

Effect of Brown Manuring and Herbicide Application on Weed Parameters on Aerobic Rice Under Varying Planting Geometry

ABSTRACT

A Field Experiment was conducted at Main Rice Research Centre, Navsari Agricultural University, Navsari during *kharif* 2021. The experiment was carried out in randomized block design with factorial concept with three replication. The results revealed that density of grasses, sedges, broad-leaved weeds and thus total weed density were significantly higher in 40 cm line sowing at 20 DAS and 40 DAS. Weed dryweight at 60 DAS and at harvest was also significantly higher with 40 cm line sowing. Handweeding twice at 20 and 40 DAS recorded no weed at 20 DAS and at 40 DAS and was closely followed by Pendimethalin 750 g a.i. ha⁻¹ (PE) + Bispyribacsodium 40 g ha⁻¹ at 30 DAS. Considerably lower weed dry weight at 60 DAS and at harvest was recorded with Handweeding twice at 20 and 40 DAS which was at par with Pendimethalin 750 g a.i. ha⁻¹ (PE) + Bispyribacsodium 40 g ha⁻¹ at 30 DAS. Numerically higher weed control efficiency at 60 DAS and at harvest and lower weed index was also recorded by Handweeding twice at 20 and 40 DAS followed by Pendimethalin 750 g a.i. ha⁻¹ (PE) + Bispyribacsodium 40 g ha⁻¹ at 30 DAS. Weed smothering efficiency was found to be higher with Pendimethalin 750 g a.i. ha⁻¹ (PE) + Brown Manuring at 60 DAS and at harvest.

Keywords: Herbicide, Brown manuring, Aerobic rice, Crop geometry, Weed parameters

Introduction

Cereals are the most important part of a human's diet throughout the world and have the ability to meet the food demand of an increasing population. India has the largest area under rice cultivation in the world. Aerobic rice is grown in well-drained, non-puddled and non-saturated soil and hence, weed menace is more compared to flooded rice. Direct seeding changes the type and relative abundance of weed flora. The weed flora found in direct seeded rice are *Echinochloa crusgalli*, *Echinochloa colona*, *Digitaria sanguinalis*, *Eleusine indica*, *Cyperus iria*, *Eclipta alba*, etc. (Mahajan and Timsina, 2011). Weeds having fast nutrient and moisture absorption ability and higher reproduction capacity, grow faster than crop and smother the crop, resulting in poor growth and reduced yield of rice. Yield loss due to weed flora varies from 40 to 100 per cent depending upon weed flora, weed intensity and crop-weed competition time (Choubey *et al.*, 2001).

In aerobic rice growers practice two to three mechanical weeding which controls weed effectively and are environment friendly too, but this is time consuming, labour intensive, tedious and expensive. Therefore, a proper alternative is chemical herbicides which have rapid effect on weeds and are cheaper and easier to use than traditional method of hand weeding (Mian and Mamun, 1969). Herbicides have contributed substantially to the spectacular decrease in weed biomass and weed dry weight. However, application of inorganic herbicides alone in large quantities over a longer period has posed some environmental problems. Frequent use of herbicides develops resistance in weed flora and shift in weed population. So, there is need for integrated environment friendly approach which can supplement the use of herbicides in long run. Brown manuring reduces weed population because of its

faster growth rate than weeds and maintains ground cover to have higher dry matter production of crops before weeds set viable seeds.

