Available online at www.ijpab.com

ISSN: 2320 – 7051
Int. J. Pure App. Biosci. **3 (3):** 113-116 (2015)

INTERNATIONAL JOURNAL OF PURE & APPLIED BIOSCIENCE

Research Article

OPEN ACCESS

Effect of Weed Management Practices on Growth and Economics of Transplanted Rice

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ABSTRACT

Collection and identification of predominant weeds were done from the rice field of Bapatla. Out of different species, 10 weed species were identified as predominant, constituting 90% of the weed population. The weed control treatments consists of hand weeding @ 20&40 DAT, Oxadiargyl @100 g ha^{-1} pre emergence as sand mix application (SMA) fb 2,4-D sodium salt @ 0.8 kg ha^{-1} as post emergence and orthosulfamuron at different doses (80 g ha^{-1}, 120 g ha^{-1}) and times of application (pre-emergence alone, post-emergence alone and sequential). Among different weed management treatments the results reveal that the orthosulfamuron @ 120 g ha^{-1} pre-emergence as SMA at 3-5 DAT fb orthosulfamuron @120 g ha^{-1} as post-emergence at 25-30 DAT (T_{11}) found to be effective and economical in managing weeds in rice grown under transplanted conditions without any crop injury as an alternative to manual weeding and it was on par with other sequential treatments T_{10}, T_9, T_8, T_3 and also with hand weeding.

Keywords: *Orthosulfamuron, Transplanted rice, Sequential application*

INTRODUCTION

Weed competition is one of the prime yield limiting constrain in rice crop resulting in to yield reduction of 28-45% [1]. Most of the herbicides available in the market are pre-emergence with high dose, persistent, narrow spectrum and more pollutant[5]. Weed management through hand weeding is very difficult in this crop due to frequent rainfall coupled with water stagnation in transplanted rice and is very costly. So, there is a need to evaluate the effect of new herbicides on growth and economics of transplanted rice in order to gain profitability and for providing wider options to farmers.

MATERIAL AND METHODS

An experiment was conducted at Agricultural College Farm, Bapatla during *kharif* 2013. The soil of the experimental field was sandy clay loam in texture with pH of 7.1. The experiment was laid out in randomized block design with eleven treatments (Table 2) and replicated thrice. The pre-emergence herbicides were applied at 3 DAT as sand mix application and the early post emergence application were applied at 20 DAT and post emergence application were applied at 30 DAT through knap-sack sprayer using a spray volume of 500 L ha^{-1}. The data on weed density and dry weight were recorded at 60 DAT, harvest and were subjected to square root x+0.5 transformation before statistical analysis to normalise their distribution[2]. The growth and yield attributes like number of effective tillers per square metre, number of filled grains per panicle, test weight were recorded at the time of harvesting and threshing were recorded at the time of maturity. Economics of different treatments were calculated taking into account of the prevailing market prices of inputs and out put.

RESULTS AND DISCUSSION

Weed flora collected indicated that 10 spp. Of weeds constituted about 90% of the total weed population. Among these *Echinochloa colonum, Cynodon dactylon , Echinochloa crus-galli* were grasses, *Cyperus difformis, Fimbristylis miliacea, Cyperus rotundus,* were sedges and *Eclipta alba, Ammannia baccifera, Ludwigia parviflora* and *Euphorbia hirta* were broad leaved weeds. However the weed species, *Echinochloa colonum* and *Eclipta alba* were dominant throughout the crop growth period.

Effect on weed dry weight:

Data presented in Table1 on density and dry weight of weeds revealed that all the weed control treatments reduced the weed dry weight significantly from that of unweeded treatment. Among different weed control treatments, orthosulfamuron @ 120 g ha^{-1} pre-emergence as SMA at 3-5 DAT *fb* orthosulfamuron @ 120 g ha^{-1} as post-emergence at 25-30 DAT (T_{11}) was found significantly superior in reducing the weed density and dry weight of dominated weed flora at 60 DAT and harvest stages. While the highest value was observed in weedy check treatment. All the sequential treatments were on a par with T_{11} in reducing the weed dry weight.

Crop injury: The herbicides oxadiargyl and orthosulfamuron application as pre and post emergence were found to be safe to rice as no phytotoxic symptoms were seen. However, at 7 days after spraying, post-emergence application of 2,4-D sodium salt showed slight phytotoxicity with an injury score of 1. This herbicide exhibited slight stunting of seedling growth and discolouration of developing leaves. The symptoms persisted up to 7 days after spraying and slowly vanished by 14 days after spraying.

Effect on yield:

Perusal of the Table 1 further revealed that Among the herbicide treatments, number of productive tillers/m^2 (258), grains per panicle (163) and the highest grain yield (5700 kg/ ha) was obtained with orthosulfamuron@120g/ha pre-emergence as SMA at 3-5 DAT *fb* orthosulfamuron@120g/ha as post-emergence at 25-30 DAT (T_{11}) and it was at par to other sequential treatments, T_{10}, T_9, T_8,T_3 and also with hand weeding (5433 kg/ ha) with of weed control efficiency (71.3%) (Table2). T_{10}, T_9, T_8, T_3 and also with hand weeding (5433 kg/ ha) with of weed control efficiency (71.3%) (Table2). The minimum grain yield and straw yield was observed in weedy check with an yield loss of 39.7% and 25.5%, respectively as compared to $T_{11.}$ An increase in yield of 66.0% over weedy check was observed in case of T_{11} treatment followed by other sequential treatmenst T_{10} and $T_9$with 59.2% to 49.5% increase in yield, respectively. The increased grain yield might be due to cumulative effect of lower weed density , weed dry weight and better weed control efficiency. These findings are in agreement with that of reported by Subrata *et al.*,[4].

