



INFLUENCE OF HERBIGATION BASED INTEGRATED WEED MANAGEMENT PRACTICES ON GROWTH AND YIELD OF AEROBIC RICE

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ABSTRACT

A field experiment was conducted during the summer season of 2015 at Zonal Agricultural Research Station, University of Agricultural Sciences (UAS), Gandhi Krishi Vignana Kendra (GKVK), Bengaluru to assess the herbigation based integrated weed management in aerobic rice. The experiment consisted of 12 treatments laid out in randomized complete block design with three replications comprising pre-emergent herbigation of two herbicides at three doses integrated with one hand weeding, post emergent herbigation at two doses, post emergent herbigation with one hand weeding, one hand weeding and one intercultivation compared with weedy check and weed free check. The results revealed that pre-emergent herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + one hand weeding + one inter-cultivation recorded significantly higher growth parameters viz., plant height, number of tillers, leaf area and total dry matter accumulation (35.5 cm, 25.1 hill⁻¹, 3954.3 cm² hill⁻¹ and 153.8 g hill⁻¹, respectively) yield parameters like number of productive tillers, panicle length, panicle weight, total number of grains, grain and straw yield (33.2 hill⁻¹, 25.8 cm, 204.3 g hill⁻¹, 291.0 panicle⁻¹, 8954 kg ha⁻¹ and 11371 kg ha⁻¹), net returns(98865 Rs. ha⁻¹). Further, higher availability of major nutrients (N, P₂O₅ and K₂O) higher uptake by crop and lower uptake by weeds were also recorded in the same treatment.

KEY WORDS: Aerobic rice, herbigation, growth and yield, Economics, Integrated weed management.

INTRODUCTION

Rice (*Oryza sativa* L.) is major food crop for more than half of the world's population. It occupies the enviable prime place among the food crops cultivated around the world and is grown in 162.3 million hectares with a production of 738.1 million tonnes with a productivity of 4.54 tonnes per hectare (Anon, 2015). It is considered to be primarily an irrigated crop. Since olden days it was cultivating under traditional puddled soil and transplanting method. Their, it was consuming around 4000-5000 litres of water to produce 1 Kg grain which is 2 to 3 times higher than that of other cereals. Water shortage is becoming severe in many rice growing areas of the world, the introduction of aerobic rice which means growing of high yielding rice in nonpuddled and non-flooded aerobic soil with the support of external inputs like supplementary irrigation, manures and fertilizers; aerobic rice systems can reduce water use in rice production by as much as 50% (Bouman, 2001). However, direct-seeded aerobic rice is subject to more severe weed infestation than transplanted lowland rice, because in aerobic rice systems weeds germinate simultaneously with rice, and there is no water layer to suppress weed growth. In aerobic rice, weeds cause yield loss to an extent of 56.4 to 90.70 per cent (Paradkar *et al.*, 1997). In such condition to ensure high yield, we should take necessary and time bound weed management practices. Since many years research on weed control methods like hand weeding, intercultivation, herbicide spray and their integration has achieved good progress. Apart from this to overcome water shortage problems there is more scope for micro irrigation systems like drip and sprinkler. Herbigation is "the process of

injecting an approved chemical (herbicide) into irrigation water and applying through the irrigation system to crop, weed or field". In aerobic rice there is possibility to follow herbigation through drip irrigation system along with other weed control methods, whose efficiency needs to be worked out. Hence, the present investigation was undertaken to study the effect of herbigation based integrated weed management practices on growth, yield and economics of aerobic rice.

