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Weed management in spring planted sugarcane growing under West Bengal situtions

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ABSTRACT

A field experiment was conducted at Bidhan Chandra Krishi Viswavidyalaya, West Bengal, India during 2017-2018 and 2018-19 to study the effect of different herbicide molecules in spring planted sugarcane. *Cyperus rotundus*, *Cynodon dactylon* and *Alternanthera philoxeroides* were dominant weed flora in the sugarcane field. Application of ametryn 1.0 kg/ha at 30 days after planting (DAP) followed by (*fb*) 2,4-D 1.0 kg/ha at 60 DAP effectively suppressed the grasses, sedges and broad-leaved weeds, improved yield attributes and registered higher cane yield (102.49 t/ha), juice recovery (52.80%) and B:C ratio (2.90) due to better weed control efficiency (71.05%). Next best treatments were atrazine 1.0 kg/ha at 30 DAP *fb* glyphosate 1.0 kg/ha at 60 DAP; and three hand weeding at 30, 60 and 90 DAP. Application of ametryn 1.0 kg/ha at 30 DAP + 2,4-D 1.0 kg/ha at 60 DAP proved to be a cost-effective option for getting higher cane yield in new alluvial zone of West Bengal.

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) is a major commercial crop of India, occupies an area of 4.74 million hectares with a production of 379.90 million tonnes with an average yield of 80.20 t/ha in the country during 2017-18 (Anonymous 2020). Losses in cane yield, quality and recovery occur at a varying extent (43.40-73.70%), depending on the nature and stage of weed infestation (Srivastava 2001, Tomar *et al*. 2003, Verma 2000). Sugarcane, by virtue of its long duration, has a longer critical period of 60-120 days for weed competition (Chauhan and Srivastava 2002a). None of the herbicides, either pre- or post-emergence, can take care of weeds for such a long period. Sequential spray of atrazine 2.0 kg/ha and 2,4-D 1.0 kg/ha has been recommended for effective control of weeds in sugarcane (Srivastava *et al*. 1998, Mondal 2018). It has been reported that continuous use of atrazine at lower dose has given rise to resistant biotypes, apart from increased metabolism reduced absorption and translocation, which can also impart PS-II-inhibitor resistance (Jugulam and Shyam 2019). Identification of alternative herbicides is of urgent necessity for reducing the possibility of evolution of resistant weed biotypes and improving sugarcane yield and sugar recovery as well. Hence, the present experiment was conducted to test the efficacy of some herbicide molecules.

MATERIALS AND METHODS

A field experiment was conducted during 2017-18 and 2018-19 at the Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal (22°87'N latitude, 88°32' E longitude, 9.75 m above mean sea level) India. The texture of the soil was sandy loam with medium fertility and neutral soil reaction. The annual rainfall received during the experimental period was 1289.0 and 1420.5 mm during 2017-18 and 2018-19, respectively. The experiment was laid out in a randomized block design with ten treatments replicated thrice. The treatments were: untreated control, ametryn 1.5 kg/ha at 30 days after planting (DAP) followed by (*fb*) one hand weeding (HW) at 45 DAP, ametryn 3.0 kg/ha at 30 DAP, ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D (sodium salt) 1.0 kg/ha at 60 DAP, atrazine 1.0 kg/ha at 30 DAP *fb* 2,4-D (sodium salt) 1.0 kg/ha at 60 DAP, two HW at 30 and 60 DAP, atrazine 1.0 kg/ha at 30 DAP, 2,4-D (sodium salt) 1.0 kg/ha at 30 DAP, atrazine 1.0 kg/ha at 30 DAP *fb* glyphosate 1.0 kg/ha at 60 DAP and three HW at 30, 60 and 90 DAP. The herbicides were applied with a spray volume of 700 L/ha, using a knapsack sprayer. Three-budded sugarcane setts were planted in the trenches in end-to-end system at an inter-row spacing of 100 cm during March in both the cropping seasons and harvested at February. Sugarcane variety used in the experiment was '*Swapan*' (CoB 99161). The recommended fertilizer dose of 180:80:60

kg N:P:K/ha was applied through urea, single super phosphate and muriate of potash, respectively. Necessary intercultural operations like mulching, earthing up, tying, irrigation and pest management were done as and when required. The data on weeds, crop yield, juice quality parameters like brix and juice recovery percentage were estimated following the standard procedures.

