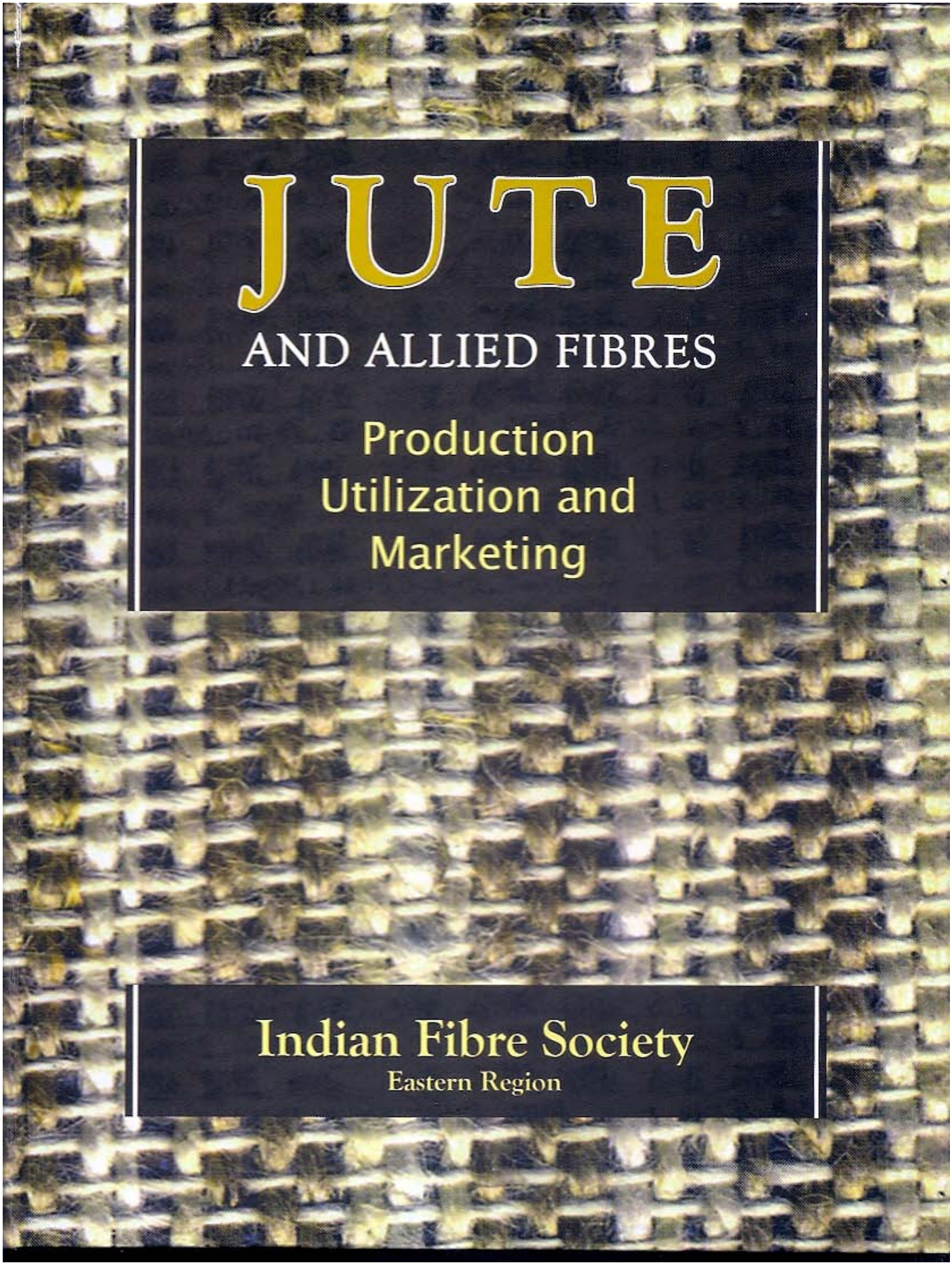
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Weed management in jute by pre- and post-emergence herbicides

