Integrated weed management in spring sugarcane

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Adoption of improved technology based on seed nutrient and plant protection has enabled the attainment of self-sufficiency of food in India. However, there is a fear that it may hort-lived, as a gap between food demand and supply is increasing due to high population growth rate. In this situation, the urgency lies in increasing agricultural productivity with technologies that lead to remunerative, sustainable and eco-friendly agricultural system.

Sugarcane is the most important cash crop of Maharashtra. Sugar industry plays a pivotal role in the socio-economic and educational development in rural areas of Maharashtra. During 2013-14, the area of sugarcane in the state was 10.54 lakh hectares with 767.0 lakh tons of Sugarcane production. The average sugarcane productivity was 82.5 t/ha while the average sugar recovery of 11.41% attained 11.41%. Many production factors are responsible for poor productivity of sugarcane, *viz.* pure seed, nutrient and water management, aftercare operations in which weed management in a crucial one. Weeds are among the most under estimated pest, especially in India, where they cause average crop losses of 33 percent and more. Low productivity is mainly due to heavy weed infestation (Srivastava *et al.* 2002). It is more appropriate that weeds, unlike insect and diseases often cause hidden symptoms of damage prior to harvest of sugarcane, and possibly also because of fatalistic attitude that weeds will always be present. Labour shortage is always there with sugarcane production. Therefore, the investigation was planned with objective to find out economical and effective weed management system in spring sugarcane

METHODOLOGY

The field experiment was conducted to assess the performance of different weed management practices in spring sugarcane variety '*Co 86032*' during year 2008-09 to 2010-11 at Central Sugarcane Research Station, Padegaon. The twelve treatments (Table 1) were replicated thrice in randomised block design. The sugarcane variety '*Co 86032*' was planted in spring season with 120 cm row spacing in gross and net plot size 10 x 7.20 m and 8 x 4.80 m, respectively. The crop was fertilized with 300:140:140 kg/ha N, P_2O_5 and K_2O. The soil of experimental plot was medium black.

RESULTS

The major weed flora observed in experimental plot were, *viz. Cynodon dactylon, Panicum isachne, Commelina benghalensis, Bracheria* spp (among grasses); and, *viz. Parthenium hysterophorus, Portulaca olererecea, Convolvulus arvensis, Ameranthus viridis, Digeria arvensis, Ipomoea aquatica, Eclipta* spp., *Xanthium strumarium and Euphorbia* spp. (broad leaf weeds) and *Cyperus rotundus* (sedge).

Application of atrazine at 2 kg/ha as PE + 2,4-D at 1.0 kg/ha as PoE at 15-18 DAP + hoeing at 90 DAP (T_{10}) significantly reduced the weed intensity which was found at par with metribuzine at 1.0 kg/ha as PoE at 15-18 DAP + power tiller with rotator at 90 DAP (T_{12}), atrazine at 2.0 kg/ha as PE + 2,4-D at 1.0 kg/ha as PoE at 15-18 DAP+ atrazine at 2 kg/ha + 2,4-D at 1.0 kg/ha as PoE at 45 DAP (T_{11}), metribuzine at 1.0 kg/ ha spray at 15-18 DAP + metribuzine at 1 kg/ha as PoE at 45

Table 1. Weed dynamics, sugarcanegrowth, yield and economics as affected by various weed