MATERIALS & METHODS

A field experiment was conducted during the summer season of 2015 at Zonal Agricultural Research Station, Gandhi Krishi Vignana Kendra (GKVK), University of Agricultural Sciences (UAS), Bengaluru. The soil of the experimental site was red sandy clay loam in texture, acidic in reaction (6.28), medium in available nitrogen (294.6 kg ha⁻¹), available phosphorus (44.2 kg ha⁻¹) and available potassium (233.2 kg ha⁻¹). The organic carbon content was medium in range (0.58 %). KRH 4, a medium duration hybrid was sown on February 16 at a spacing of 25 x 25 cm. Experiment consisting 12 treatments *i.e.*, T₁: PE herbigation of pyrazosulfuron ethyl 10% WP @ 250 g ha⁻¹ + one HW, T₂: PE herbigation of pyrazosulfuron ethyl 10% WP @ 375 g ha⁻¹ + one HW, T₃: PE herbigation of pyrazosulfuron ethyl 10% WP @ 500 g ha⁻¹ + one HW, T₄: PE herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + one HW, T₅: PE herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 15 kg ha⁻¹ + one HW, T₆: PE herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 20 kg ha⁻¹ + one HW, T₇: PE herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + PoE herbigation of bispyribac sodium

10% SC @ 200 ml ha⁻¹, T₈: PE herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + PoE herbigation of bispyribac sodium 10% SC @ 300 ml ha⁻¹, T₉: PE herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + PoE herbigation of bispyribac sodium 10% SC @ 200 ml ha⁻¹ + one HW, T₁₀: PE herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + one HW + one intercultivation, T₁₁: Weedy check, T₁₂: Weed free check. The trial was laid out in randomized complete block design (RCBD) with three replications. Pre-emergent herbigation at one day after sowing and post emergent herbigation at 23 DAS was done through drip irrigation system. The data on growth parameters viz., plant height, number of tillers, leaf area

and dry matter accumulation, yield parameters viz., number of productive tillers, panicle length, panicle weight, total number of grains, 1000 grain weight, grain and straw yield were recorded adopting standard procedure. After harvest of the crop data on nutrient (N,P and K) uptake by crop and weeds, nutrient remained in the soil was analysed. Nutrient use efficiency was calculated by using the formulae. The collected data was subjected to Fisher's method of "Analysis of Variance" (Panse and Sukhatme, 1967). Wherever, F- test was significant an appropriate value of critical difference (C.D.) was worked out for comparison among the treatment means, otherwise, against C.D. values NS (Non-significant) was indicated.

$$\text{Nutrient use efficiency (kg kg}^{-1}\text{)} = \frac{\text{Grain yield (kg ha}^{-1}\text{)}}{\text{Plant nutrient applied (kg ha}^{-1}\text{)}}$$

RESULTS AND DISCUSSION

Effect on crop growth

Among the treatments, weed free check recorded has recorded higher plant height (36.5 cm), number of tillers (28.3 hill⁻¹), leaf area (4108.0 cm² hill⁻¹) and total dry matter accumulation (167.7 g hill⁻¹) which was on par with pre-emergent herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + one hand weeding + one intercultivation (35.5 cm, 25.1 tillers hill⁻¹, 3954.3 cm² hill⁻¹ and 153.8 g hill⁻¹ respectively) (Table 1). This is due to better suppression of weeds during the initial stage and provided optimal condition for crop to establish. These results are in line with the findings of Kusuma (2007) and Bhagirath Singh *et al.* (2015).

Effect on Yield and Yield Parameters

Among herbigation treatments pre-emergent herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹

+ one hand weeding + one intercultivation has recorded higher yield components like, productive tillers hill⁻¹ (33.2), Panicle length (25.8 cm), Panicle weight (204.3 g hill⁻¹), Total No. of grains panicle⁻¹ 291.0), Grain yield (8954 kg ha⁻¹) and straw yield (11371 kg ha⁻¹) (Table 2) followed by pre-emergent herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + post emergent herbigation of bispyribac sodium 10% SC @ 200 ml ha⁻¹ + one hand weeding (32.1 hill⁻¹, 25.7 cm, 197.5 g hill⁻¹, 288.8 panicle⁻¹, 8767 kg ha⁻¹ and 11085 kg ha⁻¹ respectively). This was due to better weed control in these treatments resulted in higher growth, because of the better growth, photosynthates were translocated into economic part. Similar results have been obtained by Jagdish (2015).