RESULTS AND DISCUSSION

Weed density

The dominant weed flora were *Cyperus rotundus* (sedge) (31.28%), *Cynodon dactylon* (grassy weeds) (22.55%) and *Alternanthera philoxeroides* (broad-leaved weeds) (30.49%).

There was no significant difference in treatment effects on weed density at 30 DAP (**Table 1**). However, the least population of *Cyperus rotundus* was registered with ametryn 3.0 kg/ha at 30 DAP, followed by three HW at 30, 60 and 90 DAP. The density of *C. rotundus* at 60 DAP was significantly highest in untreated control plot, compared with other treatments. Based on pooled data of two years, the lowest weed density at 60 DAP was observed with ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP, which was significantly better than other treatments. Maximum density of *C. rotundus* was noticed at 90 DAP in untreated control, whereas it was significantly the least with the application of ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP. *C. rotundus* population was significantly controlled by treatment ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP. Although the density of *C. dactylon* did not significantly vary under all the treatments at 30 DAP, it was minimum under ametryn 1.5 kg/ha at 30 DAP *fb* one HW at 45 DAP, which was followed by sole application of ametryn 3.0 kg/ha at 30 DAP. Lower density of *C. dactylon* at 90 DAP was also observed with ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP and atrazine 1.0 kg/ha at 30 DAP *fb* glyphosate 1.0 kg/ha at 60 DAP, which were significantly superior to all other treatments. There was a similar trend of treatment effect on the density of *A. philoxeroides* as in case with *C. rotundus* at 30 DAP. The density of *A. philoxeroides* at 30 DAP was the lowest with combined application of atrazine 1.0 kg/ha at 30 DAP + glyphosate 1.0 kg/ha at 60 DAP, which was followed by three HW. Highest density of *A. philoxeroides* was at 60 DAP in untreated plot and significantly poor to other treatments. At 90 DAP, maximum density of *A. philoxeroides* was recorded in untreated control plot. Least weed population was found with the ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP and the treatment was significantly superior to other treatments. The second-best result was recorded in atrazine 1.0 kg/ha at 30 DAP *fb* glyphosate 1.0 kg/ha at 60 DAP. In case of other weed flora, herbicides failed to produce any significant difference in weed density at 30 DAP. However, minimum number of other weeds was observed under atrazine 1.0 kg/ha at 30 DAP *fb* glyphosate 1.0 kg/ha at 60 DAP. Observation at 60 DAP revealed that lowest weed population registered with the ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP and it was significantly better than other treatments. The sequential application of ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP lowered the weed count than sole application either of ametryn, atrazine or 2,4-D. This was in agreement with findings of Kundu *et al*. (2020).

Weed biomass

The weed biomass at 30, 60 and 90 DAP has been presented in (**Table 2**). At 30 DAP minimum weed biomass was observed with only application of ametryn 3.0 kg/ha at 30 DAP followed by ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP and atrazine 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP. However, at 60 DAP, the lowest weed biomass was observed with ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP treated plot, which was significantly superior to other treatments. At 90 DAP, minimum biomass of *C. rotundus* observed from ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP treatment and which was significantly better than other assignment of different plot. In case of *C. dactylon* at 30 DAP, lowest weed biomass was found in combination of ametryn 1.5 kg/ha at 30 DAP *fb* one HW at 45 DAP. Least biomass of *C. dactylon* was recorded with ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP, which was significantly better than other treatments. At 90 DAP, minimum biomass of *C. dactylon* recorded from same herbicide management practices *i.e.* ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP and was statistically superior over other treatments. However highest weed biomass of this weed was registered with the untreated control plot followed by 2,4-D 1.0 kg/ha at 30 DAP and ametryn 1.5 kg/ha at 30 DAP *fb* HW at 45 DAP. Observations revealed that minimum weed biomass of *A. philoxeroides* at 30 DAP was observed with untreated control treatment followed by ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP and atrazine 1.0 kg/ha at 30 DAP *fb* glyphosate 1.0 kg/ha at 60 DAP. At 60 DAP, treatments gave positive results with various observations. Least biomass of *A. philoxeroides* was recorded with ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP, which was significantly better

