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**A Upendra Rao**Agricultural Research Station,  
Acharya N G Ranga Agricultural  
University, Ragolu, Andhra  
Pradesh, India**K Madhu Kumar**Agricultural Research Station,  
Acharya N G Ranga Agricultural  
University, Ragolu, Andhra  
Pradesh, India**V Visalakashmi**Agricultural Research Station,  
Acharya N G Ranga Agricultural  
University, Ragolu, Andhra  
Pradesh, India**S Govinda Rao**Agricultural Research Station,  
Acharya N G Ranga Agricultural  
University, Ragolu, Andhra  
Pradesh, India**N Hari Satyanarayana**Agricultural Research Station,  
Acharya N G Ranga Agricultural  
University, Ragolu, Andhra  
Pradesh, India**Corresponding Author:****A Upendra Rao**Agricultural Research Station,  
Acharya N G Ranga Agricultural  
University, Ragolu, Andhra  
Pradesh, India

## Bio efficacy testing of sequential application of pendimethalin followed by florpyrauxifen-benzyl in aerobic rice

**A Upendra Rao, K Madhu Kumar, V Visalakashmi, S Govinda Rao and N Hari Satyanarayana**

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### Abstract

A field study was conducted on sandy clay loam soils at agricultural research station Ragolu, A.P. India during *Kharif*, 2016. The trial was conducted in Randomized Block Design with seven treatments Viz., T1-Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 31.25 g a.i/ha at 4-7 leaf stage of weeds; T2-Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 37.5 g a.i/ha at 3-4 leaf stage of weeds; T3-Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Bispyribac sodium 10 SC @ 20 g a.i/ha at 3-4 leaf stage of weeds; T4-Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Metsulfuronmethyl + chlorimuronehtyl – 20 %WP @ 4 g a.i/ha at 3-4 leaf stage of weeds; T5-Weed free Condition; T6-Hand weeding twice at 15 and 35 DAS and T7-Weedy Check replications four times. Results revealed that in aerobic rice, reduction in grain and straw yield due to weeds was 54.64% and 24.68 % respectively. Sequential application of Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 37.5 g a.i/ha at 3-4 leaf stage of weeds was effective controlling weeds with 6.19 weed index, 92.3 % weed control efficiency resulted into at par yield to that of weed free condition. Among chemical weed management treatments, number of panicles m<sup>-2</sup>, number of filled grains per panicle, 1000 grain weight, grain and straw yield of rice was the highest with application of Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 37.5 g a.i/ha at 3-4 leaf stage of weeds.

**Keywords:** Aerobic rice, florypyrauxifen-benzyl, weed index, weed control efficiency, yield attributes, yield

### Introduction

Rice is a prime staple food crop of Asia and is the backbone to maintain food security in India. A big challenge before India is to meet the rice requirement of burgeoning population with shrinking natural resources like fertile soil and irrigation water. Ever increasing scarcity for fresh water threatening farming in general and rice cultivation in particular in India and the problem will be more intensified in the years to come. Hence, shifting from traditional flooded rice culture to aerobic rice system is inevitable to sustain rice production especially in water scarce irrigated lowlands. Among various systems of rice culture, aerobic rice is a unique, in which rice is established on dry soil and soil moisture is maintained near field capacity. Aerobic rice is mostly growing rice under non-flooded and non-puddled situation. It is growing rice just like any other irrigated dry (ID) crop. "Rice grown under upland conditions, where the crops are not flooded at any time during the growth period is an effective way to save water and to reduce the methane emissions produced by flooded rice paddies" (Tuong *et al.* 2005) [1].

"Weeds are the greatest threat under aerobic rice resulting in yield losses between 30 and 98 per cent" (Oerke and Dehne, 2004) [3]. Severe weed growth observed throughout the crop growth in aerobic rice culture and sometimes leads to complete crop failure too. Therefore, success of aerobic rice culture depends mostly on effective weed control. Decreased availability of human labour for manual control of weeds become very costly affair and timely control of weeds is highly impossible. Usage of herbicides is inevitable in the present scenario of rice culture.

