Economics of Herbicides as a Means of Weed Control in Transplant Aman Rice

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Abstract: The experiment was carried out to evaluate the efficacy of different herbicides and to compare the economics of hand weeding and herbicidal weed control in transplant aman rice cv. BRRI Dhan 32. There were fourteen treatments viz., three levels of Acetochlor 90 EC, three levels of Ronstar 25 EC, three levels of Set-off 20 WG, three levels of Golter 5 G, hand weeding and weedy check (no weeding). Among the applied herbicides, Acetochlor 90 EC @ 150 ml a.i. ha⁻¹ showed the best performance in killing weeds (98.96%) but it was statistically identical with Acetochlor 90 EC @ 100 ml a.i. ha⁻¹ and Golter 5 G @ 10 kg ha⁻¹. The benefit cost ratio (BCR) was the highest (1.46) in Acetochlor 90 EC @ 100 ml a.i. ha⁻¹ with highest profit (Tk. 13294 ha⁻¹) was obtained from the same treatment which was Tk. 2812.00 higher than the profit (Tk. 10482.00) obtained from the treatment Golter 5 G @ 25 kg ha⁻¹. It was found that Acetochlor 90 EC @ 100 ml a.i. ha⁻¹ showed its superiority over all other treatments used for controlling weeds in transplant aman rice.

Key words: Herbicide, weed control, economics, transplant aman rice

Introduction
Weeds grow in each of the crop field throughout the world. So, it is often said that “Crop production is a fight against weeds” (Mukhopadhyay and Ghosh, 1981). Where there is cultivable land, there is weed. Subsistence farmers of the tropics spend more time, energy and money on weed control than any other aspects of crop production (Kassasian, 1971). Poor weed control is one of the major factors for yield reduction of rice depending on the type of weed flora and their intensity (Amarjit et al., 1984). According to Ileay (1960) the losses due to infestation of weeds is greater than the combined losses caused by insect pests and diseases in rice. In Bangladesh, weeds are traditionally controlled by hand weeding. This method of weed control is very much laborious, time consuming, inefficient and costly. On the other hand, herbicides are used successfully for weed control in rice fields for rapid effect, easier to application and low cost involvement in comparison to the traditional methods of hand weeding (Mian and Mamun, 1969). Moreover, in Bangladesh during aman season, uprooting of weeds at the critical periods is difficult due to unfavourable weather and peak labour demand. In such situation, herbicides are promising alternatives for controlling weeds (Rahul and Rao, 1974; DeCatta, 1980). Nova-a-days, the chemical methods of weed control are gaining popularity all over the world because of its miraculous results in crop production but most of the herbicides are very new in Bangladesh. A little information is available on the effectiveness in controlling weeds in rice, especially, in transplant aman rice in Bangladesh. The present study was, therefore, undertaken to assess the weed control efficacy of different herbicides and to compare the economics of hand weeding and herbicidal weed control in transplant aman rice.

Materials and Methods
The study was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, during the period from July to December, 1989. The experimental field was medium high belonging to the Agro-ecological zones (AEZ-6) of Old Brahmaputra Floodplain (FAO, 1988; BARC, 1997). The experiment was laid out in a randomized complete block design. There were fourteen treatments namely Acetochlor 90EC® 75 ml a.i. ha⁻¹ (T1), Acetochlor 90EC® 100 ml a.i. ha⁻¹ (T2), Acetochlor 90EC® 150ml a.i. ha⁻¹ (T3), Ronstar 25EC® 1.5L ha⁻¹ (T4), Ronstar 25EC® 2L ha⁻¹ (T5), Golter 5EC® 2.5L ha⁻¹ (T6), Set-off 20 WG @ 20 ml ha⁻¹ (T7), Set-off 20 WG @ 25 ml ha⁻¹ (T8), Set-off 20 WG @ 12.5 ml ha⁻¹ (T9), Golter 5G @ 20 kg ha⁻¹ (T10), Golter 5G @ 25 kg ha⁻¹ (T11), Golter 5G @ 30 kg ha⁻¹ (T12) and weedy check (T13) (No weed control), Acetochlor, Ronstar and Set-off were applied mixing with 500 litres water at 5 days after transplanting (DAT) but Golter was broadcast at 3 DAT. The field was well prepared and fertilized with urea, TSP (triple super phosphate), MP (muriate of potash), gypsum and zinc sulphate @ 150, 100, 70, 60 and 10 kg ha⁻¹ respectively. Thirty day old two seedlings per hill were transplanted maintaining a distance of 25 x 13 cm². Other intercultural operations were done as and when necessary. The crop was harvested plot-wise at maturity. Data collection on weed control efficiency, grain and straw yields, variable cost of production and returns for different treatments were recorded. All collected data were analyzed statistically following the ANOVA technique and the mean differences were adjudged with Dancans multiple range test (Gomez and Gomez, 1984) using the statistical computer package MSTAT.

