

## Effect of integrated weed management on sugarcane (*Saccharum officinarum*)

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### ABSTRACT

A field experiment was conducted during 2011–12 at Navsari, to study the effect of integrated weed management on sugarcane (*Saccharum officinarum* L.). Three hand-weedings (HW) at 30, 60 and 90 days after planting (DAP) and 2 interculturing (IC) at 45 and 90 DAP recorded significantly higher number of tillers/m row length, plant height and yield-attributing characters, i.e. millable cane height, number of millable canes and number of internodes/millable cane as well as cane yield. This resulted in higher monetary returns followed by the treatment comprising application of metribuzin 1.0 kg/ha as pre-emergence + 1 HW and IC at 60 DAP or Atrazine 2.0 kg/ha as pre-emergence + one HW and IC at 60 DAP.

**Key words** : Crop protection, Economics, Integrated weed management, Sugarcane, Yield

Sugarcane, a remunerative cash crop, occupies important position in Indian agriculture. Sugar industry, located in rural areas in India is the second largest agro-based industry after textiles. The longer time (3–5 weeks) required by the crop to germinate, slow initial crop growth, wider spacing, heavy manuring coupled with frequent irrigation provides congenial condition for weed growth that leads to intense competition of weed with crop plants for nutrients, moisture, light, CO<sub>2</sub> and space. Critical period of crop-weed competition in sugarcane falls between 30 and 90 days after planting (Patel *et al.*, 2006). Among the factors for low productivity, negligence towards weed management is the most important one, as the losses due to weeds range from 30–70% reduction in cane yield (El Shafai *et al.*, 2010). For getting higher yield from sugarcane crop, weed management plays a vital role. Keeping these points in view, an experiment was thus carried out to study influence of integrated weed management on sugarcane.

The field experiment was conducted during the year 2011–12 at Instructional Farm, Department of Agronomy, Navsari Agricultural University, Navsari, Gujarat. The total rainfall received during crop-growing period was

1,266 mm. The experimental soil was clay in texture, low in available nitrogen (254 kg/ha), medium in available phosphorus (23.9 kg/ha), fairly rich in available potassium (427 kg/ha) and alkaline in reaction (pH 8.3). Treatments comprised 14 weed-management practices, viz. unweeded control, 3 hand-weedings (HW) at 30, 60 and 90 days after planting (DAP) and 2 interculturing (IC) at 45 and 90 DAP, Atrazine 2.0 kg/ha as pre-emergence, Atrazine 2.0 kg/ha as pre-emergence + 1 HW and 1 IC at 60 DAP, Pendimethalin 1.0 kg/ha as pre-emergence + 1 HW and IC at 60 DAP, Metribuzin 1.0 kg/ha as pre-emergence + 1 HW and IC at 60 DAP, Atrazine 2.0 kg/ha as pre-emergence + 2,4-D Na-salt 1.0 kg/ha as post-emergence applied at 60 DAP, 2,4-D Na-salt 1.0 kg/ha as post-emergence + paraquat 0.5 kg/ha as post-emergence applied at 30 DAP followed by 60 DAP, 2,4-D amine salt 1.0 kg/ha as post-emergence + paraquat 0.5 kg/ha as post-emergence applied at 30 DAP followed by 60 DAP, 2,4-D amine salt 1.0 kg/ha as post-emergence + metribuzin 0.5 kg/ha as post-emergence applied at 30 DAP followed by 60 DAP, 2,4-D amine salt 1.0 kg/ha as post-emergence + atrazine 1.0 kg/ha as post-emergence applied at 30 DAP followed by 60 DAP, Pendimethalin 1.0 kg/ha as pre-emergence + sunnhemp as a smother crop harvested and mulched at 60 DAP, metribuzin 1.0 kg/ha as pre-emergence + sunnhemp as a smother crop harvested and mulched at 60 DAP and atrazine 1.0 kg/ha as pre-emergence + sunnhemp as a smother crop harvested and mulched at 60 DAP arranged in randomized block design with 3 replications.

