*Plant Archives* Vol. 20 No. 1, 2020 pp. 727-730 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

# IMPACT OF ORGANIC MANURES ON RICE WEED CONTROL

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## Abstract

Field experiment was conducted at the Experimental Farm, Department of Agronomy, Annamalai University during *Late samba* season (September, 2017-January, 2018) with rice variety ADT 49 to study the impact of various organic manures on rice weed control. The experiment was taken up in Randomized block design with that treatments comprised of unweeded control ($T_1$), off season ploughing treatment ($T_2$), application of organic manures *viz.,* goat manure @ 5 t $ha^{-1}$ ($T_3$), poultry manure @5 t $ha^{-1}$ ($T_4$), farm yard manure @ 12.5 t $ha^{-1}$ ($T_5$) and green leaf manure (*Glyricidia sepium*) @ 6.25t $ha^{-1}$ ($T_6$) and hand weeding twice ($T_7$). Among the rice weed control measures, twice hand weeding at 20 and 40 DAT recorded the least weed counts, weed biomass (78.90 kg $ha^{-1}$) and highest weed control index (89.84 percent) favouring higher yield attributes and grain yield (4.94 t $ha^{-1}$).

***Key words:*** Organic manure, Off season ploughing, Transplanted rice, Hand weeding.

## Introduction

Rice (*Oryza sativa* L.) is one of the most important ancient crops being cultivated in 117 countries and about 90 per cent of total rice is grown and consumed in Asia (Seema *et al*., 2014). Rice plays a vital role in the national food security .In the world, rice is the second most widely consumed cereal next to wheat and it has occupied an area of 159.17 million hectares with the production and productivity of 472.16 million tonnes and 4.42 tonnes $ha^{-1}$, respectively (USDA, 2017). To meet the future food requirements of ever increasing population and to maintain self sufficiency, the estimated rice production in India should be 350 million tonnes by 2020 AD (Veeraputhiran and Balasubramanian, 2013).

In India, weed is one of the most important biotic constraint that limits rice productivity. Weeds, not only cause quantitative loss but also reduce quality of the produce due to competition for nutrients, moisture, light and to some extent for space. They harbor many insects, pests and pathogens resulting in poor crop growth. Normally, the loss in rice yield ranges between 15-20 percent, yet in severe cases the yield losses can be more than 50 per cent depending upon the species and intensity of weeds (BRRI, 2006).

Transplanted rice, in particular, is infested by heterogeneous type of weed flora under lowland ecosystems which reduces yield upto 48 per cent with an yearly loss of 15 million tonnes due to weed competition (Saha, 2009). It has also been estimated that without weed control, the yield loss can be as high as 90 per cent (Ferrero and Tinarelli, 2007). Weed competition can be included as a huge factor that limits the crop yield (Leghari *et al.,* 2016). Weeds compete with rice and causes yield losses to the tune of 50-65 percent under wet seeded rice and up to 76 per cent in transplanted rice (Jai Prakash *et al*., 2017). Prevention of weed competition and provision of weed free environment at critical period of rice growth is necessary for successful rice production. The usage of herbicides in India and elsewhere in world is increasing due to attractive benefits to farmers. At the same time, continuous use of same group of herbicides over a period of time on a same piece of land leads to ecological imbalance in terms of weed shift, herbicides resistance in weeds and environmental pollutions. Herbicide application may also kill species of bacteria, fungi and protozoa that combat disease causing microorganisms thereby upsetting the balance of pathogens and beneficial organisms and allowing the opportunist, disease causing organisms to become a problem (Kalia and Gupta, 2004). Exploring the weed control through cultural measures including the use of

organic manures for weed suppression rather than elimination by virtue of its acidic nature and allelopathic metabolites is worth for consideration (Kathiresan and Ramah, 2000; Kathiresan, 2009). In addition, it also enhances soil microbial counts, increases soil organic carbon is economically viable and is socially acceptable. The present investigation was carried out with the following objectives:

To evaluate the impact of organic manures on rice weed flora.

To find out the response of organic manures on reduction of weed competition and yield maximization.

## Materials and methods

Field experiment was conducted in the Experimental Farm, Department of Agronomy, Annamalai University during *Late Samba* season (September, 2017 - January, 2018) to evaluate the impact of organic manures on rice weed control. The weed flora was allowed to grow without any disturbance throughout the crop duration in the Unweeded control ($T_1$). In the off season ploughing treatment ($T_2$). In the treatments that comprised application of organic manures, ($T_3$)- Goat manure @ 5t $ha^{-1}$, ($T_4$)- Poultry manure @ 5t $ha^{-1,}$ ($T_5$) - Farm yard manure @ 12.5t $ha^{-1,}$ ($T_6$) - Green Leaf manure (*Glyricidia sepium)* @ 6.25t $ha^{-1}$, Twice hand weeding at 20 DAT and 40 DAT ($T_7$). The manures mentioned above are applied and incorporated to corresponding plots seven days prior to transplanting. The difference in quantity of nutrients is compensated by adding required quantity of fertilizers. The data pertaining to the crop and weed were statistically analyzed as per the procedure suggested by Gomez and Gomez (1984). The data involving percentage values were transformed by angular transformations for analysis. Square root transformations were done for weed counts before statistical analysis. For significant results, the critical differences were worked out at 5 percent probability to draw statistical conclusions.