The Presently recommended and widely used herbicide for this system is Pre-emergence application of pendimethalin which is partially successful in controlling weeds up to 15 -20 DAS only. Effective post emergence herbicide which control the weeds beyond 20 days under aerobic conditions is lacking. Under these circumstances Florpyrauxifen-benzyl 2.5%EC, a new post emergence herbicide is field tested at two concentrations i.e, 31.25 and 37.5 g a.i/ha for its bio-efficacy and to control weeds in sequence to pendimethalin duly comparing with Bispyribac sodium 10 SC and Metsulfuronmethyl + chlorimuronehtyl – 20 %WP along with two hand weedings at 15 & 35 DAS and weed free check.

### Material and Methods

A field study was conducted on sandy clay loam soils at agricultural research station Ragolu, A.P. India during *Kharif*, 2016. The trial was conducted in Randomized Block Design with seven treatments Viz., T1-Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 31.25 g a.i/ha at 4-7 leaf stage of weeds; T2-Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 37.5 g a.i/ha at 3-4 leaf stage of weeds; T3-Pendimethalin 30% @ 750 g a.i/ha Within 2 days of sowing followed by Bispyribac sodium 10 SC @20 g a.i/ha at 3-4 leaf stage of weeds; T4-Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Metsulfuronmethyl + chlorimuronehtyl – 20 %WP @ 4 g a.i/ha at 3-4 leaf stage of weeds; T5-Weed free Condition; T6-Hand weeding twice at 15 and 35 DAS and T7-Weedy Check replications four times.

The seed of rice was directly sown in lines in the non puddled and non flooded soil. RGL1880 (120 days duration) was the test culture. Seed was treated with fungicide Carbendazim @ 1g/kg seed. and then dibbled @ 2-3 seeds hill<sup>-1</sup> with a spacing of 20 x 10 cm. Thinning and gap filling were done at 10 DAS to maintain the uniform plant stand in all the plots. Recommended dose of Nitrogen (120 kg) through urea was applied in three equal splits as basal at active tillering and at panicle initiation stage of the crop. 60 kg P2O5 through single super phosphate at field preparation and 50 kg K2O per hectare was applied in the form of murate of potash twice as basal and at panicle initiation stage of the crop. Recommended package of practices for *kharif* direct sown rice was followed for this crop except weed control. The data on weed parameters like weed counts and weed dry weight were collected randomly at panicle initiation stage and were subjected to square root ( $x+0.5$ ) transformation to normalize their distribution. Data on tillers m<sup>-2</sup>, yield attributing characters, grain and straw yields were recorded following standard procedure. Data was analyzed using ANOVA and the significance was tested by Fisher's least significance difference (p= 0.05).

### Results and Discussion

The major weeds namely *Echinochloa colona*, *Echinochloa crus-galli*, *Cyperus rotundus*, *Digitaria sanguinalis*, *Commelina benghalensis*, *Ammonia basifera*, *Dactyloctenium aegyptium*, *Digera arvensis*, *Fimbristilis miliacea*, *Eclipta alba*, *Ludwigia parviflora*, *Cleome viscosa*, *Cleome chelidoni*, *Boerhavia erecta* etc. were noticed in the experimental site. In aerobic rice, reduction in grain yield was 54.64% and straw yield was 24.68 % due to weeds. Singh *et al.* (2005) [4] also reported that “uncontrolled weed growth in direct-seeded rice resulted in reduction in grain yield by 75.8%”.

Among different chemical weed control treatments, application of Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Metsulfuronmethyl +

chlorimuronehtyl – 20 %WP @ 4 g a.i/ha at 3-4 leaf stage of weeds produced higher number of tillers m<sup>-2</sup>. Whereas number of panicles m<sup>-2</sup>, number of filled spikelets per panicle, 1000 grain weight grain and straw yield of rice was the highest with application of Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 37.5 g a.i/ha at 3-4 leaf stage of weeds by controlling weeds effectively (6.19 weed index and 92.3 % weed control efficiency) and gave on par yield to that of weed free condition. There was no traceable variation between the two concentrations (31.25 and 37.5 g a.i/ha) of Florpyrauxifen-benzyl tried with respect to yield attributes and yield.

