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EVALUATION OF WEED MANAGEMENT PRACTICES ON YIELD PARAMETERS IN DIFFERENT RICE (*Oryza sativa*) FARMING SYSTEMS

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ABSTRACT

An experiment was undertaken in a farmer's field in Chidambaram Sathamangalam, Cuddalore district of Tamil Nadu, during *Samba* 2020 to determine the weed management in different rice farming systems. The experiment was conducted in split plot design with four replications, two main treatments with different rice farming systems *viz,* M_1-Monocropping and M_2-Annamalai rice + fish + poultry farming system and three sub treatments with weed management practices *viz.,* S_1 – unweeded control, S_2 – twice hand weeding on 20 and 40 DAT, S_3 – pre emergence (PE) application through tank mix of butachlor (50 % EC) @ 1.25 kg a.i. ha^{-1} + 2,4-DEE (38 % EC) @ 0.6 kg a.i. ha^{-1}. The results indicated that, in farming systems the Annamalai rice + fish + poultry farming system (M_2) show significant performance on the various yield parameters than rice monocropping (M_1). In weed management practices, twice hand weeding in on 20 and 40 DAT (S_2) recorded the highest yield parameters. It was followed by PE application through tank mix of butachlor (50 % EC) @ 1.25 kg a.i. ha^{-1} + 2,4-DEE (38 % EC) @ 0.6 kg a.i. ha^{-1} (S_3). The lowest yield parameters registered in unweeded control (S_1).

Among interactions, Annamalai rice + fish + poultry farming system along with two hand weedings on 20 and 40 DAT (M_2S_2) recorded significantly the highest yield parameters during *Samba* 2020. This was followed by Annamalai rice + fish + poultry farming system along with PE application through tank mix of butachlor (50 % EC) @ 1.25 kg a.i. ha^{-1} + 2,4-DEE (38 % EC) @ 0.6 kg a.i. ha^{-1} (M_2S_3) in *Samba* 2020 cropping season. During the season lowest yield parameters were recorded in rice monocropping under unweeded control (M_1S_1). In this line it gives conclusion that, the Annamalai rice + fish + poultry farming system performs significantly better than rice mono cropping by recording the highest yield parameters during *Samba* 2020.

Keywords: IFS, Annamalai rice + fish + poultry farming system, Rice monocropping, Yield parameters, Twice hand weeding, Butachlor + 2,4-DEE.

INTRODUCTION

Rice (*Oryza sativa* L.) is consumed as a staple food by more than 60 % of the current world population. (Maharajan *et al.,* 2014). Globally rice is cultivated on 167.13 Mha of arable land with production and productivity of 782 Mt and 4.67 t ha^{-1}, respectively (FAO,2018). India is one of the leading producers of rice in the world and more than 100 million metric tons of rice was produced in 2019–2020 (Economic Survey, 2020–2021). The total cultivated area

is 41,21,000 hectares (World bank, 2020) and area under rice constitute 1.5 million hectares (Tripathi, 2019). The southern state of Tamil Nadu, Rice is cultivated in an area of 2.7 million ha with production of 7.98 billion kg (Department of Agriculture, Cooperation and Farmers Welfare 2019). The Cauvery delta region (popularly known as the "Granary of Tamil Nadu") contributes a major share of rice production, with a total rice growing area of 0.74 million ha and rice production of 1.67 billion kg, contributing 47.02 % of the rice production in the state of Tamil Nadu, in India (Department of Economics and Statistics 2017). However, considering the current population growth rate of 1.5 per cent, the projected demand for rice for the exploding population of the total rice requirement by 2025 would be around 125 million tonnes (Dey *et al.,* 2020). The low land rice production in India is attributed to the infestation of pests and diseases, weeds, poor water and fertility management besides low yielding varieties.

In the view of farming community, the Indian government was formulated several programs training programmes to bring livelihood security of small and marginal farmers and to aide agriculture, and livestock production (Behera *et al.,* 2013; Mahapatra and Behera, 2011). IFS in terms of mixed farming systems has drawn attention to these contemporary, specialised, intensive farming methods that have an impact on the variety of weed flora and fauna and farmers with limited resources are more vulnerable to weather and market variations as a result of their dependence on fewer agricultural products an farmers with limited resources are more vulnerable to weather and market variations as a result of their dependence on fewer agricultural products (Manjunath *et al.,* 2018; Paramesh *et al.,* 2019; Paramesh *et al.,* 2018).

This integrated farming system approach assumes greater significance especially with small-farm holders as Additionally, it improves the food standards of resource-poor farmers and creates meaningful work while minimising pesticide usage and environmental damage and additionally, it improves the food standards of resource-poor farmers and creates productive work while minimising pesticide usage and environmental damage and maintenance of sustainability (Kathiresan *et al.,* 2001; Gunasekaran and Kathiresan, 2003).

