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Influence of weed management practices on growth and productivity of transplanted rice

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Abstract

A study was designed to identify the best ready-mix herbicide combination in transplanted rice variety 'ADT 43' during *kharif* season 2022. The research consisted of eight treatments were laid out in RBD with three replications. The treatments involve pre-emergence herbicides *viz.,* bensulfuron methyl + pretilachlor @ 660 g ha^{-1} and pretilachlor + pyrazosulfuron-ethyl @ 615 g ha^{-1}, early post-emergence herbicides *viz.,* bispyribac sodium + pyrazosulfuron-ethyl @ 150 g ha^{-1}, metsulfuron methyl + chlorimuron ethyl @ 20 g ha^{-1}, post-emergence herbicides *viz.,* penoxsulam + cyhalofop-butyl @ 135 g ha^{-1}, triafamone + ethoxysulfuron @ 200 g ha^{-1} and a treatment with Twice hand weeding which were compared with the treatment unweeded control. All the weed management practices significantly influenced the growth parameters, yield parameters and yield of transplanted rice. The findings revealed that twice hand weeding significantly recorded the maximum growth attributes *viz.,* plant height, LAI and DMP, yield attributes *viz.,* number of productive tillers per meter square and number of filled grains per panicle and yield of rice. However, based on economics, it was concluded that the POE application of triafamone + ethoxysulfuron @ 225 g ha^{-1} on 21 DAT was found to be an economically feasible, and effective weed management practice for boosting rice productivity to its maximum potential.

Key words : Triafamone + Ethoxysulfuron, Hand weeding, Transplanted rice.

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Rice is the leading stable food crop which occupies second position after wheat in the world. Among cereals, rice is a major crop that is widely grown and consumed nearly half of the Asia's populations[3]. In order to feed the predicted population of 1.52 billion people by 2030, India would need to produce an additional 50 million tons of rice annually[15]. Increasing the production from the same area to feed an expanding population is difficult due to numerous constraints. Among the several production constraints, weeds plays a major role due to its greater genetic diversity[2]. Presence of weeds reduces the photosynthetic efficiency, dry matter production, and distribution to economical parts, which in turn lowers the crop capacity to absorb nutrients and results in poor yield. Thus, the increase in yield loss caused by weeds mainly depend upon the type of weed species present in the standing crop, the level of yield drop was estimated upto 95 per cent in India[9]. In general, weeds are either managed by herbicides or by manual and or by mechanical method. In Tamil Nadu, manual weeding was extensively adopted method for weed control in rice. However, manual weeding is possible only when weeds have reached a sufficient height to be pulled out easily by hand. And its becoming more uncommon because of labour shortage at crucial times and increased labour cost which have reduced the profitablility of the crop. Therefore, it is important to have feasible and practical approaches to handle them[1]. For controlling weeds in different crops, the use of herbicides has been found to be very effective one. About 16 per cent of total crop protection chemicals in market, herbicides are found to be the largest growing segment[14]. However, the effectiveness of herbicides can vary depending on the molecule and the operating environmental condition[6]. Therefore, farmers need herbicides which have high efficiency and safe without causing any toxicity to crops. In light of the aforementioned fact, the present study was conducted to evaluate the efficacy of a pre-mixed herbicides for broad spectrum weed control in transplanted rice.

The field trail were conducted at wetland block, Department of Agronomy, Faculty of Agriculture, Annamalai University, Chidambaram, Tamil Nadu during *kharif* season of 2022. It is located at 11°24' N latitude and 79°44' E longitutde at an altitude of +5.79m above MSL. The experimental area experiences a warm, humid and tropical climate. The experimental site's soil belonged to the clay loam textural class. The availability of NPK in the research area was found to be low, medium and high, respectively. The statistical design used for research was RBD (randomized block design) with eight treatments and three replications. The treatment details are *viz.,* T_1 – unweeded control, T_2 – twice hand weeding (20 and 40 DAT), T_3 – bensulfuron methyl + pretilachlor @ 660 g ha^{-1} at 3 DAT, T_4 – pretilachlor + pyrazosulfuron-ethyl @ 615 g ha^{-1} at 3 DAT, T_5 – bispyribac sodium + pyrazosulfuron-ethyl @ 150 g ha^{-1} at 14 DAT, T_6 – metsulfuron methyl + chlorimuron ethyl @ 20 g ha^{-1} at 14 DAT, T_7 – penoxsulam + cyhalofop-butyl @ 135 g ha^{-1} at 21 DAT, T_8 – triafamone + ethoxysulfuron @ 200 g ha^{-1} at 21 DAT. The rice variety ADT-43 was transplanted two at seedling $hill^{-1}$ with a spacing of 15 x 10 cm. Care was taken to fill the gaps eight days after transplanting in order to maintain optimum plant population. The rice

