Performance of Herbicides for Weed Control in Sugarcane Field

N. Islam[1], M.A.T. Sohel[2*], M.N. Alam[1], A. K. M. R. Islam[2] and S. Akhter[1]
[1] Regional Sugarcrop Research Station, Joydebpur, Gazipur, Bangladesh
[2] Agronomy & Farmimg System Division, BSRI, Ishurdi, Pabna, Bangladesh

ABSTRACT

A field experiment was conducted during 2008-09 cropping season at RSRS farm, Gazipur to find out the herbicide with optimum dose for effective control of weed in sugarcane field. The herbicide Sencro 70WG (Metribuzin) was used for controlling sugarcane weed. Sencro 70WG pre and post emergence was used in different doses@ 1.5 kg a.i/ha, 2.0 kg a.i/ha and 2.5 kg a.i/ha at immediately 7 days after plantation whereas post emergence spray was done 30 days after cane plantation. Among different doses of herbicides Sencro 70WG@ 1.5 kg a.i/ha controlled weeds above 75.6% and 86.3% at 120 days and 180 days after cane plantation, respectively. The highest (111.8 t ha^{-1}) cane yield and BCR (2.66) was also calculated from T_2 (Sencro 70WG @ 1.5 kg a.i/ha). The highest (19.23) Brix % of cane was obtained from treatment T_5 (Farmer's practice) So, for commercial cane cultivation it may be recommended that pre and post emergence application of Metribuzine herbicide (Sencro 70WG@ 1.5 kg a.i/ha) was found most effective for controlling weeds.

Key words: Herbicides, metribuzin, weed control efficiency and cane yield

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) is an important cash and native culture related crop in Bangladesh. It is cultivated on an area about 0.17 million hectares annually with average cane yield of only 41 ton per hectare (BBS, 2008). It is a long duration crop which faces competition with all types of weed flora throughout the year. Weed means unwanted any plant that is found out of its place. The nature of weed problem is quite different from other field crops because of sugarcane is planted with a relatively wider row spacing, in the initial stages growth is very slow It takes about 30-45 days to complete germination and another 60-75 days for developing full canopy cover and the crop is grown under abundant water and nutrient supply conditions. Weeds that are present in the furrows i.e., along the cane rows cause more harm than those present in the inter-row spaces during early crop growth sub-periods. As a result increase production cost and compete for light, space, nutrient and moisture and thus reduce crop yield. They also harbour insects, pests and micro-organisms. Bangladesh Sugarcrop Research institute (BSRI, 1998-99) recommended keeping the sugarcane field weed free upto 135 days after transplanting (DAT) is the most significant for obtaining maximum cane yield. Regarding cane yield declining due to weed, many works stated in different ways. Singh and Moolani (1975) reported that in sugarcane weeds have been estimated to cause 12 to 72 % reduction in cane yield depending upon the severity of infestation. Uncontrolled growth of weeds in sugarcane may cause yield loss upto 40 % (Verma *et al.*

* Corresponding author: M.A.T. Sohel, Senior Scientific Officer
e-mail: atsohel@yahoo.com

1983). Hossain *et al.* (2011) reported that though best management of weeds has been observed by adopting of weeding by cultural practices but the availability of labour required for conducting these cultural operations may be a constrain to pursue the operation in time. Parker and Frayer (1975) stated that chemical weed control has been found suitable under labour constraint condition and in plantation crops like sugarcane. Use of herbicides holds promise for effective and economic management of weed in sugarcane as reported by Kumar and Shrivastava (1994). But in Bangladesh very limited works were done previously regarding weed control using herbicides. Therefore, this study was aimed to find out the feasibility of using herbicides and to evaluate effective doses of herbicides for weed management in sugarcane field.

