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Effect of weed management practices with new generation herbicides in transplanted rice

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Abstract
A Study was conducted during Samba season of 2017 to evaluate the efficacy of pre and post emergence herbicides in transplanted rice in Cuddalore district. The new herbicides evaluated were Pretilachlor 6% + Pyrazosulfuron-ethyl 0.15% GR @ 10 kg ha^{-1} along with post emergence herbicides Fenoxaprop-p-ethyl 9.3% w/w @ 875 ml ha^{-1}, Bispyribac-sodium 10% SC @ 200 ml ha^{-1}. Results of the study revealed substantial reduction in weed biomass in all the herbicide treated plots compared to weedy check. Pre-emergence herbicide application followed by application of post emergence herbicides recorded lower weed control efficiency. The highest grain yield (5163 kg ha^{-1}), straw yield (7654 kg ha^{-1}), net return (Rs. 52070 ha^{-1}) and BCR (2.52) were obtained with application of Pretilachlor 6% + Pyrazosulfuron-ethyl 0.15% GR @ 10 kg ha^{-1} on 3 DAT + Bispyribac-sodium 10% SC @ 200 ml ha^{-1}on 20 DAT (T_7). The least weed biomass, grain and straw yield, net income and return rupee^{-1} invested were accounted with un weeded check. On the basis of the above results, it can be concluded that application of Pretilachlor + Pyrazosulfuron-ethyl + Bispyribac-sodium (T_7) hold promise as an appropriate method of weed management for obtaining higher yield and net income in transplanted rice and it was on par with twice hand weeding.

Keywords: New generation herbicides, weed management.

Introduction
Rice (*Oryza sativa* L.) is an important food crop contributing major share in the total food grain production. Generally, low rice productions attributed to infestation of pests and diseases, weeds, poor water quality and its management, fertility management besides low yield potential of varieties. Weed management is one of the major factors, which affect rice yield. Uncontrolled weeds cause grain yield reduction up to 76% under transplanted conditions (Rao *et al*. 2007) [4]. Therefore, timely weed control is imperative for realizing desired level of productivity.

Therefore, an efficient and economic weed management program is necessary to control different types of weeds throughout the cropping period. Hand weeding though efficient is expensive, time consuming, difficult and often limited by scarcity of labour in time. On the other hand, herbicides offer economic and efficient weed control if applied at proper dose and stage.

However, the continuous use of single herbicide or herbicides having the same mode of action may lead to the weed resistance problem and also weed shifts. Hence it is necessary to test some high efficacy herbicides to control mixed weed flora in transplanted rice. Keeping this in view, a field experiment was carried out to evaluate the performance of pre- and post-emergence herbicides alone and in combination in transplanted rice.

Materials and Methods
The field experiment was conducted at experimental farm, Annamalai University, Chidambaram, Tamil nadu, located at 11º24' N latitude and 79º44' E longitude and an altitude of +5.79 m above MSL. The soil of the experimental field is clayey loam in texture. The soil pH was 7.3 and EC was normal (0.37 dS m^{-1} which is safe limit), high in organic carbon and available P, medium in available N and K. The field experiment was conducted during Samba season (September-January, 2017) by transplanting rice seedling variety of 'ADT -49' in Randomised Block Design with three replications.

The treatments included different pre-emergence herbicides applied alone and their combinations with either post emergent herbicides or hand weeding. The new herbicides used were Pretilachlor + Pyrazosulfuron-ethyl, Fenoxaprop-p-sodium 10% SC @ 200 ml ha^{-1} were taken. Experiment was laid out in Randomised Block Design with three replications.

All herbicides were applied using knapsack sprayer fitted with flat fan nozzle with a spray volume of 500 l. ha^{-1}.

Thirty days old seedlings of rice variety '*ADT 49*' were transplanted with a spacing of 20 x 10 cm. Half of the nitrogen and whole of phosphate and potash were applied at the time of final puddling and the remaining quantity of nitrogen was applied at panicle initiation stage. Weed dry weight were sampled randomly at two places with the help of a 0.25 m^2 sized quadrate on 60th day. Yield was recorded at crop harvest. Weed control index was also calculated on the basis of dry matter production by weeds.