It was found that application of Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 37.5 g a.i/ha at 3-4 leaf stage of weeds was more effective against sedges than grasses and BLW by recording lowest Weed count m<sup>-2</sup>, weed biomass and higher values of weed control efficiency with respect to sedges. The reduced weed count, weed biomass and weed control efficiency with application of Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 37.5 g a.i/ha at 3-4 leaf stage of weeds might be due to broad-spectrum and long lasting weed control due to sequential application of pre emergence followed by effective post-emergence herbicides. Reduced weed competition in these plots ultimately lead to better yield structure there by higher grain and straw yield in these treatments which were found at par to two hand weedings and weed free treatments. Similar findings of “effective weed control with application of pendimethalin 1000 g/ha *fb* florpyrauxifen-benzyl 25 g/ha in rainfed lowland rice” reported by Gangireddy *et al.* (2019) [2]. Vijayalakshmi *et al.* 2020 [6] also reported “superior weed control with sequential application of Pyrazosulfuron ethyl @ 20 g a.i ha<sup>-1</sup> at 8-12 DAS *fb*. florpyrauxifen-benzyl @ 31.25 g a.i ha<sup>-1</sup> at 25 DAS in semi dry rice”.

Application of Pendimethalin 30% @ 750 g a.i/ha Within 2 days of sowing followed by Bispyribac sodium 10 SC @20 g a.i/ha at 3-4 leaf stage of weeds found to be at par to application of Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Metsulfuronmethyl + chlorimuronehtyl – 20 %WP @ 4 g a.i/ha at 3-4 leaf stage of weeds in terms of yield attributes and yield, weed counts, weed dry weight. However, application of Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Bispyribac sodium 10 SC @ 20 g a.i/ha at 3-4 leaf stage of weeds superior in controlling broad leaved weeds and recorded lesser weed index values and higher weed control efficiency over application of Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Metsulfuronmethyl + chlorimuronehtyl – 20 %WP @ 4 g a.i/ha at 3-4 leaf stage of weeds. Effectiveness of sequential application of herbicides on weed growth and the resultant enhancement of grain yield of rice might be due continuous check on weeds by these chemicals. Similar results and views on chemical weed management in aerobic rice were also expressed by Chandra Prakash *et al.* (2013) [1]

### Conclusion

Sequential application of Pendimethalin 30% @ 750 g a.i/ha on the next day of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 37.5 g a.i/ha at 3-4 leaf stage of weeds was effective controlling weeds with 6.19 weed index, 92.3 % weed control efficiency resulted into vcomparable yield to that of weed free condition.

**Table 1:** Effect of different herbicides on tiller, yield attributes and yield of aerobic rice

Treatment	Tilles m <sup>-2</sup>	Panicles m <sup>-2</sup>	filled grains/panicle	1000 grain wt (g)	Grain yield (kg/ha <sup>-1</sup> )	Straw yield (kg/ha <sup>-1</sup> )
T1- Pendimethalin 30% @ 750 g a.i/ha Within 2 days of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 31.25 g a.i/ha at 4-7 leaf stage of weeds	425	371	137	25.10	5192	6385
T2- Pendimethalin 30% @ 750 g a.i/ha Within 2 days of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 37.5 g a.i/ha at 3-4 leaf stage of weeds	433	377	139	25.50	5369	6604
T3- Pendimethalin 30% @ 750 g a.i/ha Within 2 days of sowing followed by Bispyribac sodium 10 SC @20 g a.i/ha at 3-4 leaf stage of weeds	455	349	135	24.83	4838	6127
T4-Pendimethalin 30% @ 750 g a.i/ha Within 2 days of sowing followed by Metsulfuronmethyl + chlorimuronehtyl – 20 %WP @ 4 g a.i/ha at 3-4 leaf stage of weeds	526	348	134	24.53	4602	6081
T5-Weed free Condition	592	404	140	25.63	5723	6911
T6-Hand weeding twice at 15 and 35 DAS	557	377	139	25.43	5428	6698
T7-Weedy Check	302	189	129	23.63	2596	5014
SEm±	35.3	15.8	4.71	0.40	246	268
CD at 0.05	105	47	14	1.20	730	801