Results and Discussion
The efficiency of different weed control methods with grades of weed control of these weeding treatments have been presented in Table 1. Out of 10 species of weeds Fimbristylis miliacea was completely controlled (ICC) by T2 and T12 treatments. The treatments T1, T2, T3, T5, T6, T10, T11 and T12 were excellent control (EC) to Fimbristylis miliacea. Scirpus juncoides was completely controlled (ICC) only by the treatments T12 and the treatments T5, T6, T10, T11 and T12 were excellent control (EC) to Scirpus juncoides and T2, T4, T5, T7 and T10 treatments were also good controlled of these weed. Cyperus difformis was excellent control (EC) by T5, T6, T8, T9, T10, T11 and T12 treatments and T1, T2, T10 and T11 were good control (GC) to Cyperus difformis, Monochoria vaginalis, Ludwigia hyssopifolia, Sagittaria guayannensis, Ammophyllum axillaris, Laveria haxandra and Rottboellia protensa were more or less excellent control (EC) to both recommended doses and higher doses of pre-emergence herbicides but Paspalum scrobiculatum was completely controlled by hand weeding and higher dose of Acetochlor 90 EC @ 150 ml a.i. ha⁻¹. It is evident from the study that pre-emergence of Acetochlor, Ronstar, Set-off and Golter at higher and recommended doses were more effective for controlling weeds than lower doses of that herbicides. Higher and recommended doses of pre-emergence herbicides reduced the weeds more or less 100%. It may be suggested from this study that hand weeding may be used for effective weed control. Higher and recommended doses of Acetochlor 90 EC, Ronstar EC, Set-off 20 WG and Golter 5 G may be used for effective weed control instead of hand weeding at peak period of labour to minimize the cost of production. Among the different weed control treatments, the highest grain yield (6.4 1 ha⁻¹) and percent grain yield increased 46.16% (Table 2) was produced by the treatment Acetochlor 90 EC @ 100 ml a.i. ha⁻¹ which was statistically different from other treatments, except the grain yield resulted from the treatment of hand weeding (T13). The weedy check (T13) produced the lowest amounts of grains (3.72 t ha⁻¹) and it was significantly
different from any other treatments. The lowest yield ha⁻¹ in the weedy check (T₄) might be due to the result of effects of the lowest performance of yield contributing characters. This happened due to severe infestation of various species of weeds in the field and greater competition for moisture, space, air, light, nutrients between weeds and rice plants which influenced the reduction of all yield components and finally the grain yield.

The highest straw yield (16.06 t ha⁻¹) and percent straw yield increase 67.51% was produced in the treatment (T₃) Acetochlor 90 EC @ 100 ml a.i. ha⁻¹ (Table 2) which was statistically similar to the treatments of hand weeding (T₁₃) and Goelter 5G @ 25 kg ha⁻¹ (T₁₁) and Ronstar 25 EC @ 2.0 l ha⁻¹ (T₄). However, the straw yield in the treatment weedy check (T₄) was significantly the lowest (3.66 t ha⁻¹).

Economic performance of different methods of weed control treatments: Among the 14 treatments, T₄ was weedy check. Another thirteen were weeded controlling weeds. In case of weedy check, there was no involvement of cost for control.

In the treatment T₄ (two hand weeding) was required 70 labours for weeding and involvement of weeding cost Tk. 4,200.00. In case of herbicidal weedy control treatments involvement of weeding cost for one hectare of T. aman rice was Tk. 1,400.00, 1,400.00, 1,400.00, 1,400.00, 1,400.00, 1,400.00, 1,400.00, 1,400.00, 1,400.00, 1,400.00, 1,400.00, 1,400.00 and 1,400.00 for the treatments T₃, T₅, T₆, T₈, T₉, T₉, T₁₀, T₁₁, T₁₂, T₁₃ respectively. Excluding weeding cost, cost of production of BRRI Dhan32 was calculated. Tk. 2,727.20. The cost of production BRRI Dhan32 (including weeding cost was the highest (Tk. 3,147.20 ha⁻¹) for the treatment T₃ (hand weeding) and the lowest (Tk. 2,727.00 ha⁻¹) for the treatment T₄ (weedy check) (Table 3). The highest gross return (Tk. 4,200.00 ha⁻¹) was obtained from the treatment T₄ (Acetochlor 90 EC @ 100 ml a.i. ha⁻¹) and the lowest gross return (Tk. 2,874.00 ha⁻¹) was obtained from the weedy check (T₄) treatment. It could be seen from the economic analysis (Table 3) that the application of Acetochlor 90 EC @ second highest profit was obtained Goelter 5G @ 25 kg ha⁻¹ (T₁₁) and the second highest benefit cost ratio was found in 100 ml a. i. ha⁻¹.
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(T2) maximized the profit and benefit cost ratio was the highest (1.46) in the same treatment, the same treatment. The recommended doses of these herbicides showed the highest benefit cost ratio in their group but the highest doses of these herbicides showed the lowest benefit cost ratio in their group. These might be due to some unidentified toxicity of the highest doses of Acetochlor 90 EC, Ronstar 25 EC, Set-off 20 WG and Golter 5G. In case of recommended doses of herbicidal treatments (Acetochlor 90 EC and Golter 5 G) were profitable than hand weeding. This might be because of less production due to higher weed competition and higher number of labours required for weeding out the field and higher labour cost. Similar results were also reported by BRRI (1988). The highest profit (Tk. 13284.00 ha⁻¹) was obtained from Acetochlor 90 EC @ 100 ml a. l. ha⁻¹ (T2) which was Tk. 2812.00 higher than the profit (Tk. 10,482.00) obtained from the treatment from Golter 5 G @ 28 kg ha⁻¹ (T1). In fine, it may be concluded from economic point of view that when labour is a limiting factor, herbicide may serve as an alternative means of weed control and Acetochlor 90 EC @ 100 ml a. l. ha⁻¹ is a better substitute to hand weeding in transplanted aman rice (BRRI Dhan 32).

References