Materials and Methods

A field experiment was conducted during the *kharif* season of the year 2021 at Main Rice Research Centre, Navsari Agricultural University, Navsari, Gujarat. The experimental site was medium in organic carbon, available nitrogen and phosphorus and very high in available potassium. This experiment was laid out in randomized block design with twelve treatment combinations replicated thrice using the rice variety "GNR-8 (Aarti)". The two factors under investigation comprised of (Factor 1) spacing level: S_1 – 30 cm line sowing, S_2 – 40 cm line sowing and (Factor 2) weed management treatments: W_1 - Brown manuring at 30 days, W_2 - Pendimethalin 750 g a.i./ha (PE) + Brown manuring, W_3 - Pyrazosulfuron ethyl 25 g a.i./ha (PE) + Brown manuring, W_4 - Pendimethalin 750 g a.i./ha (PE) + Bispyribac sodium 40 g a.i./ha at 30 DAS, W_5 - Hand weeding twice at 20 and 40 DAS and W_6 - Weed check. Therecommended dose of fertilizer @ 100-30-00 NPK kg ha⁻¹ were applied to the crop. The field was levelled and dhaincha seeds @ 20 kg ha⁻¹ were broadcasted as per treatments. Thereafter, the seeds of rice cv. GNR-8 @ 50 kg ha⁻¹ was directly sown in rows with the row spacing of 30 cm and 40 cm according to treatment. Weed management was carried out at required time as per treatment. The required quantities of all three herbicides were worked out according to treatments and dissolved in 500 l ha⁻¹ and 600 l ha⁻¹ water for pre and post emergence herbicides, respectively. The prepared solutions were sprayed separately as per treatment in respective plots. For brown manuring, dhaincha were knocked down at 30 DAS with application of 2,4-D sodium salt @ 1.25 l ha⁻¹. Hand weeding was done with help of *khurpias* per treatment.

RESULTS AND DISCUSSION

Weed Count (m⁻²) at 20 DAS and 40 DAS

The results on weed density of grasses, broad-leaved weeds and sedges along with total weed density in experimental plots during study with different treatments at 20 DAS and 40 DAS is presented in Fig. 1. Between the two spacing levels, the density of grasses, sedges, broad-leaved weeds and thus total weed density were significantly higher in 40 cm line sowing as compared to 30 cm line sowing at 20 DAS and 40 DAS. This was because narrow spacing provides lesser space for weed growth and thus better crop-weed competition as compared to wider spacing. These findings are in accordance with Chauhan and Johnson (2010) and Sunyob et al. (2012). Among the weed management practices, no weeds were observed with handweeding twice at 20 DAS and 40 DAS. Significantly lower grassy weeds, sedges and total weeds were found with pendimethalin 750 g a.i. ha⁻¹ + brown manuring (W_2) and pyrazosulfuron ethyl 25 g a.i. ha⁻¹ (PE) + brown manuring (W_3). Weed check treatment recorded significantly higher density of grasses, broad-leaved weeds, sedges and total weeds. At 40 DAS, again no weed count was observed with treatment of two hand weeding at 20 DAS and 40 DAS. Next to this lower density of grasses, sedges and total weeds were recorded with treatment W_4 (pendimethalin 750 g a.i. ha⁻¹ + bispyribac sodium 40 g a.i. ha⁻¹ at 30 DAS). In terms of dicot control, W_4 (pendimethalin 750 g a.i. ha⁻¹ + bispyribac sodium 40

g a.i. ha⁻¹ at 30 DAS), W₂ (pendimethalin 750 g a.i. ha⁻¹ (PE) + brown manuring), W₃ (pyrazosulfuron ethyl 25 g a.i. ha⁻¹ (PE) + brown manuring) and W₁ (brown manuring at 30 days) treatments were found equally effective. This finding has also been supported by Maity and Mukherjee (2011).

Brown manuring alone reduced grasses by 39.55 per cent and 39.54 per cent, sedges by 25 per cent and 27.36 per cent, broad-leaved weeds by 37.14 per cent and 59.21 per cent and total weed density by 37.48 per cent and 46.35 per cent at 20 DAS and 40 DAS, respectively in comparison to weedy check. Srawet *et al.* (2017) and Nawaj *et al.* (2017) also reported similar results. Integration of brown manuring and pre-emergence herbicides controlled all types of weed to a considerable level due to the synergistic effect of herbicidal effect coupled with smothering action of brown manuring. The interaction effect between weed management treatments and spacing level was non-significant.