MATERIALS AND METHODS

The present study was carried out during *Samba* 2020 (August 2020 – January 2021) in Chidambaram Sathamamgalam, Cuddalore district of Tamil Nadu on effect of weed management rice farming systems on yield parameters. The experiment was done in split plot design. The design of experiments comprises of two rice farming systems *viz.,* Rice monocropping (M_1) and Annamalai rice + fish + poultry (M_2) as main plots. In sub plot three weed management strategies comprising unwedded control (S_1), twice hand weeding on 20 and 40 DAT (S_2) and pre emergence (PE) application through tank mix of butachlor 50 % EC @ 1.25 kg a.i. ha^{-1} and 2,4-DEE 38 % EC @ 0.6 kg a.i. ha^{-1} (S_3). The long duration rice cultivar BPT 5204 was used as test variety. The field was levelled and laid out into plots with irrigation and drainage channels. In the Annamalai rice + fish + poultry farming system, field trenches of 20 x 1 x 1m dimensions in an area of 20 m^2 were dug for fish shelter in respective treatments. Poultry cages of dimension 6 x 4 x 2 ft were installed in respective plots, supported by concrete poles of 8 ft length of which 4 ft was buried into the soil. The harvest index for each treatment was calculated

by using the following formula described by Donald (1962). Economics of production for the cropping systems were also computed and recorded. The experimental data were statistically analysed following analysis of variance and least significant difference was worked out at 5% probability level.

RESULTS AND DISCUSSION

Effect on no. of panicles and no. of filled grains

The findings in **Table 1** demonstrated, among the different farming systems evaluated, Among the different farming systems practices, Annamalai rice+ fish + poultry (M_2) has registered the highest number of panicles of 222 m^{-2} and 107 no. of filled grains 25 panicle^{-1} during *Samba* 2020 and the lowest number of panicles of 196 m^{-2} and no. of filled grains 99 panicle^{-1} during *Samba* 2020 as recorded in rice monocropping system (M_1).

Among the weed management practices investigated, two hand weedings on 20 and 40 DAT (S_2) recorded the highest number of panicles and no. of filled grains panicle were recorded as 245 m^{-2} and 112 panicle^{-1} respectively during *Samba* 2020. This was followed by PE application through tank mix of butachlor (50 % EC) @ 1.25 kg a.i. ha^{-1}+ 2,4-DEE (38 % EC) @ 0.6 kg a.i. ha^{-1} (S_3) registered number of panicles and no. of filled grains panicle^{-1} were recorded as 226 m^{-2} and 108 panicle^{-1} respectively during the cropping season. Regardless of the stages of crop growth the unweeded control (S_1) resulted with the lowest number of panicles of 156 m^{-2} and no. of filled grains 89 panicle^{-1} during *Samba* 2020. The higher yield in weed control treatments *i.e,* in treated plots where weeds were substantially reduced, hand weeding at 20 and 40 DAT may be attributed to less competition between crop plants and weeds (Lhungdim *et al*. 2019). Kuotsu and Singh, 2020 The crop's yield can be increased by twice had weeding at 20 and 40 DAT, regardless of the agricultural techniques used, it was determined.

With respect to the interactions, the highest number of panicles and no. of filled grains panicle^{-1} were record of 262 m^{-2} and 118 panicle^{-1} during *Samba* 2020 were resulted with Annamalai rice+ fish + poultry farming system with two hand weedings on 20 and 40 DAT (M_2S_2) during *Samba* 2020. This was followed by Annamalai rice+ fish + poultry farming system along with PE application through tank mix of butachlor (50 % EC) @ 1.25 kg a.i. ha^{-1} + 2,4-DEE (38 % EC) @ 0.6 kg a.i. ha^{-1} (M_2S_3). In this season the lowest number of panicles of 148 m^{-2} and no. of filled grains 88 panicle^{-1} during *Samba* 2020 was documented with rice monocropping under unweeded control (M_1S_1). There is no significant variation found among the treatments in the test weight.

Grain yield and Straw yield

Among the different farming systems practices, Annamalai rice + fish + poultry (M_2) registered significantly highest grain yield, straw yield of 4,580 kg ha^{-1}, 6,264 kg ha^{-1} respectively during *Samba* 2020. The lowest grain yield of 3,715 kg ha^{-1} and straw yield of 5,196 kg ha^{-1} during cropping season was recorded under rice monocropping system (M_1)

Among the weed management practices investigated, two hand weedings on 20 and 40 DAT (S_2) recorded the highest grain yield of 5,202 kg ha^{-1} and straw yield 7,079 kg ha^{-1} during

Samba and this was followed by PE application through tank mix of butachlor (50 % EC) @ 1.25 kg a.i. ha^{-1} + 2,4-DEE (38 % EC) @ 0.6 kg a.i. ha^{-1} (S_3). The lowest grain yield and straw of 2,620 kg ha^{-1}, 3,755 kg ha^{-1} during *Samba* 2020 respectively were recorded under unweeded control (S_1).

