

## Weed Management Strategies for Direct Seeded Drill Sown Rice

K. Srinivasulu\*, S B S N Rao, B Pramila Rani, K Bayyapu Reddy and D Venkatesh Babu

**Abstract:** A field experiment was carried out during Kharif 2013-14 and 2014-15 in black soils of Agricultural Research Station, Jangamaheswarapuram, Guntur district of Andhra Pradesh with an objective to find out the most effective weed management strategy for controlling late emerging weeds in direct drill sown rice. The experiment consists of 10 treatments involving various weed management practices in a randomized block design with three replications. Among the weed management practices Pendimethalin @ 1.0 kg a.i./ha fb cono weeder at 20, 40 and 60 DAS results in highest weed control efficiency due to reduced weed density and weed dry matter accumulation and is comparable with that of the treatment received Pendimethalin @ 1.0 kg/ha fb Bispyribac sodium at 40 and 60 DAS as well as the Bispyribac sodium at 20, 40 and 60 DAS during both years of study. Similarly, the highest grain yield was observed with the treatment received Pendimethalin @ 1.0 kg a.i./ha fb conoweeder at 20, 40 and 60 DAS which were significantly higher than that observed with all other treatments studied, except the hand weeding at 20, 40 and 60 DAS. The pooled mean data of 2013-14 and 2014-15 reveals that the grain yield (6165 kg/ha), net returns (Rs 55,762/-) and benefit cost ratio (2.52) were observed with the treatment Pendimethalin @ 1.0 kg/ha fb conoweeder at 20, 40 and 60 DAS were markedly higher than all other treatments studied. However, the treatments received Pendimethalin @ 1.0 kg a.i./ha fb either Cyhalofop butyl 100g +2,4-D @ 0.8 kg or Bispyribac sodium @ 25 g a.i./ha. at 20, 40 and 60 DAS gave comparable grain yield, net returns and benefit cost ratio with hand weeding at 20, 40 and 60 DAS.

**Key words:** Direct sown rice, Weed management, Conoweeder and Economics

Rice (*Oryza sativa* L.) is the principal food crop of India. The ever growing population stresses the need to increase the productivity of rice crop in India. To keep pace with the projected demand, the rice productivity in the country need to be stepped up through adoption of suitable and newer technologies.

Recently, direct drill sown rice becoming popular among the rice growers of Krishna delta and NSP command area as an alternate system of rice culture to the late release of canal water situations, because of availability of many pre and post emergence selective herbicides for management of diversified weed flora. Weeds are the major menace in direct seeded drill sown rice as there is no standing water especially during the initial stages of crop growth and there was no age

advantage to the rice crop over the weeds as in the case of transplanted rice. Appropriate weed management practice to eliminate weed competition in direct seeded drill sown rice is needed to uphold the rice productivity. Under this situation weeds poses severe competition up to 60 DAS is critical in drill sown rice.

Simerjeet and Surjit, 2015 (1) stated that, conversion from transplanted to direct seeded rice results in more competitive weed flora as the weeds start from the time of emergence of rice crop and it requires revised weed management approach for effective control.

Considering the above facts present study was carried out to find out the appropriate weed management strategy for controlling the late emerged weed flora in drill sown rice.

\* Integrated weed management Unit, Regional Agricultural Research Station, Lam, Guntur-522 034

## MATERIALS AND METHODS

A field experiment was carried out during Kharif 2013-14 and 2014-15 in black soils of Agricultural Research Station Jangamaheswarapuram, Guntur district of Andhra Pradesh with an objective to find out the most effective weed management strategy for controlling late emerging weeds in direct drill sown rice. The experiment consists of 10 treatments involving various weed management practices in a randomized block design with three replications. The treatments are T1- weedy check, T2-Hand weeding at 20,40 and 60DAS T3-Pendimethalin as PE @ 1.0kg fb IC with cono weeder at 20, 40 and 60 DAS, T4-Pendimethalin @ 1.0 kg as PEe fb Bispyribac@ 25g at 40 DAS as POE, T5-Pendimethalin @ 1.0 kg as PE fb Cyhalofop butyl @ 100g+ 2,4-D @1.0kg at 40 DAS as POE, T6-Pendimethalin@ 1.0 kg as PE fb Bispyribac Na@ 25g at 40 DAS POE fb Cyhalofop butyl@ 100 g + 2,4-D @ 1.0 kg at and 60 DAS as POE, T7-Pendimethalin @ 1.0kg as PE fb Bispyribac Na@ 100g at 40 and 60DAS as POE, T8 - Pendimethalin @1.0 kg as PE fb Cyhalofop butyl@ 100g+ 2,4-D @ 1kg at 40 and 60 DAS as POE, T9-Bispyribac Na at 20,40 and 60 DAS as POE, T10-Cyhalofop butyl @ 100g + 2,4-D @ 1.0 kg at 20,40 and 60 DAS as POE. Sowing was done with tractor drawn seed drill with dry seed @ 50 kg/ha. The variety tested was popular rice variety i.e. BPT-5204. Pre emergence herbicide pendimethalin was applied on the same day following the sowing at appropriate soil moisture levels with help of knapsack sprayer fitted with the flat fan nozzle by using the spray fluid @ 500 l/ha. Post emergence herbicides were applied with the knapsack sprayer fitted with the solid cone nozzle by using the spray fluid @ 500 l/ha. Weed dry weight samples were collected and are oven dried after initial sun drying. Weed control efficiency was calculated by using the following formulae.

