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Study of integrated weed management practices in direct seeded puddled rice

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Abstract
A field experiment was conducted at Experimental farm, Faculty of Agriculture, Annamalai University, Annamalai Nagar, to study the effect of integrated weed management practices in direct seeded puddle rice during *Navarai* (January to April 2015). The experiment was laid out in a randomized block design with ten treatments and three replications. The treatments comprised of T_1 - Unweeded control, T_2 - Hand weeding on 20 and 40 DAS, T_3 – Pre emergence application of oxadiargyl@125g ha^{-1} followed by hand weeding on 30 DAS, T_4 - Pre emergence application of pendimethalin0.75 kg ha^{-1} followed by hand weeding on 30 DAS, T_5 –Post emergence application of ethoxysulfuron@100g ha^{-1}on 20 DAS, T_6 - Post emergence application of fenoxa prop-p-ethyl@60g ha^{-1} on 20 DAS, T_7 - Pre emergence application of oxadiargyl@125g ha^{-1}followed bypost emergence application of ethoxysulfuron @100g ha^{-1}on 20 DAS, T_8 - Pre emergence application of pendimethalin@0.75kg ha^{-1} followed bypost emergence application of ethoxysulfuron @ 100 g ha^{-1} on 20 DAS, T_9 - Pre emergence application of oxadiargyl@125g ha^{-1}followed bypost emergence application of fenoxa prop-p-ethyl @60 g ha^{-1} on 20 DAS and T_{10} - Pre emergence application of pendimethalin @ 0.75 kg ha^{-1} followed bypost emergence application offenoxa prop-p-ethyl @ 60g ha^{-1} on 20 DAS.
Among the treatments, pre-emergence application of oxadiargyl @ 125g ha^{-1} followed by one hand weeding on 30 DAS recorded the least weed count, weed biomass and the highest weed control index and higher growth and yield attributes of rice. This was followed by hand weeding on 15 and 30 DAS. Unweeded check recorded the highest weed density, weed biomass resulting in the least grain yield.

Keywords: weed management, seeded puddled rice, Experimental farm

Introduction
Rice occupies a pivotal place in Indian agriculture and is grown on more than 44 million hectares and accounts for about 43 percent of total food grain production in the country (Pradhan *et al.,* 2013) [5]. Tamil Nadu alone contributes nearly eight percent of the national rice production from an area of 2.2m.ha with a production of 8.55 m.t. (Anonymous, 2007) [1]. Direct seed rice in puddled condition is heavily infested by heterogeneous types of weed flora consisting of grasses, sedges and BLW causes yield reduction up to 90 percent.
Rice crop suffers from various biotic and abiotic constraints. Weed competition is one of the primary yield-limiting biotic constraints in rice. There are several reasons for low productivity and the one due to weeds is the most important. Weeds complete with rice for moisture, nutrients, light, temperature and space. Uncontrolled weeds have caused yield reduction of 28 to 90% in direct seeded rice. (Manhas *et al*., 2012) [2]. Further more any delay in weeding will lead to increased weed biomass which has a negative correlation with yield. Weeds are the silent but virulent robbers of plant nutrients, moisture and solar energy occupying the space which would otherwise be available to the main crop, harbor of insect-pests and disease causing organisms, agents causing adverse all allopathic effects and increasing cost of production indirectly.
Puddled transplanted rice is labour intensive method. Rice planting is labour intensive method. Rice planting has become narrow and there is scarcity of labour during window period. Delayed transplanting of rice not only causes reductions in rice yield but also become an obstacle for timely sowing of subsequent crop. This led to high wage rates at the time of transplanting because of limited labour availability. It has been observed that labour wages for rice transplanting during last few years increased more times. Therefore farmers have shown more interest in direct seeded rice as it helps in the timely planting of rice and subsequent crop. It increases profitability, requires less labour and energy and is more conducive to mechanization.
Herbicides are effective against weed species but most of them are specific and are effective against narrow range of weed species (Mukerjee and singh. 2005) [3]. In contrast to this, chemical weed control is effective to control weeds economically now a days use of herbicides

is gaining popularity in rice culture due to their rapid effects and less cost involvement compared to traditional methods. Chemical weed control offers economic and efficient weed control if applied at proper dose and stage. The use of herbicides offers selective control of weeds right from beginning, giving crop an advantage of good start and competitive superiority over weeds (Saha, 2006).