## Results and Discussion

Among the crop weed control measures compared hand weeding twice recorded the least weed counts of (7.11 and 9.41 $m^{-2}$ on 30 and 60 DAT, respectively) and weeds biomass (78.90 kg $ha^{-1}$ on 60 DAT) and was found to be significantly superior than the rest of the treatments (Table 1). Off season ploughing was found to be next in order by suppressing the weeds and was on par with the treatments that included application of green leaf manure (*Glyricidia sepium*) @ 6.25 t $ha^{-1}$, poultry manure @ 5 t $ha^{-1}$ and application of goat manure @ 5 t $ha^{-1}$. All the organic manures *viz.*, goat manure, poultry manure and green leaf manure (*Glyricidia sepium*) were found to be superior in reducing the weed counts and weed biomass compared to farm yard manure. Unweeded control recorded the highest weed counts of (123.71 and 181.15 $m^{-2}$ on 30 and 60 DAT, respectively) and weeds biomass of (776.84 kg $ha^{-1}$ on 60 DAT).

The field experiment showed that all the sources of organic manures except FYM were statistically equal and higher in reducing the weed count and weed biomass in comparison with unweeded control. This could be because of unique properties of each of those organic manures. Poultry manure with slightly acidic pH and allelomediatry principles as reported earlier (Kathiresan, 2007) could have suppressed the weed growth and development. Similarly, in green leaf manure, the allelopathic metabolites on decomposition might have interrupted with weed seed germination and seedling establishment of weeds in rice as reported earlier (Mohammad Nasir *et al*., 2016). Incorporation of fresh leaves of *Glyricidia sepium* @10 t $ha^{-1}$ effectively controlled weeds and recorded the increased weed control

**Table 1:** Weed Parameters.

| | Total Weed count | Weed dry matter | Weed control Index | Nutrient removal by weeds (kg $ha^{-1}$) | | |
|---|---|---|---|---|---|---|
| | | | | N(kg | $P_2O_5$ | $K_2O$ |
| **Treatments** | **60 DAT($m^{-2}$)** | **60 DAT** | **60 DAT** | **$ha^{-1}$)** | **(kg $ha^{-1}$)** | **(kg $ha^{-1}$)** |
| $T_1$ – Unweeded control | 13.51(181.15) | 776.87 | - | 29.51 | 16.28 | 23.92 |
| $T_2$ – Off season ploughing | 7.46(62.51) | 213.24 | 58.54(72.55) | 22.84 | 11.83 | 11.79 |
| $T_3$ – Goat manure application @ 5 t $ha^{-1}$ | 7.84(60.69) | 223.66 | 57.55(71.21) | 22.98 | 12.21 | 12.24 |
| $T_4$ – Poultry manure application @ 5 t $ha^{-1}$ | 7.67(58.01) | 221.11 | 57.75(71.53) | 22.94 | 12.08 | 12.13 |
| $T_5$ – Farm yard manure application @ 12.5 t $ha^{-1}$ | 9.27(85.00) | 338.40 | 48.70(56.44) | 23.79 | 14.73 | 18.28 |
| $T_6$ – Green leaf manure (*Glyricidia sepium*) application @ 6.25 t $ha^{-1}$ | 7.69(58.37) | 220.50 | 57.80(71.61) | 22.91 | 11.87 | 11.98 |
| $T_7$ – Hand weeding twice at 20 and 40 DAT | 3.12(9.41) | 78.90 | 71.41(89.84) | 15.31 | 10.90 | 11.16 |
| S. EdCD (p=0.05) | 1.423.10 | 5.6912.41 | 1.633.56 | 0.370.80 | 0.200.44 | 0.210.46 |

(Figures in parenthesis indicate original values)