$$\text{WCE} = \text{DWC} - \text{DWT}/\text{DWC} \times 100$$

Where, DWC- Dry weight of weeds in control plot, DWT- Dry weight of weeds in treated plot. Data on weed dry weight, yield attributes and yield were recorded. Weed control efficiency, net returns and benefit cost ratios were calculated.

The predominant weed flora found in the drill sown rice were broad leaved weeds like *Ammania baccifera*, *Lippia nodiflora*, *Ludwigia parviflora*, *Eclipta alba*, *Physalis minima*, sedge, *Cyperus rotundus*, and grasses like *Echinochloa colonum*, *Panicum javanicum*, *Digitaria sanguinalis*, *Cynodon dactylon*, *Paspalum scrobiculatum*, *Leptochloa chinensis*.

Sowing of rice was done with the help of tractor attached with the seed drill. Pre emergence herbicide pendimethalin was applied on the same day following the sowing at appropriate soil moisture levels with help of knapsack sprayer fitted with the flat fan nozzle by using the spray fluid @ 500 l/ha. Post emergence herbicides were applied with the knapsack sprayer fitted with the solid cone nozzle by using the spray fluid @ 500 l/ha.

## RESULTS AND DISCUSSION:

The study conducted during the year 2013-14 reveals that the highest weed control efficiency at 60DAS (87.5 %) was observed with *Pendimethalin @ 1kg fb IC with cono weeder at 20,40and 60DAS*. However the weed control efficiency at maturity was highest (93.7%) with *Cyhalofop butyl @ 100g + 2,4-D @ 1 kg at 20,40and 60 DAS* and *Bispyribac sodium at 20,40 and 60DAS*. The results of the study carried out during Kharif 2014 (Table 1) reveals that the weed management practices reduced the weed density and dry weight markedly across the growth stages of rice crop. Among the weed management practices *Pendimethalin@ 1.0 kg a.i. /ha fb conoweeder at 20,40 and 60 DAS* results in highest weed control efficiency, which is comparable with *Pendimethalin @ 1.0 kg/ha fb Bispyribac sodium at 40 and 60 DAS* and *Bispyribac sodium at 20, 40 and 60 DAS*.

The treatment received *Pendimethalin @ 1.0 kg/ha fb conoweeder at 20, 40 and 60 DAS* caused marked reduction in weed biomass and tilted the crop weed competition in favour of the crop plants resulting in higher number of tillers, panicles, spikelets and finally increased grain yield.

Highest grain yield of 6331 kg/ha was observed with *Pendimethalin @ 1kg fb IC with conoweeder at 20, 40 and 60 DAS*, which is markedly higher than all other treatments except hand

**Table 1**  
**Dry weight of weeds and weed control efficiency as influenced by weed management practices in direct seeded drill sown rice**