Treatment	Weed intensity (no. /m²)			Weed dry wt. (g/m²)		WCE (%)	Millable canes /ha	Cane yield (t/ha)	CCS yield (t/ha)	Net profit (₹/ha)	B:C ratio
	30 DAP	60 DAP	90 DAP	60 DAP	90 DAP	90 DAP					
Weedy check	35.0 (6.00)	46.0 (6.84)	59.00 (7.74)	59.0 (7.72)	64.0 (8.05)	--	84503	72.01	9.85	10225	1.14
Two weeding at 30 and 60 DAP + 1 hoeing at 90 DAP.	33.0 (5.82)	21.0 (4.68)	18.00 (4.34)	23.0 (4.81)	17.0 (4.22)	70.3	93866	108.01	14.82	41801	1.52
Atrazine at 2.0 kg/ha as PE +2,4-D at 1.0 kg/ha as PoE at 60 DAP + hoeing at 90 DAP	17.0 (4.24)	30.0 (5.56)	18.00 (4.33)	34.0 (5.88)	20.0 (4.56)	68.7	95928	111.80	15.53	50416	1.66
Metribuzine at 1.0 kg/ha as PE + 2,4-D at 1.0 kg/ha as PoE at 60 DAP + hoeing at 90 DAP	11.0 (3.45)	19.0 (4.46)	14.00 (3.85)	23.0 (4.83)	18.0 (4.35)	71.8	98093	115.52	17.33	54628	1.72
Metribuzine at 1.0 kg/ha as as PoE spray at 15-18 DAP + hoeing at 90 DAP.	8.00 (3.00)	16.0 (4.12)	27.00 (5.26)	19.0 (4.44)	33.0 (5.71)	48.4	96056	107.96	15.01	46162	1.60
Atrazine at 2.0 kg/ha as PE + Atrazine at 2.0 kg/ha as PoE at 45 DAP.	17.0 (4.24)	17.0 (4.23)	29.00 (5.45)	18.0 (4.11)	29.0 (5.40)	54.6	94205	101.72	13.94	39608	1.52
Metribuzine at 1.0 kg/ha spray at 15-18 DAP + metribuzine at 1.0 kg/ha as PoE at 45 DAP	8.0 (3.00)	6.00 (2.62)	21.00 (4.64)	9.00 (3.06)	21.0 (4.66)	67.1	95910	103.68	14.37	39832	1.51
Atrazine at 2.0 kg/ha as PE + Tractor drown cultivator at 60 DAP.	17.0 (4.24)	32.0 (5.73)	13.00 (3.73)	35.0 (5.96)	17.0 (4.22)	73.4	94600	100.63	13.64	38210	1.50
Atrazine at 2.0 kg/ha as PE + Tractor drown cultivator at 90 DAP.	18.0 (4.35)	31.0 (5.66)	34.00 (5.89)	35.0 (5.96)	41.0 (6.44)	35.9	94168	97.86	13.57	35014	1.46
Atrazine at 2.0 kg/ha as PE +2,4-D at 1.0 kg/ha as PoE at 15-18 DAP + hoeing at 90 DAP.	6.00 (2.64)	22.00 (4.76)	27.00 (5.27)	29.0 (5.44)	32.0 (5.71)	50.0	95585	104.85	14.46	43642	1.58
Atrazine at 2.0 kg/ha as PE + 2,4-D at 1.0 kg/ha as PoE at 15-18 DAP. + Atrazine at 2.0 kg/ha,+2,4-D at 1.0 kg/ha as PoE at 45 DAP.	8.00 (3.00)	14.0 (3.86)	24.00 (4.96)	17.0 (4.21)	25.0 (5.07)	60.9	95989	105.02	14.45	41958	1.54
Metribuzine at 1.0 kg/ha as PoE at 15-18 DAP + power tiller with rotator at 90 DAP.	8.00 (2.99)	18.0 (4.33)	29.00 (5.46)	20.0 (4.48)	32.0 (5.65)	50.0	96272	106.66	14.64	45123	1.59
LSD (P=0.05)	0.54	0.90	1.21	1.98	1.64		1.15	4.07	0.95		

DAP (T_7) and metribuzine at 1 kg/ha as as PoE spray at 15-18 DAP + hoeing at 90 DAP (T_5). The dry weight of weeds at 30 DAP was significantly lower in application of atrazine at 2.0 kg/ha as PE + 2,4-D at 1.0 kg/ha as PoE at 15-18 DAP + atrazine at 2.0 kg/ha + 2,4-D at 1.0 kg/ha as PoE at 45 DAP (T_{11}) which was found at par with T_{12}, T_{10}, T_7, T_5 and T_4 (Table 1).

Application of metribuzine at 1.0 kg/ha as PE spray+ 2,4-D at 1.0 kg/ha as PoE at 60 DAP + hoeing at 90 DAP observed significantly higher millable canes (98093 /ha) and cane yield (115.5 t/ha) and CCS yield (17.2 t/ha) than other treatments. While the cane yield was found at par with application of atrazine at 2.0 kg/ha as PE + 2,4-D at 1.0 kg/ha as PoE at 60 DAP +hoeing at 90 DAP (111.8 t/ha). Metribuzine at 1.0 kg/ha as PE +2,4-D 1.0 kg/ha as PoE at 60 DAP + hoeing at 90 DAP realized the higher net profit (₹ 54628/ha) and B:C ratio (1.72) followed by Atrazine at 2.0 kg/ha as PE + 2,4-D at 1.0 kg/ ha as PoE at 60 DAP +hoeing at 90 DAP.