**Table 2:** Crop Growth and Yield Parameters

| Treatments | Plant height (cm) | Number of tillers | LAI | Crop dry matter production | Yield | | Return rupee$^{-1}$ invested (Rs. ha$^{-1}$) |
|---|---|---|---|---|---|---|---|
| | 60 DAT | Number of tillers hill$^{-1}$ | LAI | 60 DAT (t ha$^{-1}$) | Grain yield (t ha$^{-1}$) | Straw yield (t ha$^{-1}$) | |
| $T_1$ – Unweeded control | 56.89 | 10.17 | 2.94 | 4.49 | 2.47 | 5.20 | 1.68 |
| $T_2$ – Off season ploughing | 65.24 | 19.47 | 5.29 | 8.39 | 4.49 | 6.42 | 2.68 |
| $T_3$ – Goat manure application @ 5 t ha$^{-1}$ | 62.76 | 18.71 | 5.16 | 8.27 | 4.43 | 6.38 | 2.36 |
| $T_4$ – Poultry manure application @ 5 t ha$^{-1}$ | 64.89 | 18.76 | 5.11 | 8.32 | 4.41 | 6.35 | 2.39 |
| $T_5$ – Farm yard manure application @ 12.5 t ha$^{-1}$ | 58.89 | 14.24 | 4.54 | 7.67 | 3.87 | 5.92 | 2.04 |
| $T_6$ – Green leaf manure (*Glyricidia sepium*) application @ 6.25 t ha$^{-1}$ | 65.19 | 18.84 | 5.21 | 8.36 | 4.46 | 6.36 | 2.17 |
| $T_7$ – Hand weeding twice at 20 and 40 DAT | 77.06 | 20.26 | 5.84 | 8.74 | 4.94 | 8.36 | 2.82 |
| S. EdCD (p=0.05) | 1.262.75 | 0.360.79 | 0.100.22 | 0.150.34 | 0.080.18 | 0.130.29 | - |

efficiency (60.6 per cent) by strong allelopathic against weeds. As regards goat manure, the digestive pattern of small ruminants involve intensive regurgitation and an extensive process of digestion that deprives both moisture content and the process of endozoochory, making their voiding peletted without much weed seed content as reported earlier (Geetha jebarathnam and Kathiresan, 2005) addition of goat manure recorded least weed biomasss of 42.74 g m$^{-2}$ and weed control index of 32.95 percent compared to control in millets. Off season ploughing exposed the weed seeds and vegetative propagules to scorching sun in the summer months there by exhausting the weed seed bank. This resulted in better weed control next to twice hand weeding as reported earlier (Gnanavel and Kathiresan, 2002) Off season ploughing was found to be superior in reducing the population of weeds *viz.*, *Cyperus rotundus*, *Cypreus difformis*, *Sphenoclea zeylanica* and *Fimbristyiis littoralis* and recorded highest weed control index in succeeding rice crop. Better weed control resulted in enhanced crop biometrics, crop yield and economics (Table 2) as the weeds were silent robers, snatching away the required nutrients, sunlight, space and moisture. This is reflected in those treatments resulting on higher yield and economics.

**Nutrient Removal by Weeds**

Among the treatments, hand weeding twice recorded the least nutrient removal of 15.31, 10.94 and 11.16 kg of N, $P_2O_5$ and $K_2O$ ha$^{-1}$ by weeds and was found to be significantly superior than the rest of the treatments. Off season ploughing was found to be next in order with nutrient removal of 22.84 kg N, 11.83 kg $P_2O_5$ and 11.79 kg $K_2O$ ha$^{-1}$ and were on par with the treatments that included, application of green leaf manure *(Glyricidia sepium)* @ 6.25 t ha$^{-1}$, poultry manure @ 5 t ha$^{-1}$ and goat manure application @ 5t ha$^{-1}$. All the organic manures *viz.*, goat manure, poultry manure and green leaf manure (*Glyricidia sepium*) were found to be superior in reducing the nutrient removal by weeds compared to farm yard manure. The unweeded control recorded the highest nutrient removal of 29.51 kg N, 16.28 kg $P_2O_5$ and 23.92 kg $K_2O$ ha$^{-1}$.

**Nutrient uptake by the crop**

Hand weeding twice in crop favoured higher nutrient uptake by crop (136.78, 36.16 and 99.27 kg of N, $P_2O_5$, $K_2O$ ha$^{-1}$) and was significantly superior than rest of the treatments compared. Off season ploughing was found to be next in order with nutrient uptake of crop (133.11, 34.21 and 99.71 kg of N, $P_2O_5$, $K_2O$ ha$^{-1}$). All the organic manures *viz.*, goat manure, poultry manure and green leaf manure (*Glyricidia sepium*) was found to be superior in increasing nutrient uptake by crops compared to farm yard manure. Unweeded control registered minimum crop nutrient uptake of 100.72, 24.89 and 75.19 kg N, $P_2O_5$, $K_2O$ ha$^{-1}$, respectively.

## Conclusion

From the present study, it could be concluded that twice hand weeding at 20 and 40 DAT could be an effective weed control practice for transplanted rice. However off season ploughing and application of organic manures *viz.*, green leaf manure *(Glyricidia sepium)* @ 6.25 t ha$^{-1}$, poultry manure @ 5 t ha$^{-1}$ and goat manure application @ 5 t ha$^{-1}$ could also be suggested as effective weed control options for transplanted rice.

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