than other treatment. Further found that at 90 DAP minimum biomass of *Alternanthera philoxeroides* recorded from ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP treated plot and was statistically better to other treatments. However, the highest weed biomass of the weeds registered with the untreated control plot, followed by ametryn 1.5 kg/ha at 30 DAP *fb* HW at 45 DAP. Minimum biomass of other weeds was observed with only application of ametryn 3.0 kg/ha at 30 DAP. Observation at 60 DAP revealed the lowest biomass with the ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP and which was significantly better to other weed control measures. At 90 DAP, lowest biomass observed with the same treatment *i.e.* ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP and which was significantly superior to all other treatments. It was followed by atrazine 1.0 kg/ha at 30 DAP *fb* glyphosate 1.0 kg/ha at 60 DAP. Use of ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP and atrazine 1.0 kg/ha at 30 DAP *fb* glyphosate 1.0 kg/ha at 60 DAP was found better than other weed control measures. Dry biomass of weeds was found decreased with advancement of crop age with ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP of sugarcane. The second-best treatment was three HW at 30, 60 and 90 DAP which reduced the biomass of *C. rotundus, C. dactylon, A. philoxeroides* and other weeds. More weed biomass reduced cane yield (**Figure 1**). Such differential behaviour might have been attributed to more competition offered by crop plants in treated plots which had the lowest weeds dry matter accumulation. Reduction in weeds dry matter, attributed to three inter cultural operations, has also been reported by Chauhan and Srivastava (2002b) and Bhullar *et al.* (2008). Ametryn 1.0 kg/ha + 2,4-D 1.0 kg/ha recorded the highest weed control efficiency (71.05%) (**Figure 2**), followed by three rounds of HW (66.69%). Higher WCE under these treatments was mainly due to better control of grassy weeds with ametryn plus inhibiting action of 2,4-D against sedges and broadleaved weeds. Singh *et al.* (2008) reported that uncontrolled weeds on an average caused 69.20% reduction in cane yield as compared to three rounds of hoeing at 30, 60 and 90 DAP.

Effect on crop yield

Application of ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP significantly improved different yield attributes as compared to other treatments (**Table 3**). All the weed control treatments led to significant increase in millable cane count and accounted for low shoot mortality by virtue of reduced competition of weeds for nutrient, space, moisture and light. Ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP resulted in the highest number of millable canes (10.33/m^2) due to effective suppression of weeds. Three HW (30, 60 and 90 DAP) and atrazine 1.0 kg/ha (30 DAP) + glyphosate 1.0 kg/ha (60 DAP) were the next best treatments in registering higher millable cane count (10.00/m^2). The highest weight of millable cane (991.67 g) was recorded with ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D

Table 1. Effect of different treatments on weed density (no./m^2) at different stages of crop growth (pooled data of two seasons)

Treatment	*Cyperus rotundus*			*Cynodon dactylon*			*Alternanthera philoxeroides*			Other weeds		
	30DAP	60DAP	90DAP	30DAP	60DAP	90DAP	30DAP	60DAP	90DAP	30DAP	60DAP	90DAP
Ametryn 1.5 kg/ha at 30 DAP *fb* hand weeding at 45 DAP	6.07 (35.9)	12.03 (143.7)	10.43 (107.8)	4.56 (19.8)	6.89 (46.5)	7.05 (48.7)	6.97 (47.5)	3.76 (13.1)	4.27 (17.2)	3.12 (8.7)	4.14 (16.1)	3.26 (9.6)
Ametryn 3.0 kg/ha at 30 DAP	6.05 (35.6)	11.71 (136.3)	9.10 (81.8)	4.58 (20.0)	6.61 (42.8)	5.69 (31.5)	6.97 (47.6)	3.48 (11.1)	3.07 (8.4)	3.10 (8.6)	3.52 (11.4)	2.54 (5.4)
Ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP	6.10 (36.3)	8.06 (64.0)	5.46 (28.8)	4.71 (21.2)	4.27 (17.3)	4.37 (18.2)	6.84 (45.8)	3.28 (9.7)	2.27 (4.1)	3.02 (8.1)	2.34 (4.5)	1.91 (2.6)
Atrazine 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP	6.10 (36.2)	11.05 (121.0)	8.39 (69.4)	4.68 (21.0)	6.63 (43.1)	5.27 (26.8)	6.90 (46.7)	3.40 (10.5)	2.79 (6.8)	2.98 (7.9)	3.36 (10.3)	2.37 (4.6)
Two HW at 30 and 60 DAP	6.10 (36.2)	11.42 (129.4)	8.74 (75.4)	4.70 (21.1)	6.68 (43.8)	5.50 (29.3)	7.04 (48.5)	3.47 (11.0)	2.85 (7.1)	2.92 (7.5)	3.51 (11.3)	2.50 (5.3)
Atrazine 1.0 kg/ha at 30 DAP	6.06 (35.7)	12.02 (143.5)	10.13 (101.6)	4.58 (20.1)	6.74 (44.4)	7.27 (51.9)	6.91 (46.7)	3.60 (12.0)	4.05 (15.4)	2.99 (7.9)	3.81 (13.5)	2.75 (6.6)
2,4-D 1.0 kg/ha at 30 DAP	6.07 (35.8)	12.04 (144.0)	10.23 (103.7)	4.66 (20.8)	6.41 (40.2)	7.26 (51.7)	6.90 (46.5)	3.46 (11.0)	4.19 (16.5)	3.16 (9.0)	4.08 (15.7)	2.84 (7.1)
Atrazine 1.0 kg/ha at 30 DAP *fb* glyphosate 1.0 kg/ha at 60 DAP	6.10 (36.2)	9.39 (87.3)	6.44 (40.5)	4.72 (21.3)	4.45 (18.8)	4.49 (19.2)	6.82 (45.5)	3.31 (9.9)	2.60 (5.8)	2.90 (7.4)	3.08 (8.5)	2.12 (3.5)
Three HW at 30, 60 and 90 DAP	6.07 (35.8)	9.72 (93.7)	7.10 (49.4)	4.64 (20.6)	4.62 (20.3)	4.98 (23.8)	6.83 (45.7)	3.32 (10.0)	2.67 (6.1)	3.07 (8.5)	3.12 (8.7)	2.30 (4.3)
Untreated control	6.07 (35.9)	15.70 (245.7)	16.04 (256.2)	4.61 (20.3)	9.56 (90.4)	11.86 (139.7)	6.78 (44.9)	11.57 (132.8)	12.57 (156.9)	3.01 (8.1)	5.13 (25.3)	5.06 (24.6)
LSD (p=0.05)	NS	1.14	0.84	NS	0.44	0.31	NS	0.62	0.45	NS	0.68	0.33