Treatments	Dry weight of weeds at						Weed control efficiency at					
	30 DAS		60DAS		Maturity		60DAS		Maturity		Maturity	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
T1- Weedy Check	6.60	21.49	8.06	17.71	10.23	24.8	—	—	—	—	—	—
T2-Hand weeding at 20,40 and 60DAS	1.57	0.50	4.09	0.50	3.44	13.2	79.3	100	88.5	100	88.5	100
T3-Pendimethalin @ 1.0 kg as PE fb IC with cono weeder at 20, 40 and 60 DAS	2.64	12.11	2.86	11.00	3.82	7.6	87.5	58	86.6	91	86.6	91
T4- Pendimethalin @ 1.0 kg as PE fb Bis pyribac Na @ 25g at 40 DAS as POE	3.28	14.18	3.83	9.50	5.48	11.5	77.3	54	72.1	78	72.1	78
T5- Pendimethalin @ 1.0 kg as PE fb Cyhalofop butyl @ 100g+ 2,4-D @1.0kg at 40 DAS as POE	3.80	11.14	3.20	12.39	5.41	9.3	84.4	20	72.4	86	72.4	86
T6- Pendimethalin @ 1.0 kg as PE fb Bis pyribac@ 25 g at 40 DAS as POE fb Cyhalofop butyl @ 100 g + 2,4-D @1.0 kg at and 60 DAS as POE	4.27	11.35	4.16	10.54	4.28	9.3	73.4	66	82.7	86	82.7	86
T7- Pendimethalin @ 1.0 kg as PE fb Bispyribac na @ 25 g at 40 and 60 DAS as POE	3.89	10.63	4.89	13.42	3.53	6.8	62.5	42	87.1	92	87.1	92
T8 - Pendimethalin @ 1.0 kg as PE fb Cyhalofop butyl @ 100g + 2,4-D @ 1kg at 40 and 60 DAS as POE	4.90	14.25	4.86	10.79	3.30	9.2	63.1	62	88.7	86	88.7	86
T9-Bispyribac Na @ 25 g at 20,40 and 60 DAS as POE	4.01	8.99	4.01	11.11	2.91	4.7	74.5	61	92.1	96	92.1	96
T10- Cyhalofop butyl @ 100g + 2,4-D @ 1.0 kg at 20,40and 60 DAS as POE	3.60	13.05	4.06	12.37	2.65	8.0	74.4	52	93.7	89	93.7	89
SEm ±	0.40	1.57	0.39	1.96	0.58	1.0	—	—	—	—	—	—
CD (p=0.05)	1.21	4.67	1.17	5.81	1.73	2.9	—	—	—	—	—	—
CV (%)	18.2	23.1	15.5	31.0	22.4	16.4	—	—	—	—	—	—

**Table 2**  
**Growth and yield of drill sown rice as influenced by weed management practices**

Treatments	Plant height(cm)		Tillers/m <sup>2</sup>		Panicles/m <sup>2</sup>		Spikelets/panicle		Test weight(g)		Grain yield(Kg/ha)	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
T1- Weedy Check	93.3	78.0	179	155	123	145	119	92	13.7	14.1	1749	1694
T2-Hand weeding at 20,40 and 60DAS	93.1	93.3	363	376	269	347	175	126	14.1	13.9	5998	5389
T3-Pendimethalin @ 1.0 kg as PE fb IC with cono weeder at 20, 40 and 60 DAS	99.3	98.1	369	388	278	357	187	132	14.2	14.3	6331	6000
T4- Pendimethalin @ 1.0 kg as PE fb Bis pyribac Na @ 25g at 40 DAS as POE	93.7	94.5	344	343	217	311	159	122	14.1	14.1	5165	4917
T5- Pendimethalin @ 1.0 kg as PE fb Cyhalofop butyl @ 100g+ 2,4-D @1.0kg at 40 DAS as POE	90.1	93.1	334	341	241	306	157	124	14.0	13.9	5192	4889
T6- Pendimethalin @ 1.0 kg as PE fb Bis pyribac @ 25 g at 40 DAS as POE fb Cyhalofop butyl @ 100 g + 2,4-D @1.0 kg at and 60 DAS as POE	91.7	94.6	334	347	282	314	163	123	13.7	13.8	5692	5028
T7- Pendimethalin @ 1.0 kg as PE fb Bispyribac na @ 25 g at 40 and 60 DAS as POE	89.4	90.6	353	355	277	324	167	127	14.1	13.9	5789	5111
T8 - Pendimethalin @ 1.0 kg as PE fb Cyhalofop butyl @ 100g + 2,4-D @ 1kg at 40 and 60 DAS as POE	88.5	90.9	356	353	245	331	183	119	14.2	14.2	5484	4944
T9-Bispyribac Na @ 25 g at 20,40 and 60 DAS as POE	93.8	94.5	369	367	253	333	177	125	13.8	13.9	5651	5167
T10- Cyhalofop butyl @ 100g + 2,4-D @ 1.0 kg at 20, 40and 60 DAS as POE	93.1	92.5	354	360	262	335	173	122	13.8	14.3	5637	5083
SEm ±	2.1	1.7	15	16	10.3	12	7.9	6	0.2	0.18	173	233
CD (p=0.05)	NS	5.1	43.6	47	30.5	36	23.5	18	NS	NS	515	693
CV (%)	4.1	3.2	7.6	2.47	7.3	6.7	8.2	8.7	2.8	2.2	7.5	8.4