MATERIALS AND METHODS

The field experiment was conducted during the cropping season 2008-09 at RSRS farm, Gazipur under AEZ 28. The soil of the experimental site is typical loamy with medium high land having pH 7.5. There were four treatments including one control (no weeding). The experiment was laid out in randomized complete block design (RCBD) with three replications. Two budded sugarcane setts of variety Isd 38 were planted in 1st January, 2009 and harvested at its maturity after twelve months of planting. Cane plantation was done in deep furrows at row distance of 100 cm and plant to plant distance 30 cm, keeping plot size 8m x 6m. Treatments studied in the experiment were *as* follows:

T_1: Control (no weeding)
T_2: Spraying herbicide Sencro 70WG @ 1.5 kg a.i/ha Pre and post emergence
T_3: Spraying herbicide Sencro 70WG @ 2.0 kg a.i/ha Pre and post emergence
T_4: Spraying herbicide Sencro 70WG @ 2.5 kg a.i/ha Pre and post emergence
T_5: Farmer's Practice (3 times weeding by manually)

The crop was fertilized with 325, 250, 180,190and 9 kg ha^{-1} as Urea, TSP, MOP, Gypsum and $ZnSo_4$, respectively according to Fertilizer Recommendation Guide, 2005. Herbicide Sencro 70WG (Metribuzine) spray was done @ 1.5, 2.0 and 2.5 kg ha^{-1} with the help of sprayer. Pre-emergence spray was done just before one week of cane plantation, whereas post emergence spray was done 30 days after cane plantation. Weed sample were collected from per square meter, placed randomly at three places from each plot after 120 and 180 days of crop plantation. The weed control efficiency (WCE) was worked out by using the following formula:

$$WCE = \frac{(DMC - D\quad)\times 100}{DMC}$$

Where, DMC = Dry matter weight of weeds in control plot and DMT = Dry matter weight of weeds in treated plot

To control insect pest, Furadan 5G was applied @ 40 kg ha^{-1} as per recommendation. Intercultural operations like irrigation, gap filling, earthing-up, tying etc. were done in time. Tiller population of sugarcane was recorded at 120, 150 and 180 DAT. Millable cane, cane yield and Brix% were recorded at harvest. Economic and statistical analysis on different parameters was done following the standard procedures.

RESULTS AND DISCUSSION

Weed flora

The common weed flora observed in the crop field were *Cynadon dactylon, Elusina indica, Cyperus rotundus, Echinochola colonum, Alternanthera philoxeroides, Borreria spp, Amaranthus viridis, Heliotropium indicum, Leucas asperae*tc predominant and occupied about 70% of the total weed density.

Fresh and dry weight of weed biomass at 120 DAP

In case of fresh weight of weed biomass the highest (340 gm/m^2) was recorded from no weeding (control) treatment and the lowest (110 gm/m^2) was recorded from T_2 (Sencro 70WG @ 1.5 kg a.i/ha) herbicide treated plot. All the weed control treatments recorded significantly lower weed dry weight in comparison to no weeding (control). Among different weed control treatments T_2 (Sencro 70WG @ 1.5 kg a.i/ha) significantly recorded lowest weed dry weight (25.21 g/m^2) followed by T_3 (Sencro 70WG @ 2.0 kg a.i/ha) treated plot. Treatments T_5 differ significantly in accumulating weed dry matter among them. The highest weed control efficiency (75.6 %) was calculated from the same treatment T_2 followed by T_3 (72.54 %) where herbicide was used and the lowest (38 %) was from T_5 (Farmer's practice) (Table 1).

Table 1. Fresh weight, dry weight of weed biomass and weed control efficiency as affected by different treatments at 120 DAP

Treatment	Fresh wt. of weed at 120 DAP(gm/m^2)	Dry wt. of weeds (gm/m^2)	Weed control efficiency (%)
T_1= No weeding (control)	340 a	103.2 a	-
T_2 = Sencro 70WG @ 1.5 kg a.i/ha	110 c	25.21 d	75.6
T_3 = Sencro 70WG @ 2.0 kg a.i/ha	140 bc	28.33 d	72.54
T_4 = Sencro 70WG @ 2.5 kg a.i/ha	190 bc	38.40 c	63.0
T_5 = Farmer's practice	230 b	64.32 b	38.0
LSD (0.05)	0.10	5.35	-