[Original figures in parentheses were subjected to square root transformation before statistical analyses] DAP: Days after planting; *fb*: followed by; HW: hand weeding, NS: Not significant

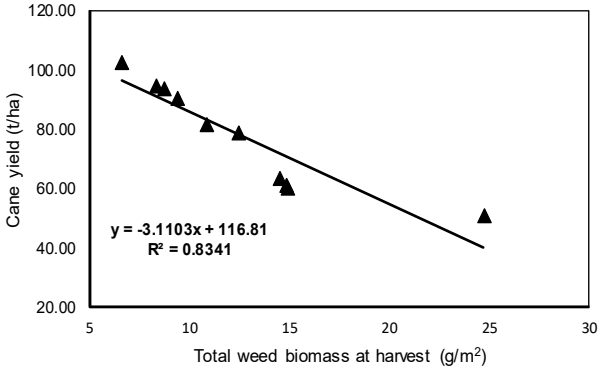

Figure 1. Relationship between cane yield and weed biomass at harvest

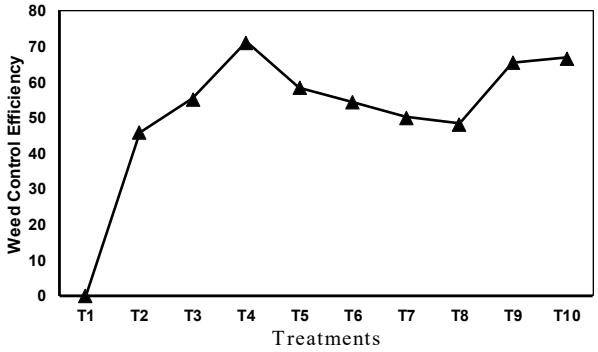

Figure 2. Weed control efficiency (%) of different treatments at 90 DAP in spring planted sugarcane

[T_1- Untreated control; T_2- Ametryn 1.5 kg/ha at 30 DAP *fb* HW at 45 DAP; T_3- Ametryn 3.0 kg/ha at 30 DAP; T_4- Ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP; T_5- Atrazine 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP; T_6- Two HW at 30 and 60 DAP; T_7- Atrazine 1.0 kg/ha at 30 DAP; T_8- 2,4-D 1.0 kg/ha at 30 DAP; T_9- Atrazine 1.0 kg/ha at 30 DAP *fb* glyphosate 1.0 kg/ha at 60 DAP; T_{10}- Three HW at 30, 60 and 90 DAP]

