 25 and 45 DAS	368	409	5707	8026	7882	10489
Unweeded control	149	182	2087	2368	3326	3044
S.E.±	13	13	183	288	276	293
C.D. (P=0.05)	27	29	379	596	572	608

on 45 DAS was found to be the ideal combination for reducing weed dry weight in drum seeded rice ecosystem.

Yield parameters and yield of rice :

All the weed control treatments brought out a significant effect on number of panicles per square metre, grain and straw yield of DSR as compared to control (Table 3). Among the treatments studied, two hand weeding registered the highest number of panicles 368 and 409 m^{-2} during both the year, respectively, which was on par with the pre-emergence application of pretilachlor + safener 0.45 kg ai ha^{-1} on 3 DAS followed by one hand weeding at 45 DAS and metamifop 125 g ai ha^{-1} followed by one hand weeding at 45 DAS.

The highest grain yield (5707 and 8026 kg ha^{-1}) was recorded by two hand weeding in both years. This might be due to better control of weeds leading to lesser nutrient removal by the same and higher uptake of nutrients by rice. Similar results were also reported by Prasad *et al.* (2001). However, two hand weeding was comparable with pre-emergence application of pretilachlor + safener 0.45 kg ai ha^{-1} on 3 DAS followed by one hand weeding at 45 DAS (5479 and 7867 kg ha^{-1}). The post-emergence application of metamifop at 100 and 125 g ai ha^{-1} followed by one hand weeding on 45 DAS registered comparable yield during both years and found to be the next best treatments in terms of higher grain yield. This might be attributed to better growth of plants under the condition of reduced weed competition at critical crop growth stages thereby resulting in increased availability of nutrients, water and light. These results are in accordance with the findings of Subramanian *et al.* (2005) and AICRIP (2011).The lowest grain yield (2087 and 2368 kg ha^{-1}) and straw yield (3326 and 3044 kg ha^{-1}) were recorded under unweeded control during both years of investigation.

Conclusion :

From the study, it may be concluded that pre-emergence application of pretilachlor + safener at 0.45 kg ai ha^{-1} followed by one hand weeding on 45 DAS exhibited better weed control efficiency thereby resulted in better uptake of nutrients by plants and increased grain and straw yield in drum seeded rice under puddled conditions. Further, application of post emergence herbicide metamifop 100 g ai ha^{-1} followed by one hand weeding on 45 DAS was also found promising when the field was heavily infested with grassy weeds.

REFERENCES

AICRIP (2011). *All India co-ordinated rice improvement programme*, Annual progress report. DRR, Hyderabad, Vol. **3**, p. 4.143.

Chinnusamy, C., Janaki, P., Nithya, C. and Muthukrishnan, P. (2010). Evaluation of grass herbicide – Metamifop on weed control and productivity of direct seeded rice. In Proceedings of the National Conference on "Challenges in weed management in agro-ecosystems-Present status and future strategies", Nov.30 and Dec.1, (pp.282-283) Tamil Nadu Agricultural University, Coimbatore, T.N. (INDIA).

Muthukrishnan, P., Subbalakshmi, L. and Sathiya, K. (2010). Weed distribution and management in rice. In : Proceedings of the National conference on "Challenges in weed management in agro-ecosystems–Present status and future strategies", Nov.30 and Dec.01,(pp. 15-20). Tamil Nadu Agricultural University, Coimbatore (T.N.) INDIA.

Nandal, D.P. and Hari, Om (1998). Weed control in direct seeded puddled rice. *Indian J. Weed Sci.,* **30** (1&2): 18-20.

Prasad, S.M., Mishra, S.S. and Singh, S.J. (2001). Effect of establishment methods, fertility levels and weed management practices on rice (*Oryza sativa*). *Indian J. Agron.,* **46** (2) : 216-221.

Rajendra Kumar, B. (2003). Studies on weed management in anaerobic tolerant rice cultivars under direct wet seeded condition. M.Sc. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore, T.N. (INDIA).

Rekha, K. B., Raju, M. S. and Reddy, M. D. (2002). Effect of herbicides in transplanted rice. *Indian J. Weed Sci.,* **34** (1-2) : 123-125.

Sangeetha, S.P. (2006). Studies on weed control in drum seeded rice under lowland ecosystem. M.Sc. (Ag.)Thesis, Tamil Nadu Agricultural University, Coimbatore (T.N.) INDIA.

Subramanian, E., James Martin, G., Rajakumar, D. and Durai Singh, R. (2011). Weed and nitrogen management through inorganic and companion crops for drum seeded wet rice, *IRRN*, **36**: 57-60.

Subramanian, E., James Martin, G. and Ramasamy, S. (2005). Effect of weed and nitrogen management on weed control and productivity of wet seeded rice. *Indian J. Agron.*, **37** (1 & 2) : 61-64.