crop was fertilized with the recommended dose of fertilizer (120:40:40 kg of N, P_2O_5 and K_2O ha^{-1}). The hand weeding were taken up one at 20 DAT and again at 40 DAT. In herbicide treatments, the herbicides were applied through knapsack sprayer fitted with flat fan nozzle using 500 liters of water as per the treatment schedule. The experimental plots were irrigated to maintain a water column of 5 cm height throughout the crop period. Irrigation was stopped seven days prior to harvest and the water if any in the field was drained completely to hasten maturity.

Biometric observations :

The growth parameters like plant height recorded at 30, 60 DAT and at harvest satge, LAI recorded at flowering stage, DMP recorded at 30, 60 DAT and at harvest stage where as yield parameters and yield like productive tillers m^{-2}, number of filled grains $panicle^{-1}$, grain yield and straw yield were recorded at the time of harvesting.

Statistical analysis :

All the experimental data was analyzed by using SPSS Statistical tool 20.0. To draw the statistical findings, the critical difference was worked out at 0.05 per cent level of probability.

Growth parameters :

Controlling the weeds by hand weeding or by pre-emergence (PE), early post-emergence (EPOE) and post-emergence (POE) herbicides had extensive impact on growth parametrs of transplanted rice as indicated by higher plant height, LAI and maximum DMP are furnished in Table-1.

Twice hand weeding at 20 and 40 DAT (T_2) recorded the maximum plant height of 45.72, 86.97 and 102.64 cm at 30, 60 and at harvest stage respectively and LAI of 5.43 at maximum flowering stage and also recorded the maximum DMP of 3487, 6939 and 12786 kg ha^{-1} at 30, 60 and at harvest stage respectively in transplanted rice. It is due to better control of weeds by uprooting along with roots resulted in weed free situation throughout the cropping period of crop which leads to better accumulation of photosynthesis and favoured for increased uptake of nutrients by rice crop which is directly reflected on maximum growth characters[7,12]. However, it was statistically followed by POE application of triafamone + ethoxysulfuron @ 225 g ha^{-1} at 21 DAT (T_8) and PE application of bensulfuron methyl + pretilachlor @ 660 g ha^{-1} at 3 DAT (T_3). The least plant height of 29.12, 57.34 and 72.95 cm at 30, 60 and at harvest stage respectively, LAI of 3.47 at maximum flowering stage and also recorded a least DMP of 2280, 4396 and 7012 kg ha^{-1} at 30, 60 and at harvest stage respectively, was recorded under unweeded control (T_1). The least growth parameters were recorded under unweeded control was mainly due to absence of weed control measures registered the highest weed infestation.

Yield parameters :

The yield parameters *viz.,* number of productive tillers per meter square and number of filled grains per panicle were significantly influenced by the weed management practices are presented in Table-1.

Table-1. Effect of weed management practices on growth and yield attributes in rice

Treatments	Plant height (cm)			Leaf area index	Dry matter production (kg ha^{-1})			Number of productive tillers m^{-2}	Number of filled grains panicle^{-1}
	30 DAT	60 DAT	Harvest		30 DAT	60 DAT	Harvest		
T_1 – Control	29.12	57.34	72.95	3.47	2280	4396	7012	275	78.34
T_2 – Twice handweeding (20 and 40 DAT)	45.72	86.97	102.64	5.43	3487	6939	12786	418	108.78
T_3 – Bensulfuron methyl + pretilachlor @ 660 g ha^{-1} at 3 DAT	41.85	78.96	94.28	4.90	3140	6198	11510	387	100.31
T_4 – Pretilachlor + pyrazosulfuron-ethyl @ 615 g ha^{-1} at 3 DAT	37.83	71.36	85.34	4.33	2832	5509	10288	352	92.35
T_5 – Bispyribac sodium + pyrazos-ulfuron-ethyl @ 150 g ha^{-1} at 14 DAT	39.79	74.85	90.11	4.56	2991	5841	10965	368	96.32
T_6 – Metsulfuron methyl+chlorimuron ethyl @ 20 g ha^{-1} at 14 DAT	33.04	63.24	77.19	3.76	2433	4828	8832	317	82.73
T_7 – Penoxsulam + cyhalofop-butyl @ 135 g ha^{-1} at 21 DAT	35.12	67.43	81.26	4.00	2614	5184	9526	335	88.46
T_8 – Triafamone + ethoxysulfuron @ 225 g ha^{-1} at 21 DAT	43.73	83.34	98.55	5.20	3294	6597	12143	403	104.18
S.Ed.	0.86	1.60	1.85	0.09	68.53	149.65	288.11	6.52	1.72
CD(p=0.05)	1.83	3.45	3.98	0.20	147	321	618	14	3.70