CONCLUSION

In spring planted sugarcane, application of metribuzine 1.0 kg/ha as PE + 2,4-D 1.0 kg/ha spray at 60 DAP + hoeing at 90 DAP found superior for control of weeds in sugarcane with the highest weed control efficiency (80.8) at 120 DAP and also recorded significantly highest cane and CCS yield (115.52 and 17.33 t/ha respectively), net profit (54628/ha) and benefit cost ratio (1.72). Application of atrazine at 2.0 kg/ha as PE + 2,4-D 1.0 kg/ha as PoE at 60 DAP + hoeing at 90 DAP was found the next best treatment for weed control in sugarcane.

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Weeds and weed control in finger millet in India – A review

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Eleusine coracana (L.) Gaertn is a nutritious and under exploited minor millet with several edible and industrial uses.Finger millet is cultivated on 1.176 million ha, with average yields of 1.64 t/ha, in India (DMD, 2014). The major finger millet growing (with area more than 10,000 ha) states of India are: Karnataka, Uttarakhand, Maharashtra, Tamil Nadu, Orissa, Andhra Pradesh, Gujarat, Jharkhand, West Bengal, Bihar and Chattisgarh. About 13.3% and 20.6% of the total area and production of finger millet is contributed by irrigated ecosystem in India. Finger millet is cultivated, mainly as rainfed crop, by seeding (broadcast- or row-seeding) and transplanting methods of establishment in India. Weeds are the major constraints limiting the productivity of finger millet due to initial slow growth of the small seeded finger millet which favors weed growth resulting in severe competition for limited resources. The objective of this review is to list weeds associated with finger millet in different parts of India and summarize the weed management options for effectively managing weeds in finger millet.

METHODOLOGY

The literature published in national and international journals on "Weeds and weed management in finger millet in India" was collected. All the papers published were read, analyzed and summarized as a review in this paper.

RESULTS

Of 88 weed species reported to be associated with finger millet in India, the most commonly reported weeds (in decreased order of importance) include: *Cyperus rotundus*, *Cynodon dactylon*, *Commelina benghalensis*, *Ageratum conyzoides*, *Echinochloa colona*, *Dactyloctenium aegyptium*, *Digitaria marginata*, *Eleusine indica*, *Spilanthes acmella*, *Acanthospermum hispidum*, *Eragrostis pilosa*, *Parthenium hysterophorus*, *Amaranthus viridis*, *Celosia argentea*, *Alternanthera sessilis*, *Dinebra retroflexa*, *Digitaria sanguinalis*, *Euphorbia hirta* and *Ocimum canum*. The pre-dominant weed flora varied in different states of India. If un-weeded, weeds smother the finger millet resulting in significant reduction in the yield by 5-70% owing to weed competition. Critical period for weed competition was identified to be first 4-6 weeks from planting in irrigated transplanted finger millet and first 5 weeks under rainfed conditions, respectivelyand thus should be kept weed free to prevent losses in yield.

Traditionally, direct row-seeded finger millet is often cultivated, twice or thrice at ten-day intervals, by farmers with tined implements drawn by draft animals. In regions where animal or machine power is not available, the weeding and cultivation operations are usually carried out by hand. Pre - emergence application of bensulfuron methyl + pretilachlor, butachlor, isoproturon, metoxuron, neburon, nitrofen, oxadiazon, oxyfluorfen and post - emergence application of 2,4-D, chlorimuron ethyl, MSMA and propanil, were found to be effective in managing weeds either alone or in combination with hand weeding or inter cultivation. Non-chemical method like stale seedbed with inter cultivations was also found to be effective in managing weeds. Integrated weed management was found to be more economical in managing weeds in finger millet.

CONCLUSION

For improving finger millet productivity, it is important to manage weeds during the critical period of crop weed competition and create conducive environment for crop. Integrated weed management strategies that are effective, economical and environment friendly are to be designed, tested and popularized among farming community to manage weeds and improve productivity and production of finger millet in India.

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