Fresh and dry weight of weed biomass at 180 DAP

From Table 2, the highest (120 gm/m^2) fresh weight of weed biomass was recorded from no weeding (control) treatment and the lowest (30 gm/m^2) was recorded from T_3 (Sencro 70WG @ 2.0 kg a.i/ha) herbicide treated plot. These results are in conformity with T. Chitkala *et al.* (2010). In case of weed dry weight, same trend was observed as like as 120 DAP. Among different weed control treatments T_2 (Sencro 70WG @ 1.5 kg a.i/ha) significantly recorded lowest weed dry weight (11.0 g/m^2) and the highest was from treatment T_1 (80.2 g/m^2). Mahadevaswamy and Martin (2001) also reported lowest weed population and weed dry matter with pre-emergence weedicides (atrazine/metribuzin) application. The highest (86.3%) weed control efficiency was

calculated from T_2 (Sencro 70WG @ 1.5 kg a.i/ha) and T_5 (Farmer's practice) was also showed good (77.6%) percentage of weed control efficiency. This may be due to effective maximum control of both monocot and dicot weeds due to manually weeding. Similar observations were made by Singh and Tomar (2005a, b).

Figure 1. View of Sencro 70WG @ 1.5 kg a.i/ha treated plot

Table 2. Fresh weight, dry weight of weed biomass and weed control efficiency as affected by different treatments at 180 DAP

Treatment	Fresh wt. of weed at 180 DAP(gm/m^2)	Dry wt. of weeds (gm/m^2)	Weed control efficiency (%)
T_1= No weeding (control)	120 a	80.2 a	-
T_2 = Sencro 70WG @ 1.5 kg a.i/ha	40 c	11.0 c	86.3
T_3 = Sencro 70WG @ 2.0 kg a.i/ha	30 d	15.0 bc	81.3
T_4 = Sencro 70WG @ 2.5 kg a.i/ha	60 b	17.0 bc	79.0
T_5 = Farmer's practice	60 b	18.0 b	77.6
LSD (0.05)	0.00	6.09	-

Yield attributes and yield

Data (Table 3) indicated that there is no significant effect on sugarcane setts germination by pre emergence herbicide application. All the herbicidal treatments and farmer's practice produced significantly higher number of tiller and millable canes than no weeding (control). Similar trend was observed by Shiv Kumar and Srivastava (1994) on sugarcane ratoon as regards the effect of weeds on sugarcane yield. The highest tiller (172.6 x 10^3 ha^{-1}) and millable cane (72.31 x 10^3 ha^{-1}) were produced from the treatment

T_2 (Sencro 70WG @ 1.5 kg a.i/ha) and the lowest (111.2 x 10^3 ha^{-1}) and (52.0 x 10^3 ha^{-1}) from no weeding (control) plot. Uncontrolled growth of weeds (no weeding) reduced the cane yield by 45% as compared to application of herbicide. Treatment T_2 (Sencro 70WG @ 1.5 kg a.i/ha) produced significantly highest (111.8 t ha^{-1}) cane yield than rest of the treatments. T. Chitkala *et al.* (2010) was also reported Metribuzin as pre-emergence application followed by post-emergence application were also effective in controlling weeds and had favorable influence on growth and registered cane yields. All the herbicidal treatments and farmer's practice produced significantly higher cane yields than no weeding (control) but little bit differ significantly with each other. This may be attributed to the fact that use of herbicide at pre emergence stage of weed and other cultural practices not only suppressed the weeds, it also helps to uptake adequate amount of nutrient from soil. In case of quality of sugarcane juice, Brix % cane was not affected by any of the treatments. The highest Brix % cane of 19.23 was obtained from treatment T_5 followed by treatment T_1,T_2 and T_4.The lowest Brix % cane of 18.94 was recorded from treatment T_3.

Table 3. Germination, yield and Brix% as affected by using different doses of herbicides during 2008-09

Treatment	Germination (%)	Tiller (10^3ha^{-1})	Millable cane (10^3ha^{-1})	Yield (t ha^{-1})	Brix (%)
T_1 = No weeding (control)	36.54 a	111.2 b	52.00 c	61.54 c	19.00
T_2 = Sencro 70WG @ 1.5 kg a.i/ha	39.06 a	172.6 a	72.31 a	111.8 a	19.00
T_3 = Sencro 70WG @ 2.0 kg a.i/ha	35.94 a	163.3 a	66.22 ab	85.3 b	18.94
T_4 = Sencro 70WG @ 2.5 kg a.i/ha	40.97 a	138.4 ab	70.12 ab	105.9 a	19.00
T_5 = Farmer's practice	38.29 a	128.1 ab	63.38 b	91.2 b	19.23
LSD (0.05)	-	46.29	7.203	11.21	-