Weed Dry Weight (gm⁻²) at 60 DAS and at Harvest

The results pertaining to weed dry matter accumulation at 60 DAS and at harvest is graphically depicted in Fig. 1. Between the two spacing level, higher total dry matter production of weed was under wider spacing *i.e.*, 40 cm line sowing as compared to closer spacing *i.e.*, 30 cm line sowing at both crop growth stages. This finding is in accordance with Sunyob *et al.* (2012) and Kaushik *et al.* (2020). Two hand weeding at 20 DAS and 40 DAS *i.e.*, weed free treatment recorded the minimum (5.87 g m⁻² and 10.10 g m⁻² at 60 DAS and at harvest, respectively) dry matter. Among herbicides, pendimethalin 750 g a.i. (PE) + bispyribac sodium 40 g a.i. at 30 DAS recorded minimum dry matter followed by pendimethalin 750 g a.i. ha⁻¹ (PE) + brown manuring and pyrazosulfuron ethyl 25 g a.i. ha⁻¹ (PE) + brown manuring. This was due to selective control of weeds by herbicides. Similar results were also found by Walia *et al.* (2009) and Pavithra *et al.* (2021). Brown manuring alone reduced weed dry matter by 63.41 per cent and 61.10 per cent at 60 DAS and at harvest, respectively as compared to weedy check. The reduction in weed dry matter showed successful effect of brown manuring in weed smothering. Almost similar finding was observed by Nawaj *et al.* (2017). Interaction effect of row spacing and weed management practices was found to be non-significant.

Weed Control Efficiency (%)

The results pertaining to weed control efficiency recorded at 60 DAS and at harvest with different row spacing and weed management practices are represented in Fig. 1. Hand weeding twice at 20 DAS and 40 DAS at both the row spacing achieved higher weed control efficiency *i.e.*, 85.11 per cent and 78.83 per cent at 60 DAS and at harvest, respectively. This was followed by pre-emergence application of pendimethalin *fb* bispyribac sodium at 30 DAS. It might be due to effective control of weed by hand weeding at critical crop-weed competition period. Also, integration of pendimethalin with bispyribac sodium effectively controlled distinct types of weed flora in broad spectrum. Patel *et al.* (2018) found similar results. Plot treated with brown manuring only, recorded around 60 to 64 per cent WCE at 60 DAS and at harvest. Integration of brown manuring with pre-emergence herbicide increased WCE up to 75 to 78 per cent and 71 to 73 per cent at 60 DAS and at harvest, respectively. This may be probably due to greater reduction of grasses, sedges and some BLWs by restricting earlier germination by PE herbicide and *Sesbania* canopy and later weed flush regrowth suppression by brown manuring. Thus, integration of brown manuring with herbicides provided better weed control. Similar results were also

observed by Kumari *et al.* (2020).

Weed Index (%)

The results pertaining to weed indexes influenced by different weed management practices under varying planting geometry are presented in Fig.1. The results on weed index as affected by weed management treatments revealed that hand weeding twice at 20 DAS and 40 DAS *i.e.* weed free treatment recorded lowest weed index as compared to other treatments because of significantly higher yield production. Minimum weed index of 1.89 per cent was recorded with application of pendimethalin 750 g a.i. ha⁻¹ + bispyribac sodium 40 g a.i. ha⁻¹ at 30 DAS which reflected its selectivity and higher efficacy in weed control and thus marginal yield reduction, whereas poor weed indices (59.98 %) was reported with weed check due to highest weed infestation and poor yield highlighting the significance of weed management in aerobic rice. Plot treated with pre-emergence herbicides, pendimethalin @ 750 g a.i. ha⁻¹ and pyrazosulfuron ethyl @ 25 g a.i. ha⁻¹ along with brown manuring recorded weed index greater than pendimethalin 750 g a.i. ha⁻¹ + bispyribac sodium 40 g a.i. ha⁻¹ at 30 DAS, but less than plot treated with brown manuring only. Plot treated with brown manuring only secured nearly half value of weed index than weed check.

Weed Smothering Efficiency (%)

Weed smothering index at 60 DAS and at harvest was computed and concerned data is presented in Fig. 1. It is the ratio of difference between average weed dry weight of weeds in sole crop and average weed dry weight in intercropping situation to that of average weed dry weight of sole crop. Since in this experiment sole crop and weed check is same, therefore WCE(%) and weed smothering efficiency of all three brown manuring plots is same. Extensive canopy of brown manuring crop precluded solar radiation penetration up to the weeds and thus smothered them.

Conclusion

It can be concluded that aerobic rice can attain maximum yield with hand weeding twice at 20 DAS and 40 DAS by managing the weeds efficiently. But on account of cost effectiveness, pendimethalin 750 g a.i. ha⁻¹ (PE) + bispyribac sodium 40 g a.i. ha⁻¹ at 30 DAS was found most economical.