Materials and Methods

The experiment was conducted in the wetland block of the Experimental Farm, Department of Agronomy, Annamalai University during *Navarai* season to study the integrated weed management practices in direct seeded puddled rice. The soils of the experimental fields wereclay loam in texture, low in nitrogen, medium in available phosphorus and high in available potash with pH of 7.2. The experiment was laid out in a randomized block design with ten treatments and three replications. The treatments comprised of T_1 - Unweeded control, T_2 - Hand weeding on 20 and 40 DAS, T_3 – Pre emergence application of oxadiargyl 125g ha^{-1} followed by hand weeding on 40 DAS, T_4 - Pre emergence application of pendimethalin0.75 kg ha^{-1} followed by hand weeding on 40 DAS, T_5 –Post emergence application of ethoxysulfuron@100g ha^{-1}on 20 DAS, T_6 - Post emergence application of fenoxa prop-p-ethyl 60g ha^{-1} on 20 DAS, T_7 - Pre emergence application of oxadiargyl 125g ha^{-1}followed bypost emergence application of ethoxysulfuron @100g ha^{-1}, T_8 - Pre emergence application of pendimethalin 0.75kg ha^{-1} followed bypost emergence application of ethoxysulfuron 100 g ha^{-1}, T_9 - Pre emergence application of oxadiargyl 125g ha^{-1}followed bypost emergence application of fenoxa prop-p-ethyl 60 g ha^{-1} and T_{10} - Pre emergence application of pendimethalin 0.75 kg ha^{-1} followed bypost emergence application offenoxa prop-p-ethyl @ 60g ha^{-1} on 20 DAS. Weed characters in each plot was recorded by using quadrate (0.5X0.5 m) in four places and expressed in number per meter. Observation on yield attributes and yield were recorded

Result and Discussion

The weed flora of experimental field consisted of four species of grasses, two species of sedges and six species of broad leaved weeds. Among the grasses *Echinochloacolonum* was the predominant species followed by *E. Crusgalli*, *Leptocholochinensis* and *Panicumrepens.* Among sedges, the dominant species was *Cyperusdifformis* followed by *Cyperus rotundus.* Among BLW *Marsiliaquadrifoliata*, *Bergiacapensis* and *Sphenocleazeylanica* was predominant weeds.

Effect on weeds

At 20, 40 and 60 DAS, the lowest weed biomass was noticed with pre emergence application of oxadiargyl integrated with hand weeding on 40 DAS and it was followed by hand weeding on 20 and 40 DAS. Highest weed DMP was recorded with unweeded. Herbicide treatment showed significant reduction in weed dry matter prductin than other treatments, unweeded control registered higher weed population. This may be explained as direct sown seeds in puddled soil was favourable for weed seeds germination and their establishment already present in weed seed bank of the soil compared to frail and weak germination of rice seedlings. It works through contact with emerging or recently emerged shoots, but there is slight absorption by the root (Nethu and Jagnnath 2011). It ensures efficient weed control during critical periods and resulted in decreased weed bioass in drum seeded rice. This findings of the study are in accordance with more of pre emergence application of oxadiargyl offers weed control from the beginning of the crop, facilitating a head strat and competitive advantage to the crop (Mahajan and Chanzen 2013). Pre-emergences application of oxadiargyl followed by hand weeding on 30 DAS registered the highest weed control index and this was followed by two hand weeding on 15 and 30 DAS This may be due reduced weed biomass resulted in higher weed index

Effect on crops.

Significant variations were noticed in function of integrated weed management in growth and yield attributes. More weed competition in unweeded control resulted in reduced plant height, dry matter production and number of tillers per hill under this treatment at harvest. Consequently weed control measures offered a better environment for enhanced plant height. Significantly highest plant height and crop dry matter production was recorded with pre emergence application of oxadiargyl integrated with hand weeding on 40 DAS Higher values of plant height and dry matter production was mainly due to lesser crop weed competition, resulting in higher availability of plant nutrients and moisture forming increase growth characters.

The uptake of primary nutrients by any crop is a function of crop biomass and plant nutrient concentration. Therefore, lower dry matter production and uptake of nutrients by weeds under effective weed management practices eventually permits the crops to absorb more nutrients resulted in increased dry matter production was recorded with pre emergence application of oxadiargyl followed by hand weeding on 30 DAS.