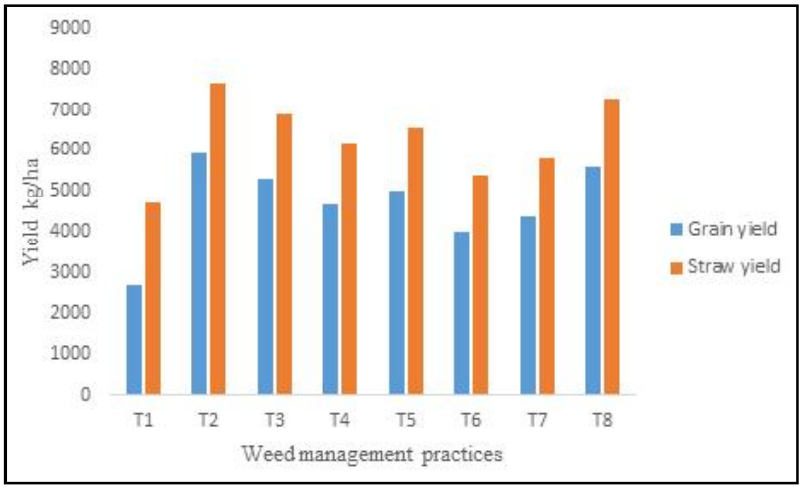

Fig. 1. Effect of weed management practices on grain and straw yield (kg ha^{-1}) of rice

Among the weed management practices, twice hand weeding at 20 and 40 DAT (T_2) recorded the maximum number of productive tillers per meter square of 418 and number of filled grains per panicle of 108.78. It is mainly due to manual weeding offered weed free condition and lower the competition between crop and weed which allowed the crop to absorb required amount of nutrients, water and sunlight for its better growth resulting in higher growth characters, which directly reflects on yield characters *viz.,* number of productive tillers per meter square and number of filled grains per panicle[10,13]. However, this treatment was followed by POE application of triafamone + ethoxysulfuron @ 225 g ha^{-1} at 21 DAT (T_8) and PE application of bensulfuron methyl + pretilachlor @ 660 g ha^{-1} at 3 DAT (T_3). Whereas, significantly lowest number of productive tillers per meter sqaure of 275 and number of filled grains per panicle of 78.34 were noticed under the treatment unweeded control plot (T_1) due to sever weed infestation, that affects the nutrient uptake and yield parameters and reduce the yield drastically[4].

Yield :

The data on grain and straw yield of rice are furnished in Fig. 1. The yield potential of rice was determined by yield attributes. Among the treatments, handweeding twice (T_2) registered significantly higher grain yield of 5945 kg ha^{-1} and straw yield of 7643 kg ha^{-1}. This might be due to better weed suppression throughout the critical period of weed, which contributed for competition free environment that helps the crop with better rooting, increased nutrient availability and moisture, that later reflected higher leaf area index which might have increased the photo-synthesis during flowering and thus it improves the source and sink, ultimately enhanced the yield attributes and finally it is reflected in higher yield. Superior performance of hand weeding twice in rice fetching highest yield[5,8]. This was followed by POE application of triafamone + ethoxysulfuron @ 225 g ha^{-1} at

21 DAT (T_8) and PE application of bensulfuron methyl + pretilachlor @ 660 g ha^{-1} at 3 DAT (T_3). The lowest grain and straw yield was registered under the treatment unweeded control (T_1). This is mainly due to the fact, weeds absorb nutrients faster than the crop and resulted in severe crop weed competition which leads to poor growth and development which drastically reduced the yield of the crop[11].

Based on the results, twice hand weeding recorded higher growth attributes, yield attributes and yield. However, manual weeding is labouries, costly and now a days availability of labours is decreasing. Considering the above fact, POE application of triafamone + ethoxysulfuron @ 225 g ha^{-1} at 21 DAT could be a better alternative option next to twice hand weeding in effective control of weeds and increase the yield in transplanted rice.

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