**Table 3**  
**Weed control efficiency, Grain yield , Net returns and BCR of drill sown rice as influenced by Weed management practices**  
**(Pooled mean of kharif, 2013-14 and 2014-15)**

Treatments	Weed control efficiency at 60 DAS (%)	Weed control efficiency at maturity	Grain yield (kg/ha)	Net Returns (Rs/ha)	Benefit cost ratio
T1- Weedy Check	-- --	--	1722	-3258	0.89
T2-Hand weeding at 20,40 and 60DAS	79.3	88.5	5693	41,307	1.94
T3-Pendimethalin @ 1.0 kg as PE fb IC with cono weeder at 20, 40 and 60 DAS	73.0	88.8	6165	55,762	2.52
T4- Pendimethalin @ 1.0 kg as PE fb Bis pyribac Na @ 25g at 40 DAS as POE	65.7	75.0	5040	42,512	2.28
T5- Pendimethalin @ 1.0 kg as PE fb Cyhalofop butyl@ 100g+ 2,4-D @1.0kg at 40 DAS as POE	52.2	79.2	5041	42,027	2.25
T6- Pendimethalin @ 1.0 kg as PE fb Bis pyribac@ 25 g at 40 DAS as POE fb Cyhalofop butyl @ 100 g + 2,4-D @1.0 kg at and 60 DAS as POE	69.7	84.4	5360	46,812	2.39
T7- Pendimethalin @ 1.0 kg as PE fb Bispyribac na @ 25 g at 40 and 60 DAS as POE	52.2	89.5	5450	42,662	2.33
T8 - Pendimethalin @ 1.0 kg as PE fb Cyhalofop butyl @ 100g + 2,4-D @ 1kg at 40 and 60 DAS as POE	62.5	87.4	5214	43,122	2.17
T9-Bispyribac Na @ 25 g at 20,40 and 60 DAS as POE	67.8	94.0	5409	46,047	2.31
T10- Cyhalofop butyl @ 100g + 2,4-D @ 1.0 kg at 20,40and 60 DAS as POE	63.2	91.5	5360	43,812	2.20
SEm ±	--	--	151	--	--
CD (p=0.05)	--	--	449	--	--
CV (%)	--	--	5.2	--	--

weeding at 20,40 and 60DAS (5988 kg/ha). Similarly, the highest grain yield (6000 kg/ha) observed with the treatment received Pendimethalin@ 1.0 kg a.i. /ha fb conoweeder at 20,40 and 60 DAS which was significantly higher than that observed with all other treatments studied, except the hand weeding at 20, 40 and 60 DAS (Table 2).

The pooled mean data of 2013-14 and 2014-15 reveals that the grain yield (6165 kg/ha), net returns (Rs 55,762/-) and benefit cost ratio (2.52) were observed with the treatment Pendimethalin @ 1.0 kg/ha fb conoweeder at 20, 40 and 60 DAS were markedly higher than all other treatments studied. However, the treatments received Pendimethalin @ 1.0 kg a.i./ha fb either Cyhalofop butyl 100g +2,4-D 0.8 kg or Bispyribac sodium @ 25 g a.i. /ha. at 20, 40 and 60 DAS gave comparable grain yield, net returns and benefit cost ratio with hand weeding at 20, 40 and 60 DAS (Table 3).

Higher benefit cost ratio was obtained when bispyribac sodium was applied as follow up application after pendimethalin compared to alone application of pendimethalin was also reported by Walia *et al.*, 2012 (2).

## CONCLUSION

Overall the study indicates that the treatment received Pendimethalin @ 1.0 kg/ha fb conoweeder at 20, 40 and 60 DAS results in markedly higher weed control efficiency, higher yield attributes and grain yield leading to higher net returns and benefit cost ratio than all other treatments studied.

## References

- Simer jeet Kaur and Surjit Singh (2015), Bio efficacy of different herbicides for weed control in direct seeded rice. *Indian Journal of Weed Science* 47 (2): 106-109.
- Walia US, Walia SS, Amardeep singh and Shelly nayyar (2012), Bioefficacy of pre and post emergence herbicides in direct seeded rice in central Punjab. *Indian Journal of Weed Science* 44(1); 30-33.