**Table 2:** Effect of different herbicides on weed counts and weed dry weight in aerobic rice

Treatments	Weed count m <sup>-2</sup>			Weed Dry weight (g)		
	Grasses	Sedges	BLW	Grasses	Sedges	BLW
T1- Pendimethalin 30% @ 750 g a.i/ha Within 2 days of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 31.25 g a.i/ha at 4-7 leaf stage of weeds	28 (5.28)	23 (4.80)	51 (7.14)	17.96 (4.25)	12.85 (3.64)	41.04 (6.43)
T2- Pendimethalin 30% @ 750 g a.i/ha Within 2 days of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 37.5 g a.i/ha at 3-4 leaf stage of weeds	20 (4.47)	16 (3.98)	25 (5.02)	12.83 (3.60)	9.07 (3.03)	20.52 (4.53)
T3- Pendimethalin 30% @ 750 g a.i/ha Within 2 days of sowing followed by Bispyribac sodium 10 SC @20 g a.i/ha at 3-4 leaf stage of weeds	36 (6.02)	31 (5.56)	29 (5.42)	23.09 (4.84)	17.39 (4.22)	23.76 (4.89)
T4-Pendimethalin 30% @ 750 g a.i/ha Within 2 days of sowing followed by Metsulfuronmethyl + chlorimuronehtyl – 20 %WP @ 4 g a.i/ha at 3-4 leaf stage of weeds	39 (6.25)	28 (5.25)	51 (7.14)	24.80 (5.02)	15.88 (3.99)	41.04 (6.44)
T5-Weed free Condition	0 (0.71)	0 (0.71)	0 (0.71)	0 (0.71)	0 (0.71)	0 (0.71)
T6-Hand weeding twice at 15 and 35 DAS	7 (2.65)	7 (2.65)	11 (3.33)	6.65 (2.65)	5.88 (2.50)	13.44 (3.72)
T7-Weedy Check	220 (14.84)	219 (14.79)	239 (15.46)	164 (12.84)	145 (12.04)	225 (15.03)
SEm±	0.35	0.45	0.37	0.28	0.35	0.34
CD at 0.05	1.03	1.35	1.11	0.83	1.04	1.02

Fig. in parenthesis are transformed values of  $\sqrt{QRT(x+0.5)}$ ; BLW- Broad Leaved weeds

**Table 3:** Effect of different herbicides on Weed Index and Weed control efficiency in aerobic rice

Treatment	Weed Index	Weed control efficiency (%)			
		Grasses	Sedges	BLW	Total
T1- Pendimethalin 30% @ 750 g a.i/ha Within 2 days of sowing followed by Florpyrauxifen-benzyl 2.5% EC @ 31.25 g a.i/ha at 4-7 leaf stage of weeds	9.28	89.09	91.11	81.80	87.3
T2- Pendimethalin 30% @ 750 g a.i/ha Within 2 days of sowing followed by Florpyrauxifen-benzyl 2.5%EC @ 37.5 g a.i/ha at 3-4 leaf stage of weeds	6.19	92.20	93.73	90.90	92.3
T3- Pendimethalin 30% @ 750 g a.i/ha Within 2 days of sowing followed by Bispyribac sodium 10 SC @20 g a.i/ha at 3-4 leaf stage of weeds	15.46	85.97	87.98	89.47	87.8
T4-Pendimethalin 30% @ 750 g a.i/ha Within 2 days of sowing followed by Metsulfuronmethyl + chlorimuronehtyl – 20 %WP @ 4 g a.i/ha at 3-4 leaf stage of weeds	19.59	84.93	89.02	81.80	85.3
T5-Weed free Condition	0.00	100	100	100	100
T6-Hand weeding twice at 15 and 35 DAS	5.15	95.96	95.93	94.04	95.3
T7-Weedy Check	54.64	0.00	0.00	0.00	0.0

BLW- Broad Leaved weeds

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