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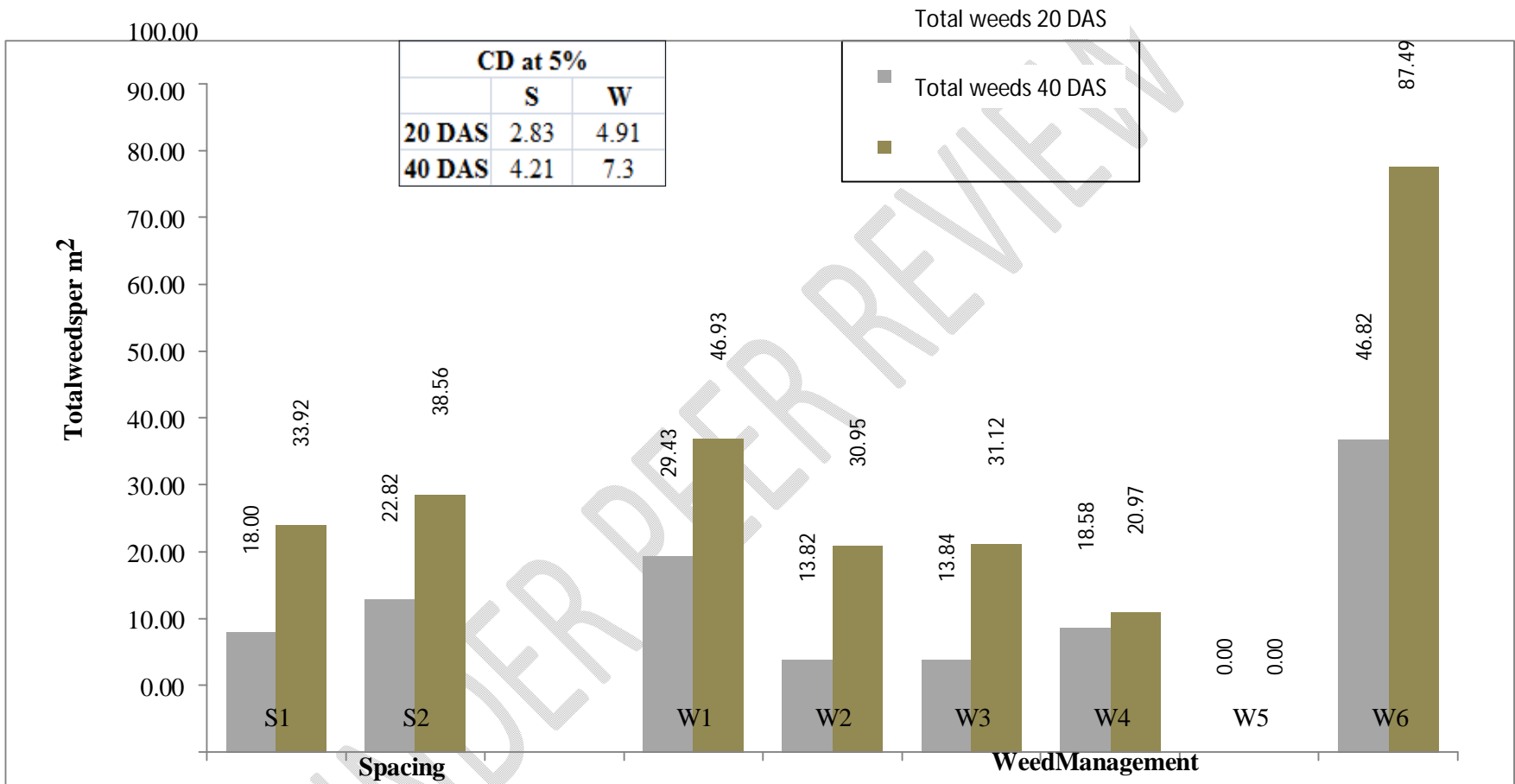


Fig.1: Total weed density (Number m⁻²) in aerobic rice at 20 DAS and 40 DAS as influenced by various treatments

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