SITANGSHU SARKAR ,BIJAN MAJUMDAR AND B.MAJI

Central Research Institute for Jute and Allied Fibres (ICAR), Barrackpore, Kolkata - 700120

ABSTRACT. In general, grasses are the dominant weed species in jute. But in some specific situation, sedges (especially Cyperus rotundus) may compete seriously with jute. Management of most of the grassy weeds (and some broadleaved weeds) in jute by use of pre-emergence herbicides like Trifluralin right from early crop growth stage is advantageous. Although, pre-emergence application of Trifluralin (and post-emergence application of Quizalofop ethyl) have little efficacy if the sedge weeds dominate in the weed complex. In purely rainfed situation, farmers sow jute seed hurriedly to get the benefit of sudden occurrence of pre-monsoon shower and it may not be possible to delay sowing one day after herbicide application which is a pre-requisite in case of Trifluralin. Moreover, there are number of post-emergence grass herbicides such as Cyhalofop butyl, Quizalofop ethyl and Fenoxaprop-p-ethyl which showed good weed control in several broad-leaved field crops. Therefore, a field experiment was conducted during 2007-08 at the main farm of CRIJAF (22.75°N, 88.43°E, 3.14 mAMSL), Nilgunj to study the effectiveness of the sedge controlling herbicide, S-Metolachlor besides Trifluralin and available post-emergence grass herbicides for more effective and economic herbicidal weed control in jute. Among the herbicides tested, Trifluralin in the pre-emergence category and Quizalofop ethyl in the post-emergence category proved effective by producing 34.3 and 34.6 q ha-1 of jute fibre respectively. Trifluralin (2.02) and Quizalofop ethyl (1.98) were superior in terms of B:C ratio also. The degree of reduction of soil bacteria by the pre-emergence herbicides was in the order of Metolachlor (51.3%)> Trifluralin (23.6%)> Pretilachlor (10.2%) at 14 days after application. Out of the post emergence herbicides tested, Quizalofop ethyl reduced the bacterial population more (64.32%) than Fenoxaprop ethyl (58.18%). At 35 DAA, the microbial population started improving and at jute harvest the soil microbial population reached to the near normal level.

Introduction

Hot and humid climate coupled with intermittent rainfall during the jute growing season in alluvial plains encourage profuse weed growth resulting severe crop-weed competition and atleast 75-80% yield is lost (Sahoo and Saraswat, 1988; Saraswat, 1999). In general, grasses are the dominant weed species in jute (Sarkar, 2004). But in some specific situation, sedges (especially Cyperus rotundus) create serious competition for jute (Sarkar and Bhattacharya, 2005). Management of grassy weeds (and some broadleaved weeds) in jute by pre-emergence herbicides like Trifluralin right from early crop growth phase is advantageous if the farmers get sufficient time for land preparation and herbicide application to the soil before sowing (Sarkar et al., 2005). Trifluralin (and Quizalofop ethyl) has little efficacy if the sedge weeds dominate in the weed composition (Sarkar, 2006). Recently it was

reported that S-Metolachlor, a pre-emergence herbicide can effectively control sedge weeds in some dicot crop (Steven et al., 2001) and therefore, it will be wiser to test the efficacy of S-Metolachlor for weed management in jute especially for the sedge weeds besides the grasses. Generally speaking, in rainfed situation, farmers sow jute seed hurriedly to get the benefit of sudden pre-monsoon shower and it is not possible to delay sowing one day after herbicide application which is a prerequisite in case of Trifluralin (Sarkar et al., 2005). There are number of post-emergence grass herbicides such as Cyhalofop butyl, Quizalofop ethyl and Fenoxaprop-p-ethyl which showed best weed control in broad-leaved field crops such as sunflower, soybean and potato (Bedmar, 1997; Ito et al., 1998). Of this group of available post-emergence herbicides, only Quizalofop ethyl (5% EC) was tried and found effective to control grassy weeds in jute (Ghorai et al., 2004; Bhattacharya et al., 2004). Therefore, a field experiment was conducted to study the effectiveness of the sedge controlling herbicide, S-Metolachlor besides Trifluralin and available post-emergence grass herbicides (other than Quizalofop ethyl) to find a more effective and economic herbicidal weed control for jute.