Effect on Economics:

Data in Table 2 indicated that results of the study revealed that hand weeding is expensive due to high labour cost. Use of herbicides was cheaper in cost and effective in controlling the weeds and reducing total energy required for rice cultivation. Similar findings were also reported by Srinivasan and Chaudhary[3].

The highest gross returns (Rs. 89,597 ha^{-1}) were observed with T_{11}. While the lowest gross returns (Rs. 55,839 ha^{-1}) as observed with weedy check. The gross returns followed similar trend as that of grain yield. The highest benefit cost ratio (1.91) was observed with T_{11} and was followed by, T_{10}, T_3 T_8 and T_9 which showed almost the same ratio. All herbicide treatments registered higher benefit cost ratio over weedy check which recorded markedly higher than that observed with hand weeding at 20 and 40 DAT (1.65). The highest benefit cost ratio (BCR) obtained by T_{11} might be due to higher grain yield in this treatment compared to other treatments. The lower BCR in in hand weeding treatment was mainly because of higher labour cost involved in hand weeding. Therefore, the higher cost involved in manual weeding was not compensated by the additional grain yield obtained in hand weeding resulting in lower BCR (1.65).

Table 1: Effect of different weed management practices on weed density , weed dry weight and yield contributing characters of transplanted rice

Treatments	Weed density (no. m^{-2})		Weed dry weight ($g.m^{-2}$)		No.of tillers/m^2	No. of grains/ panicle	Grain yield (q/ha)
	60 DAT	Harvest	60 DAT	Harvest			
T_1- weedy check	13.85 (193.3)	17.03 (293)	6.64 (44.3)	6.76 (45.4)	195	115	3433
T_2-H.W @ 20&40 DAT	6.83 (47.3)	6.00 (36.3)	1.79 (2.8)	2.32 (5.0)	248	163	5433
T_3-Oxadiagryl 100g as SMA *fb* 2,4-D@0.8 kg ha^{-1}	7.59 (58.6)	7.40 (55.6)	2.07 (3.8)	2.59 (6.2)	236	154	5133
T_4-Orthosulfamuron @80g ha^{-1} as SMA at 3-5 DAT	11.16 (125.0)	11.76 (138.6)	3.43 (11.3)	3.89 (14.7)	217	140	4100
T_5- Orthosulfamuron @120g ha^{-1}as SMA at 3-5 DAT	11.03 (122.3)	11.57 (133.6)	3.18 (9.7)	3.68 (13.2)	221	145	4266
T_6- Orthosulfamuron @80g ha^{-1} at 20 DAT	11.74 (137.6)	12.07 (146.0)	3.62 (12.6)	4.10 (16.4)	198	140	4066
T_7- Orthosulfamuron @120g ha^{-1} at 20 DAT	11.29 (127.6)	11.69 (137.0)	3.24 (10.0)	3.83 (14.4)	202	143	4133
T_8-T_4 *fb* T_6 at 25-30 DAT	7.89 (62.0)	7.30 (53.3)	2.00 (3.5)	2.62 (6.6)	229	145	5233
T_9-T_4 *fb* T_7 at 25-30 DAT	7.28 (53.6)	7.19 (51.6)	1.69 (2.4)	2.30 (4.9)	240	146	5366
T_{10}-T_5 *fb* T_6 at 25-30 DAT	6.71 (46.6)	6.51 (43.0)	1.41 (1.5)	2.13 (4.1)	249	156	5466
T_{11}-T_5 *fb* T_7 at 25-30 DAT	6.25 (39.0)	6.02 (37.3)	1.22 (1.1)	1.92 (3.2)	258	163	5700
LSD (P=0.05)	11.8	12.9	15.6	11.4	8.8	9.8	10.2

The data were transformed to $\sqrt{X + 0.5}$. The figures in parenthesis are original values.

Table 2: Economics of weed management treatments

Treatments	Cost of cultivation ($Rs.ha^{-1}$)	Gross returns ($Rs.ha^{-1}$)	Net returns (Rs. ha^{-1})	B:C ratio
T_1- weedy check	24900	55839	30939	1.24
T_2-H.W @ 20&40 DAT	39900	85939	46039	1.15
T_3-Oxadiagryl 100g as SMA *fb* 2,4-D@0.8 kg ha^{-1}	28405	80904	52499	1.84
T_4-Orthosulfamuron @80g ha^{-1} as SMA at 3-5 DAT	26947	65345	38398	1.42
T_5- Orthosulfamuron @120g ha^{-1} as SMA at 3-5 DAT	27750	67909	40159	1.44
T_6- Orthosulfamuron @80g ha^{-1} at 20 DAT	27097	64687	37590	1.38
T_7- Orthosulfamuron @120g ha^{-1} at 20 DAT	27900	65988	38088	1.36
T_8 -T_4*fb* T_6 at 25-30 DAT	29144	82583	53439	1.83
T_9-T_4*fb* T_7 at 25-30 DAT	29947	84572	54625	1.82
T_{10}-T_5 *fb* T_6 at 25-30 DAT	29947	86117	56170	1.87
T_{11}-T_5*fb* T_7 at 25-30 DAT	30750	89597	58847	1.91

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