From economic analysis (Table 4) of different treatments, the highest total production cost of Tk. 76,000 was for treatment T_5 (Farmer's practices) followed by Tk. 75,200 for T_4 and the lowest of Tk. 70,500 for treatment T_1(no weeding). The maximum gross return of Tk. 1,96,768.00 was recorded from T_2 followed by Tk. 1,86,384.00 from T_4 and the lowest was from T_1 of Tk. 1,08,310.40. The highest gross margin of Tk. 1,67,768.00 was obtained from T_2 followed by T_4 (Tk. 1,56,184.00) while the lowest of Tk. 82,810.40 was recorded from T_1. The highest benefit cost ration (BCR) of 2.66 was recorded from T_2 followed by T_4 (2.50) and the lowest (1.54) BCR was from T_1.

Table 4. Economics and benefit cost ration (BCR) as influenced by different weed control practices during 2008-2009

Treatments	Total production cost (Tk. ha^{-1})	Gross return (Tk. ha^{-1})	Gross margin (Tk. ha^{-1})	BCR
T_1 = No weeding (control)	70,500	1,08,310.40	82,810.40	1.54
T_2 = Sencro 70WG @ 1.5 kg a.i/ha	74,000	1,96,768.00	1,67,768.00	2.66
T_3 = Sencro 70WG @ 2.0 kg a.i/ha	74,600	1,50,128.00	1,20, 528.00	2.01
T_4 = Sencro 70WG @ 2.5 kg a.i/ha	75,200	1,86,384.00	1,56,184.00	2.50
T_5 = Farmer's practice	76,000	1,60,512.00	1,29,512.00	2.11

Price of-Sugarcane: 1760.00 Tk./ton and Sencro 70WG: 1200Tk./kg

From the result it can be concluded that the efficacy of pre and post emergence application of Sencro 70 WG@1.5 kg a.i/ha was found most effective in reducing population and dry matter of weeds and producing maximum yield of sugarcane.

REFERENCES

BBS (Bangladesh Bureau of Statistics), 2008. Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics. Planning Division, Ministry of planning, Government of Peoples' Republic of Bangladesh,pp.119.

BSRI, 1999. BSRI Annual Report, 1999. Bangladesh Sugarcane Researchinstitute. Ishurdi, Pabna, Annual Report, 1999. p. 40-42.

Hossain, M. S.; Alam, M. J.; Islam, A. K. M. R.; Rahman, M. K. and Sohel, M. A. T. 2011.Performance of different herbicides for weed control in sugarcane field. *Bangladesh J. Sugarcane*, **32** : 138-141.

Kumar, S. and Shrivasta, S.N.L. 1994. Herbicidal and non-conventional method of weed management in sugarcane ratoon. *Indian J. Sugarcane Technol.*, **9**(2):123-126.

Mahadevaswamy, M. and Martin, G.J. 2001. Chemical and cultural weed control in ratoonsugarcane. *Madras Agricultural Journal*, **88**: 713-714.

Parker, C. and Frayer, J.W.1975. Weed problems causing major reduction in foodsupplies. FAO Plant Protection Bulletin.

Singh, D. and Tomar, P.K. 2005a. Productivity of sugarcane ratoon influenced byweed management practices. *Indian Sugar*, **55**(4): 25-29.

Singh, D. and Tomar, P.K. 2005b. Studies on critical period of weed removal in sugarcane ratoon. *Co-operative Sugar*, **36**(11): 911-914.

Singh, N. and Moolani, M.K. 1975. Areview of chemical weed control in sugarcane.Proc. Third All India weed control Seminar, Hissar p. 41-42.

Chitkala,T.D.; Bharathalakshmi, M.; Kumari, M.B.G.S. and Naidu, N.V. 2010. Managingweeds of sugarcane ratoon through integratedmeans. *Indian Journal of SugarcaneTechnology*, **25**(1&2): 13-16.

Verma, R.S.; Chuhan, R.S. and Singh, R.N. 1983. Chemical control of weeds in spring planted sugarcane. *Indian Sugar*, **32**(12): 883-887.