Materials and Methods

The experiment was conducted during 2007-2008 in medium fertile neutral soil (pH 7.1) at the main farm (22.75°N, 88.43°E and 3.14 m altitude) of Central Research Institute for Jute and Allied Fibres (ICAR), Barrackpore, West Bengal with nine treatments and three replications, laid out in randomised block design with a plot size of 4 m x 3 m. The nine treatments were (1) unweeded control, (2) two hand weedings (HW) at 3 and 5 weeks after sowing (WAS), (3) wheel hoeing twice (at 3 and 5 WAS), (4) Trifluralin 0.75 kg ha-1, (5) S-Metolachlor 0.50 kg ha-1, (6) Pretilachlor 0.50 kg ha-1, (7) Cyhalofop butyl 75 g ha-1, (8) Fenoxaprop-p-ethyl 75 g ha-1 and (9) Quizalofop ethyl 75 g ha-1. Trifluralin was applied as pre-plant soil incorporation (PPI) one day before sowing of jute seeds. S-Metolachlor and Pretilachlor were applied on the soil surface (PE) just after sowing. All the other herbicides were applied as post-emergence spray at 21 days after sowing (DAS) when the grass weeds were at three-four leaf stage. Jute (Corchorus olitorius) seed (JRO 8432) was sown in line with a row spacing of 25 cm in the third week of April and harvested at 120 days crop age. All other standard recommended agronomic practices including plant protection measures for olitorius jute were followed in the experimental crop. Biometrical observations on jute plant height, basal diameter, fibre yield, stick yield, type of weeds, and dry weight of weeds were recorded. Soil samples collected prior to herbicide spray and at regular interval after herbicide spraying were analyzed for change in microbial population count.

Results and Discussion

Effect on weeds

The dominant weeds were Echinochloa colona (L.) Link in the grass category and the few broadleaved weeds were Physalis minima L. and Phyllanthus niruri L. Very few Cyperus rotundus L. was also observed in the control plots. Similar observations were also noted earlier (Kundu, 1980; Saraswat, 1980; Sarkar and Bhattacharya, 2005).

The highest weed control efficiency (WCE) of 94.9% was recorded in two hand weeding treatment. Among the pre-emergence category of herbicides, Trifluralin at 0.75 kg ha-1 showed the

highest WCE of 73.9% followed by Pretilachlor (67.6%). As compared to hand weeding, Trifluralin and Pretilachlor can manage 77.9 and 71.3 % of the weeds respectively. Earlier report also supports that Trifluralin can manage jute weeds well (Sarkar et al., 2005).

In the post-emergence herbicide category, the highest WCE was recorded in Quizalofop ethyl at 75 g ha-1 (74.8%) which was closely followed by Fenoxaprop-p-ethyl at 75 g ha-1 (69.2%). Cyhalofop butyl could not provide satisfactory WEC (55.4%) in jute field. Earlier it was reported that Quizalofop ethyl can effectively control jute weeds (Ghorai et al., 2004; Bhattacharya et al., 2004).

Effect on jute crop

The highest plant height of jute at harvest was recorded in hand weeding treatment (329 cm). Among the herbicides Quizalofop ethyl at 75 g ha^{-1} gave the highest plant height (305 cm) followed by and at par with Trifluralin at 0.75 kg ha^{-1} (303 cm) and Fenoxaprop-p-ethyl at 75 g ha^{-1} (301 cm). Unweeded control treatment produced the shortest jute plants (244 cm). The basal diameter of jute plants also followed the similar pattern as of plant height for all the treatments.