With respect to the interactions, Annamalai rice+ fish + poultry farming system with two hand weedings on 20 and 40 DAT (M_2S_2) recorded the highest grain yield of 5,836 kg ha^{-1} and 7,879 kg ha^{-1} of straw yield during *Samba* and this was followed by Annamalai rice + fish + poultry farming system along with PE application through tank mix of butachlor (50 % EC) @ 1.25 kg a.i. ha^{-1} + 2,4-DEE (38 % EC) @ 0.6 kg a.i. ha^{-1} (M_2S_3). The lowest grain yield and straw yield of 2,459 kg ha^{-1} and 3,560 kg ha^{-1} were respectively recorded during *Samba* 2020 under rice monocropping under unweeded control (M_1S_1). When comparing the treatments, the harvest index shows no noticeable difference.

Among the different farming systems adapted, Annamalai rice+ fish + poultry (M_2) has registered significantly maximum grain yield, straw yield, biological yield, number of panicles, number of filled grains. This may be attributable to the fish and poultry-based agricultural method since the crop may get constant nutrient additions, increasing crop production and yield. (Kathiresan, 2021; Dwivedi *et al*., 2017).

Table 1. Effect of farming systems and weed management on yield parameters

Treatment	No. panicles m^{-2}	No. of filled grains $panicle^{-1}$	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index
Main treatment					
M_1	196	99	3715	5196	41.57
M_2	222	107	4580	6356	42.37
S.Ed	1.65	0.64	43.64	56.90	-
CD (p=0.05)	5.25	2.04	138.89	181.09	-
Sub treatment					
S_1	156	89	2620	3755	41.09
S_2	245	112	5202	7079	42.33
S_3	226	108	4621	6356	42.06
S.Ed	1.48	0.60	36.58	48.27	-
CD (p=0.05)	3.23	1.31	79.71	105.17	-

(Figures in parenthesis indicates original values)

Economics

Among the main treatments Annamalai rice+ fish+ poultry farming systems recorded the highest net income, and BCR *viz.,* ₹ 11,39,453 and 1.85 and it was followed by ice monocropping. It might be because the fish and poultry products provide more revenue, weeds are managed, and crop nutrients are supplemented. According to the economics of farming systems, the Annamalai

integrated farming system yields greater returns than rice monocropping by effectively utilising the land (Kathiresan, 2020). It is also supported by Jayathi *et al.,* (2000) in integrated farming system.

Among the weed management practices, twice hand weeding on 20 and 40 DAT results the higher net income and BCR of ₹ 6,22,808 and 1.68 and it was followed by PE application through tank mix of butachlor (50 % EC) @ 1.25 kg a.i. ha^{-1} + 2,4-DEE (38 % EC) @ 0.6 kg a.i. ha^{-1} (S_3). The lowest net income and BCR of 5,65,060 and 1.16 during *Samba* 2020 respectively were recorded under unweeded control (S_1).

With respect to interactions, Annamalai rice+ fish + poultry farming system with two hand weedings on 20 and 40 DAT (M_2S_2) recorded the highest net income and BCR of ₹ 11,78,240 and 1.90 and it was followed by Annamalai rice + fish + poultry farming system along with PE application through tank mix of butachlor (50 % EC) @ 1.25 kg a.i. ha^{-1} + 2,4-DEE (38 % EC) @ 0.6 kg a.i. ha^{-1}(M_2S_3). The net income and BCR of ₹ 21,097 and 0.52 were respectively recorded during *Samba* 2020 under rice monocropping under unweeded control (M_1S_1). When comparing the treatments, the harvest index shows no discernible difference.

IFS was able to increase net profitability and decrease production costs by recycling by-products and leftovers from various system components. IFS implementation can lower input costs by promoting resource flow and integrated pest and nutrient management, particularly for the use of necessary inputs like fertilizers, insecticides, and herbicides. The improved product diversification in IFS may be able to give small and marginal farmers with a daily income supported by components (Reddy and Biddappa, 2000). In order to increase crop development, two hand weedings are preferable since they remove weeds from the field more frequently and reduce weed competition, as documented by Deepthi Kiran and Subramnyam (2010).

Table 3. Effect of treatments on economics

Treatment	Gross income (₹)	Net income (₹)	Benefit-Cost ratio
M_1S_1	61,637	21,097	0.52
M_1S_2	1,13,317	67,377	1.47
M_1S_3	1,02,515	60,146	1.42
M_2S_1	17,23,897	11,09,023	1.80
M_2S_2	17,98,514	11,78,240	1.90
M_2S_3	17,47,801	11,31,097	1.83

Conclusion

The research revealed that Annamalai's rice farming practises, which report higher yield metrics than rice monoculture, provide superior economic benefits. Pre-emergence herbicides do not produce the same yield parameters or financial returns as twice-manual weeding on 20 and 40 DAT.

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