1.0 kg/ha at 60 DAP, which was followed by atrazine 1.0 kg/ha at 30 DAP *fb* glyphosate 1.0 kg/ha at 60 DAP (948.67 g). Similar observation was made by Ramesh and Sundri (2006). Land productivity in terms of yield varied significantly due to different weed management practices (**Table 3**). Application of ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP proved to be best in terms of cane yield. This might be due to better crop growth in ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP. Application of ametryn 1.0 kg/ha + 2,4-D 1.0 kg/ha gave significantly the highest cane yield (102.49 t/ha), which was followed by atrazine 1.0 kg/ha + glyphosate 1.0 kg/ha (94.87 t/ha) and three HW (93.83 t/ha). The plots treated with ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP registered 49.97% higher cane yield than the untreated control. The highest harvest index was found under three rounds of HW (82.73%), followed by atrazine 1.0 kg/ha + 2,4-D 1.0 kg/ha (81.86%) and ametryn 1.0 kg/ha + 2,4-D 1.0 kg/ha (81.53%). Increase in cane yield under these treatments might be attributed to effective suppression of weeds. Quality attributes (juice extraction and brix value) did not show any significant variation due to weed control treatments (**Table 3**). Similar results were reported by Mathew *et al*. (2002) and Bhullar *et al.* (2008). However, three HW at 30, 60 and 90 DAP recorded marginally higher juice recovery (52.99%) possibly due to reduced

Table 2. Effect of different herbicides on dry biomass of weed (g/m²) at different stages of crop growth (pooled data of 2 seasons)

Treatment	*Cyperus rotundus*			*Cynodon dactylon*			*Alternanthera philoxeroides*			Other weeds		
	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP
Ametryn 1.5 kg/ha at 30 DAP *fb* hand weeding at 45 DAP	2.43 (4.9)	11.90 (140.6)	10.85 (116.7)	2.09 (3.4)	6.17 (37.1)	6.98 (47.7)	4.07 (15.5)	3.94 (14.5)	5.79 (32.5)	1.72 (2.0)	4.80 (13.4)	4.71 (12.8)
Ametryn 3.0 kg/ha at 30 DAP	2.38 (4.7)	11.40 (129.1)	9.72 (93.6)	2.13 (3.5)	5.78 (32.4)	5.18 (25.8)	4.07 (15.5)	3.67 (12.5)	4.16 (16.3)	1.69 (1.9)	4.31 (9.9)	3.96 (7.8)
Ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP	2.39 (4.7)	7.59 (56.7)	5.57 (30.0)	2.13 (3.5)	3.98 (14.8)	4.26 (17.2)	3.98 (14.9)	3.17 (9.1)	3.14 (8.8)	1.73 (2.0)	3.09 (3.4)	3.03 (3.1)
Atrazine 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP	2.54 (5.5)	10.94 (118.8)	8.60 (73.1)	2.13 (3.5)	5.50 (29.2)	5.58 (30.2)	4.03 (15.2)	3.50 (11.3)	3.74 (13.0)	1.72 (2.0)	4.14 (8.9)	3.80 (6.8)
Two hand weeding at 30 and 60 DAP	2.41 (4.8)	11.15 (123.5)	9.05 (81.0)	2.13 (3.5)	5.98 (34.8)	5.38 (27.9)	4.11 (15.8)	3.57 (11.7)	3.82 (13.6)	1.73 (2.0)	4.23 (9.4)	5.71 (27.6)
Atrazine 1.0 kg/ha at 30 DAP	2.43 (4.9)	11.84 (139.3)	10.50 (109.3)	2.15 (3.6)	5.78 (32.4)	7.23 (51.3)	4.03 (15.3)	3.67 (12.4)	5.62 (30.5)	1.74 (2.0)	4.41 (10.6)	4.27 (9.7)
2,4-D 1.0 kg/ha at 30 DAP	2.49 (5.2)	11.91 (140.9)	10.55 (110.4)	2.16 (3.6)	5.78 (32.4)	6.31 (38.8)	4.03 (15.2)	3.66 (12.4)	5.67 (31.1)	1.73 (2.0)	4.55 (11.6)	4.41 (10.6)
Atrazine 1.0 kg/ha at 30 DAP *fb* glyphosate 1.0 kg/ha at 60 DAP	2.43 (4.9)	9.11 (82.1)	7.24 (51.5)	2.16 (3.7)	4.07 (15.5)	4.43 (18.6)	3.99 (14.9)	3.19 (9.1)	3.35 (10.2)	1.74 (2.0)	3.74 (6.5)	3.39 (4.7)
Three hand weeding at 30, 60 and 90 DAP	2.43 (4.9)	9.40 (87.5)	7.67 (57.9)	2.17 (3.7)	4.18 (16.4)	2.92 (23.2)	3.99 (14.9)	3.48 (11.1)	3.65 (12.3)	1.72 (1.9)	3.76 (6.6)	4.56 (26.4)
Untreated control	2.53 (5.4)	14.92 (221.7)	16.69 (277.6)	2.11 (3.5)	8.96 (79.3)	11.81 (138.5)	3.96 (14.7)	10.64 (112.3)	15.97 (254.2)	1.72 (2.0)	5.85 (22.5)	7.95 (47.2)
LSD (p=0.05)	NS	0.03	0.06	NS	0.06	0.33	NS	0.03	0.06	NS	0.06	2.49