Effect on fibre yield

Among the treatments, two hand weeding produced the highest fibre yield of 38.9 q ha^{-1} and the lowest fibre yield was recorded with unweeded control (25.2 q ha^{-1}). Earlier finding corroborates the result (Saraswat, 1999; Sarkar, 2004). Among the pre-emergence herbicides, Trifluralin at 0.75 kg ha^{-1} gave the highest fibre yield of 34.3 q ha^{-1} followed by the fibre yield obtained from Pretilachlor at 0.50 kg ha^{-1} (32.3 q ha^{-1}). In the post-emergence category of herbicides, Quizalofop ethyl 75 g ha^{-1} produced the highest fibre yield (34.6 q ha^{-1}) followed by and at par with the fibre yield obtained from Fenoxaprop-p-ethyl at 75 g ha^{-1} (33.7 q ha^{-1}). The stick yield followed the same trend as of the fibre yield in all the treatments.

Table. Effect of different weed management methods on the weed control, growth and yield in jute (Pooled data of two years)

Treatments	Plant height at harvest (cm)	Weed control efficiency (%) at 45 DAS	Fibre yield (q ha-1)
T_1: Unweeded Control	244.1	-	25.2
T_2: Hand weeding (HW) twice	328.9	94.9	38.9
T_3: Wheel hoeing twice	293.1	57.7	29.9
T_4: Trifluralin 0.75 kg a.i ha^{-1} (PPI)	302.8	73.9	34.3
T_5: S-Metolachlor 0.50 kg a.i ha^{-1} (PE)	295.1	67.1	31.0
T_6: Pretilachlor 0.50 kg a.i ha^{-1} (PE)	291.7	67.6	32.3
T_7: Cyhalofop butyl 0.075 kg a.i ha^{-1} (POE)	285.3	55.4	29.1
T_8: Fenoxaprop ethyl 0.075 kg a.i ha^{-1} (POE)	301.3	69.2	33.7
T_9: Quizalofop ethyl 0.075 kg a.i ha^{-1} (POE)	304.9	74.8	34.6
CD (5%)	13.5	-	3.95

DAS: Days after sowing; PPI: Pre plant incorporation to soil; PE: Pre emergence; POE: Post emergence

Effect of herbicides on soil microbial population

In general, application of pre and post emergence herbicides reduced the soil microbial population (bacteria, fungi and actinomycetes). Similar findings were also noted earlier (Sarkar, 2003; 2004). The degree of reduction of soil bacteria by the pre-emergence herbicides is in the order of Metolachlor (51.3%)> Trifluralin (23.6%)> Pretilachlor (10.2%) at 14 days after application. Out of the post emergence herbicides tested, Quizalofop ethyl reduced the bacterial population more (64.32%) than Fenoxaprop ethyl (58.18%). At 35 DAA, the microbial population started improving and at jute harvest the soil microbial population reached to the near normal level.

Conclusion

Hand weeding (HW) twice at 21 and 35 DAS in jute (JRO 8432) produced the tallest plant (328.9 cm) and gave maximum fibre yield of 38.9 q ha^{-1}. However, the B: C ratio in HW was only 1.40. Earlier finding corroborates this result (Sarkar and Bhattacharya, 2005a). Among the herbicides tested, Trifluralin in the pre-emergence category and Quizalofop ethyl in the post-emergence category proved effective by producing 34.3 and 34.6 q ha^{-1} of jute fibre respectively. Trifluralin (2.02) and Quizalofop ethyl (1.98) were superior in terms of B:C ratio also. Among the pre-emergence herbicides, S-Metolachlor & Pretilachlor and in post-emergence type Fenoxaprop-ethyl also showed promise in jute weed management. Pre-emergence and post-emergence herbicides reduced the soil microbial population by 25 - 55%. However, at jute harvest the soil microbial population reached to near normal level (92-99%).

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