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**Table 1.** Effect of integrated weed management on dry weight of weeds, weed control efficiency, growth parameters, yield attributes, cane yield and economics of sugarcane

Treatment	Dry weight of weed at final earthing up (t/ha)	Weed control efficiency (%)	Tillers/ m row length at 90 DAP	Plant height (cm) at harvesting	Millable cane height (cm)	NMC ('000/ha)	Millable cane girth (cm)	Internodes per millable cane	Cane yield (t/ha)	Cost of cultivation (×10 <sup>3</sup> ₹/ha)	Net returns (×10 <sup>3</sup> ₹/ha)	Benefit: cost ratio
Unweeded control	7.07	-	13.6	367	287	86.1	2.58	26.5	63.8	127.9	38.0	0.30
3 HW at 30, 60 and 90 DAP and 2IC at 45 and 90 DAP	1.43	78.6	28.0	499	409	111.6	2.94	35.5	134.4	141.7	207.6	1.46
Atrazine 2.0 kg/ha as PE	3.60	49.9	21.0	438	373	99.6	2.78	33.0	109.3	129.8	154.2	1.19
Atrazine 2.0kg/ha as PE + 1 HW and 1 IC at 60 DAP	2.89	56.3	23.0	446	378	107.0	2.71	33.0	123.9	134.6	187.3	1.39
Pendimethalin 1.0 kg/ha as PE + 1 HW and IC at 60 DAP	3.70	45.4	21.0	436	381	102.4	2.68	33.1	118.5	134.6	173.3	1.29
Metribuzin 1.0 kg/ha as PE + 1 HW and IC at 60 DAP	3.16	69.6	26.0	475	390	102.9	2.81	35.4	128.4	135.0	198.8	1.47
Atrazine 2.0 kg/ha as PE + 2,4-D Na salt 1.0 kg/ha as PoE applied at 60 DAP	6.13	31.6	16.7	405	327	97.0	2.67	31.1	115.7	130.4	170.4	1.31
2,4-D Na salt 1.0 kg/ha as PoE + paraquat 0.5 kg/ha as PoE applied at 30 DAP followed by 60 DAP	4.66	72.6	19.7	426	336	96.5	2.71	31.8	108.7	129.3	153.1	1.18
2,4-D Amine salt 1.0 kg/ha as PoE + paraquat 0.5 kg/ha as PoE applied at 30 DAP followed by 60 DAP	4.20	75.5	17.3	458	383	100.1	2.68	32.7	111.4	129.4	160.2	1.24
2,4-D Amine salt 1.0 kg/ha as PoE + metribuzin 0.5 kg/ha as PoE applied at 30 DAP followed by 60 DAP	4.05	76.9	18.3	433	355	103.5	2.69	31.5	113.0	129.9	163.8	1.26
2,4-D Amine salt 1.0 kg/ha as PoE + atrazine 1.0 kg/ha as PoE applied at 30 DAP followed by 60 DAP	3.90	39.4	18.7	463	381	96.5	2.69	32.3	116.0	129.7	171.8	1.32
Pendimethalin 1.0 kg/ha as PE + sunnhemp as a smother crop harvested and mulched at 60 DAP	6.74	56.0	16.0	433	349	96.2	2.69	32.4	99.1 (156)*	134.2	123.6	0.92
Metribuzin 1.0 kg/ha as PE + sunnhemp as a smother crop harvested and mulched at 60 DAP	4.91	60.0	16.3	476	386	96.8	2.67	31.3	106.9 (52)*	134.6	143.5	1.07
Atrazine 1.0 kg/ha as PE + sunnhemp as a smother crop harvested and mulched at 60 DAP	5.41	35.0	16.7	431	356	100.0	2.67	31.5	96.8 (118)*	133.4	118.3	0.89
SEm±	0.35		1.3	8.4	13.5	3.89	0.07	0.93	6.44			
CD (P=0.05)	1.02		3.9	62.0	39.4	11.34	NS	2.57	17.92			

\*Data presented in parentheses indicate dry weight of sunnhemp (kg/ha)

NMC, Number of millable canes; HW, hand-weeding; DAP, days after planting; IC, interculture; PE, pre-emergence

Sugarcane variety 'Co 99004' was planted at 90 cm row spacing and was managed as per the standard package of practices. The crop was planted and harvested on 22 December, 2011 and 7 January, 2013 respectively. Observations on weed flora, dry weight of weeds at final earthing up (t/ha) were taken from the net plot. The data were statistically analysed using MSTATC software. Net realization was calculated by deducting the total cost of cultivation from the gross realization for each treatment. The benefit: cost ratio was calculated on the basis of the formula given below:

$$\text{BCR} = \text{Net realization (₹/ha)} / \text{cost of cultivation (₹/ha)}$$