TABLE 1: Effect of herbigation practices on growth parameters of aerobic rice at 90 DAS

Treatments	Plant height (cm)	No. of tillers (hill ⁻¹)	Leaf area (cm ² hill ⁻¹)	Total dry matter accumulation (g hill ⁻¹)
T ₁	34.2	23.4	2744.9	126.7
T ₂	33.5	23.7	2833.3	128.7
T ₃	33.8	24.3	3320.0	133.1
T ₄	33.6	24.4	3430.0	136.1
T ₅	34.4	24.6	3673.3	139.8
T ₆	34.9	24.0	3052.8	130.4
T ₇	34.3	24.5	3547.7	137.8
T ₈	34.5	24.9	3766.7	142.4
T ₉	35.0	25.1	3863.3	147.1
T ₁₀	35.5	25.1	3954.3	153.8
T ₁₁	38.1	18.3	1223.7	98.1
T ₁₂	36.5	28.2	4108.0	167.7
S.Em.±	1.22	1.07	109.31	3.69
CD @ 5%	3.57	3.15	320.61	10.83

T₁: PE herbigation of pyrazosulfuron ethyl 10% WP @ 250 g ha⁻¹ + one HW. T₂: PE herbigation of pyrazosulfuron ethyl 10% WP @ 375 g ha⁻¹ + one HW. T₃: PE herbigation of pyrazosulfuron ethyl 10% WP @ 500 g ha⁻¹ + one HW. T₄: PE herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + one HW. T₅: PE herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 15 kg ha⁻¹ + one HW. T₆: PE herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 20 kg ha⁻¹ + one HW. T₇: PE herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + PoE herbigation of bispyribac sodium 10% SC @ 200 ml ha⁻¹. T₈: PE herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ and PoE herbigation of bispyribac sodium 10% SC @ 300 ml ha⁻¹. T₉: PE herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + PoE herbigation of bispyribac sodium 10% SC @ 200 ml ha⁻¹ + one HW. T₁₀: PE herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + one HW + one intercultivation. T₁₁: Weedy check T₁₂: Weed free check

(Note: HW: Hand Weeding, PE: Pre-emergent, PoE: Post emergent)

Economics

Among herbigation treatments, maximum gross and net returns were observed with pre-emergent herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + one hand weeding + one intercultivation (154635 and 98865 Rs. ha⁻¹ respectively) with the B:C ratio of 2.77 (Table 2). This was associated with higher grain and straw yield. whereas, highest B:C ratio was obtained in pre-emergent herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ and post emergent herbigation of bispyribac sodium 10% SC @ 300 ml ha⁻¹ (2.85) Similar results have been obtained by Jagadish (2015).

Nutrient uptake and availability

Among the treatments pre-emergent herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + one hand weeding + one intercultivation recorded more available soil nutrients (N, P₂O₅ and K₂O) after harvest (287.33, 36.77 and 249.00 kg ha⁻¹ respectively), higher uptake of nutrients by crop (88.07, 23.73 and 76.33 kg ha⁻¹) and lesser uptake by weeds (12.27, 6.20 and 17.07 kg ha⁻¹ respectively) was observed (Table 3) followed by pre-emergent herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + post emergent herbigation of bispyribac sodium 10% SC @ 200 ml ha⁻¹ + one hand weeding. These results are in line with Gopinath *et al.* (2012). Nutrient use efficiency was also higher in these treatments because of higher grain and straw yield.

CONCLUSION

Pre-emergent herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + one hand weeding + one intercultivation resulted in higher yield weed control followed by pre-emergent herbigation of pretilachlor + bensulfuron methyl 6.6% GR @ 10 kg ha⁻¹ + post emergent herbigation of bispyribac sodium 10% SC @ 200 ml ha⁻¹ + one hand weeding. These herbigation

treatments were found to be promising to control weeds in aerobic rice and would play an important role in areas where labour is too expensive and time is short.

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