[Original figures in parentheses were subjected to square root transformation before statistical analyses] DAP: Days after planting; *fb*: followed by; HW: hand weeding, NS: Not significant

Table 3. Yield and quality attributes, cane yield and production economics as influenced by different treatments in sugarcane (pooled data of 2 seasons)

Treatment	Millable cane (no./m^2)	Cane weight (g)	Cane yield (t/ha)			Harvest index (%)	B:C ratio	Juice recovery (%)	Brix value (%)
			2017-18	2018-19	Pooled				
Ametryn 1.5 kg/ha at 30 DAP *fb* hand weeding at 45 DAP	8.23	736.04	57.34	63.48	60.41	79.52	1.60	52.89	19.19
Ametryn 3.0 kg/ha at 30 DAP	9.30	847.63	77.45	80.27	78.86	82.62	2.30	52.80	18.53
Ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP	10.33	991.67	99.89	105.09	102.49	81.53	2.90	52.97	18.60
Atrazine 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP	10.12	893.75	88.20	92.80	90.50	81.86	2.50	52.76	18.71
Two hand weeding at 30 and 60 DAP	9.21	885.52	80.14	82.92	81.53	81.09	2.20	52.89	18.60
Atrazine 1.0 kg/ha at 30 DAP	8.52	743.59	60.96	65.76	63.36	79.42	1.83	52.93	18.55
2,4-D 1.0 kg/ha at 30 DAP	8.47	724.88	59.78	63.00	61.39	77.42	1.77	52.76	18.36
Atrazine 1.0 kg/ha at 30 DAP *fb* glyphosate 1.0 kg/ha at 60 DAP	10.00	948.67	92.22	97.52	94.87	81.06	2.85	52.73	18.62
Three hand weeding at 30, 60 and 90 DAP	10.00	938.33	92.16	95.50	93.83	82.73	2.60	52.99	18.64
Untreated control	7.33	699.06	49.52	52.96	51.24	74.47	1.56	52.81	18.56
LSD (p=0.05)	0.51	10.83	13.52	14.21	13.31	0.32	-	NS	NS

interference of weeds and higher millable cane weight, which was followed by ametryn 1.0 kg/ha + 2,4-D 1.0 kg/ha and atrazine 1.0 kg/ha. There was minimum juice recovery with the application of atrazine + glyphosate. However, maximum brix value was recorded with ametryn 1.5 kg/ha at 30 DAP + HW at 45 DAP (19.19%), followed by atrazine 1.0 kg/ha at 30 DAP + 2,4-D 1.0 kg/ha at 60 DAP (18.71%), whereas it was minimum under the application of 2,4-D 1.0 kg/ha at 30 DAP (18.36%). Singh and Tomar (2005) opined that sucrose content was not significantly influenced due to imposition of weed management practices.

Economics

The maximum benefit: cost ratio (2.90) was recorded in ametryn 1.0 kg/ha at 30 DAP + 2,4-D 1.0 kg/ha at 60 DAP due to lower weed control cost and better cane yield. The second-best treatment was sequential application of atrazine 1.0 kg/ha at 30 DAP + glyphosate 1.0 kg/ha at 60 DAP (2.85). The lowest B:C ratio (1.56) was recorded under unweeded control.

Conclusion

It can be concluded that application of ametryn 1.0 kg/ha at 30 DAP *fb* 2,4-D 1.0 kg/ha at 60 DAP would be a cost-effective recommendation for suppression of all types of weeds and obtaining higher cane yield with more economic returns in the Gangetic Inceptisol of West Bengal.

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