Severe weed competition in unweeded plot recorded the reduced yield characters. All weed control measures gave significantly higher grain and straw yield than unweeded plot. Pre emergence application of oxadiargyl followed by hand weeding on 30 DAS procured superior yield. The enhancement in the grain and straw yield due to pre emergence application of oxadiargyl followed by hand weeding on 30 DAS was because of the fact that they helped to keep weed free condition thus resulting in better utilization of resources led to production of higher grain yield. The results are in uniformly with the Subramani *et al.*, (2011) [6].

Table 1: Weed biomass and Weed control index as influenced by integrated weed management practices

Treatments	Weed Biomass			Weed control index		
	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS
T_1- Unweeded Control	16.2 (263.19)	18.38 (337.65)	20.14 (405.48)	-	-	-
T_2- HW on 20 and 40 DAS	16.05 (257.19)	8.68 (74.88)	9.66 (92.82)	2.27	77.82	77.10
T_3- Oxadiargyl@125g ha^{-1} + HW on 40 DAS	8.36 (69.54)	7.58 (57.03)	8.87 (78.33)	73.57	83.10	80.68
T_4- Pendimethalin@0.75kg a.i ha^{-}+ HW on 40 DAS	10.72 (114.57)	8.82 (77.4)	9.71 (93.84)	56.46	77.07	76.85

T_5-Ethoxysulfuron100g ha^{-1}on 15 DAS	16.21 (262.32)	12.27 (150.18)	14.1 (198.54)	0.33	55.52	51.03
T_6- Fenoxa prop-p-ethyl@60g ha^{-1} on 15 DAS	15.31 (234.18)	12.47 (155.19)	14.3 (204.96)	11.02	54.03	49.45
T_7- Oxadiargyl125g ha^{-1} + Ethoxysulfuron100g ha^{-1}	8.81 (77.19)	9.30 (86.13)	10.3 (107.28)	70.67	74.49	73.54
T_8- Pendimethalin 0.75kg ha^{-1} + Ethoxysulfuron100g ha^{-1}	10.72 (114.6)	9.78 (95.22)	10.92 (118.83)	46.19	71.79	70.69
T_9-Oxadiargyl125g ha^{-1}+ Fenoxa prop-p-ethyl 60g ha^{-1}	8.88 (78.36)	11.62 (134.7)	12.1 (145.98)	70.22	60.10	63.99
T_{10}-Pendimethalin 0.75kg ha^{-1} +Fenoxa prop-p-ethyl 60g ha^{-1}	10.53 (110.46)	12.03 (144.4)	13.3 (177.3)	58.03	57.23	56.27
S.Ed	0.17	0.26	0.30			
CD (P=0.05)	0.36	0.54	0.61			

Figures in the parenthesis are square root transformed [SQR (X+0.5)] values.

Table 2: Growth and yield attributes as influenced by integrated weed management practices

Treatments	Plant height	Crop DMP	Number of tillers $hill^{-1}$	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
T_1- Unweeded Control	60.58	7545	10.23	2019	4850
T_2- HW on 15 and 30 DAS	103.41	12625	18.12	4844	7173
T_3- Oxadiargyl@125g ha^{-1} + HW on 30 DAS	106.56	13225	18.90	5325	7405
T_4- Pendimethalin@0.75kg a.i ha^{-}+ HW on 30 DAS	99.91	12037	17.76	4663	6953
T_5-Ethoxysulfuron100g ha^{-1}on 15 DAS	84.90	9065	14.03	3541	5816
T_6- Fenoxa prop-p-ethyl@60g ha^{-1} on 15 DAS	80.78	8471	13.10	3296	5585
T_7- Oxadiargyl125g ha^{-1} + Ethoxysulfuron100g ha^{-1}	98.58	11441	16.25	4532	6725
T_8- Pendimethalin 0.75kg ha^{-1} + Ethoxysulfuron100g ha^{-1}	95.18	10843	15.95	4452	6495
T_9-Oxadiargyl125g ha^{-1}+ Fenoxa prop-p-ethyl 60g ha^{-1}	92.01	10248	15.05	4152	6267
T_{10}-Pendimethalin 0.75kgha^{-1} + Fenoxa prop-p-ethyl 60g ha^{-1}	88.90	9653	14.87	3851	6038
S.Ed	1.68	275	0.26	140	104
CD (P=0.05)	3.27	592	0.57	279	225

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