Predominant weed species found in the experimental field were: *Cyperus rotundus* L., *Eragrostis major*, *Brachiaria* spp., *Oryza sativa* L., *Echinochloa colonum* L., *Phyllanthus moderaspatenia* L., *Alternanthera sessilis* L., *Euphorbia hirta* L., *Digera arvensis* Forsk., *Melilotus indica* (L.), *Physalis minima* L., *Corchorus acutangulus* L. and sedges like *Cyperus rotundus* L., and *Cyperus iria* L.

Dry weight of weeds at final earthing up was significantly influenced by various weed-management treatments. Three hand-weedings at 30, 60 and 90 days after planting (DAP) and 2 intercultures at 45 and 90 DAP recorded the lowest dry weight of weed at final earthing up. While the highest dry weight of weed at final earthing up was recorded under unweeded control. Most of the integrated weed-management treatments were found effective in reducing the dry weight of weeds as compared to unweeded control. These results were as per expectation as conventional method and different herbicide application as pre-emergence and post-emergence and pre-emergence + intercrop (sunhemp) check weed growth up to 90 DAP and late-emerged weeds flush may be smothered by intercrop and vigorous sugarcane crop growth. The results confirm findings of Mishra *et al.* (2003) and Mohanty and Mishra (2011).

Three hand-weedings at 30, 60 and 90 days after planting along with 2 interculturings at 45 and 90 days recorded significantly higher number of tillers/m row length at 90 days as well as plant height (499 cm) at harvesting followed by the application of metribuzin 1.0 kg/ha as pre-emergence + 1 HW and IC at 60 days. The lowest number of tillers/m row length at 90 days and plant height at harvesting were recorded in unweeded control. These findings are in agreement with those of Rana *et al.* (2004) and Muhammad *et al.* (2010).

Significantly higher millable cane height, number of millable canes and number of internodes/millable cane were obtained with 3 hand weedings at 30, 60 and 90 days after planting and 2 intercultures at 45 and 90 days followed by that of metribuzin 1.0 kg/ha as pre-emergence + 1 HW and IC at 60 days and atrazine 2.0 kg/ha as pre-

emergence + 1 HW and 1 IC at 60 days as compared to unweeded control. This might be attributed to effective control of weeds under the treatments, which reduced the competition by a great extent and thus helped in faster growth and development of sugarcane crop, in higher value of all yield and yield-attributing characters.

Cane yield was found significantly higher with 3 hand-weedings at 30, 60 and 90 days after planting and 2 intercultures at 45 and 90 days, which remained on a par with that of application of metribuzin 1.0 kg/ha as pre-emergence + 1 HW and IC at 60 days (128.4 t/ha) and atrazine 2.0 kg/ha as pre-emergence + 1 HW and IC at 60 days (123.9 t/ha) and pendimethalin 1.0 kg/ha as pre-emergence + 1 HW and IC at 60 days as compared to the unweeded control treatment having lowest cane yield. The increase in yield under these treatments was there because the weed growth remained low from the initial crop-growth stages, which markedly improved the yield attributes. This confirms the results of Singh and Kaur (2003) and Mohanty and Mishra (2011). This is also clear from the negative correlation between most of the growth and yield attributes and dry matter of weeds at final earthing up.

Three hand-weedings at 30, 60 and 90 days after planting and 2 intercultures at 45 and 90 days resulted in higher net realization followed by the application of metribuzin 1.0 kg/ha as pre-emergence + 1 HW and IC at 60 days and atrazine 2.0 kg/ha as pre-emergence + 1 HW and 1 IC at 60 DAP. However, benefit: cost ratio was found more or less similar among these best three treatments. These results are in accordance with those of Patel (2000) and Gholve *et al.* (2001).

Based on our results, it may be concluded that potential cane production and economic weed management can be achieved in sugarcane by 3 hand-weedings at 30, 60 and 90 days after planting and 2 intercultures at 45 and 90 days. However, during scarcity of labourers an application of metribuzin 1.0 kg/ha or atrazine 2 kg/ha as pre-emergence with 500 litres water/ha + 1 hand-weeding and interculturating at 60 days is the best option.

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