Results and Discussion

Effect on weed dry matter

All the weed control measures caused significant reduction in the density of all the weeds over weedy check. Weed dry matter was highly influenced by differential application of herbicides, their combinations and integration with manual weeding. Significantly lowest weed dry matter (26.82 kg ha^{-1}) was recorded in treatment *i.e.,* Pretilachlor + Pyrazosulfuron-ethyl + Bispyribac-sodium, followed by Pretilachlor + Pyrazosulfuron-ethyl+ Fenoxaprop-p-ethyl (70.07 kg ha^{-1}) and the treatment twice hand weeding on 20 and 40 DAT (74.54 kg ha^{-1}) were on par. The highest weed dry matter production of 349.38 kg ha^{-1} on 60 DAT was recorded in unweeded control (Table 1). Similar trend has also been observed by Murugan. G and Rm. Kathiresan (2010) [1] and Yadav *et al*. (2009) [6].

Weed control index (WCI) ranged from 78.66-92.32% with various herbicide combinations. Highest WCE (92.32) was recorded in Pretilachlor + Pyrazosulfuron-ethyl + Bispyribac-sodium, while lowest was recorded with twice hand weeding on 20 and 40 DAT (78.66). The results were in conformity with the findings of Porpavai *et al*. (2006) [3].

Effect on yield

Data revealed that significantly higher grain yield and straw yield were recorded with Pretilachlor + Pyrazosulfuron-ethyl + Bispyribac-sodium (5163 and 7654 kg ha^{-1}) followed by Pretilachlor + Pyrazosulfuron-ethyl + Fenoxaprop-p-ethyl(4965 and7366 kg ha^{-1}) and was at par with twice hand weeding on 20 and 40 DAT (4787 and 7150 kg ha^{-1}), respectively. The lowest grain and straw yield (3046 and 4600 kg ha^{-1}) were recorded with un weeded control, respectively (Table 2) indicating the importance of weed management in the critical growth period of crop by herbicide application, which facilitated the efficient use of resources. The findings of these investigations were in line with Vivek Yadav and Bhagwan Singh, 2006 [5].

Economics

Economics of different herbicides their combinations and weed management were calculated on the basis of cost of cultivation and gross returns (Rs.ha^{-1}) accrued from the treatment and based on this, benefit cost ratio was calculated (BCR). Application of (Pretilachlor + Pyrazosulfuron ethyl) + Bispyribac- sodium registered the higher net income of Rs.52170 ha^{-1} and return $rupee^{-1}$ invested of Rs. 2.52. It was followed by (Pretilachlor + Pyrazosulfuron ethyl) + Fenoxaprop-p-ethyl. The lowest net income of Rs. 21171 ha^{-1} and return $rupee^{-1}$ invested of Rs. 1.71 was recorded in un weeded control. The findings of these investigations were in line with the findings of Nagwanshi Anil, 2016 [2].

Table 1: Effect of different weed managment practices on weed dry matter (WDM) and weed control index (WCI)

S. No.	Treatments	WDM (kg ha^{-1})	WCI (Per cent)
1.	Un weeded control	349.38	-
2.	HW twice on 20 and 40 DAT	74.54	62.48 (78.66)
3.	Pretilachlor + Pyrazosulfuron ethyl + One HW	110.10	55.84 (68.48)
4.	Fenoxaprop-p-ethyl + one HW	137.24	51.18 (60.71)
5.	Bispyribac-sodium + one HW	107.09	56.30 (69.23)
6.	Pretilachlor + Pyrazosulfuron ethyl + Fenoxaprop-p- ethyl	70.07	63.39 (79.94)
7.	Pretilachlor + Pyrazosulfuron ethyl + Bispyribac-sodium	26.82	73.91 (92.32)
	S.Ed	2.87	1.56
	CD (P = 0.05)	6.25	3.39

Table 2: Yield and economics as influenced by different weed control treatments

S. No	Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Gross income (Rs. ha^{-1})	Net Income (Rs.ha^{-1})	BCR
1.	Un weeded control	3046	4600	29865	21171	1.71
2.	HW twice on 20 and 40 DAT	4787	7150	34365	45802	2.33
3.	Pretilachlor + Pyrazosulfuron ethyl + One HW	4437	6653	34415	39903	2.16
4.	Fenoxaprop-p-ethyl + one HW	4236	6303	32115	35612	2.11
5.	Bispyribac-sodium + one HW	4590	6850	34215	42650	2.25
6.	Pretilachlor + Pyrazosulfuron ethyl + Fenoxaprop-p- ethyl	4965	7366	34502	48620	2.41
7.	Pretilachlor + Pyrazosulfuron ethyl + Bispyribac-sodium	5163	7654	34265	52170	2.52
	S.Ed	85.99	127.99			
	CD (P = 0.05)	187.38	278.89			

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