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Herbicides performance for management of weeds in sugarcane under central Narmada valley condition in Madhya Pradesh

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Abstract
A field experiment was conducted during autum planting seasons 2016-17 and 2017-18 to assess the performance of various herbicides for managing weeds in sugarcane under central Narmada valley. All the weed control treatment caused significant reduction in weed density and biomass as compared to weedy check. Significantly lowest weed density and weed dry matter, maximum weed control efficacy, more number of tillars and highest number of millable canes were obtained with pre emergence application of metribuzin + One hoeing and post application of 2, 4-D resulted maximum cane yield (101.50 t/ha) followed by atrazine (PI)+post application of 2,4-D and paraquata and the yield was two times more than weedy check. Highest net profit (Rs 233852) and cost benefit ratio was found in treatment where applied metribuzin in pre application + One hoeing and post application of 2, 4-D and it is received only due to reduction in weed density at tillaring stage resulted increased the number of tillars and thickness of canes.

Keywords: Herbicides, number of tillers and millable canes, yield and economics

Introduction
Sugarcane is one of the most important cash crops and India is a centre of origin of *Saccharium* ssp. after the most favorable environment for maximum growth and sugar accumulation in the sugar crops. More than lacks skilled and unskilled workers engaged in the manufacturing of sugar, jaggery, khandsari and distillery in our country. Sugarcane production hampered by several biotic and a biotic factors, among them, Weeds constitute tough competition to sugarcane crop because of wide row spacing, late germination, slow initial growth, heavy fertilization and frequent irrigation. Weeds not only reduced tonnage in the field also affected the sucrose recovery (Mehra *et al*.1995) [1]. The extent of loss in cane yield caused by weeds is from 12 to 72% to total crop depending upon composition and diversity of weeds when not properly controlled in the initial stages (Srivastava and Chauhan, 2002). Twining weeds which sprout at latter stage and twin around clumps affected number of tillars and millable cane and causes 25% reduction in yield. The total cane yield loss in the country per annum is around 25 million tones equivalent to 2.5 million tone of sugar which valued around Rs 1500 cores. Out of 86 weed species reported by Rao and Kiran (2012) [4], Cyprus, Cynodan, Sorghum, Chenopodium, Amaranthus, Vicia, Field bind, Digiteria, Cnvolus, Parthenium and striga are the main weeds of the sugarcane in Central Narmada valley in Madhya Pradesh. Among them, Striga commonly known as witch weeds is serious parasitic weeds that invade host plants root system for nutrients, water and carbohydrates, eventually stunting growth and killing the host plant. Sugarcane weed control is very important in 30, 60, and 90 days after planting (DAP). It was felt necessary that besides screening of the effective herbicides, there is need to integrate them along with manual weeding for effective and economic weed control, which have longer efficacy on weed with positive effect on growth and yield of sugarcane .Hence the objective of the present investigation is to find out the efficacy of pre and post applied herbicides along with manual weeding on weed management, yield component and yield of sugarcane. Cost benefit ratio is calculated to satisfy the sugarcane growers for adaptation of the recommendations.

Materials and Methods

A field experiment was conducted to see the performance of various herbicides plus manual weeding to control the weed in sugarcane variety Co 86032 during 2016-17 and 2017-18 .The experiment was laid out in randomized block design in three replication with eight treatments. The soil of the experimental site was clay with medium nitrogen and phosphorus with high potash and slightly alkaline pH. Recommended doses of nitrogen, phosphorus, potash, zinc and package of practices such as no. of sets/ha for sowing, row spacing, method of planting, Irrigations was same for each treatment. Detail description of each treatment is given below,

- **T1:** Control (No hoeing and no herbicide application)
- **T2:** Three hoeing at 30, 60 and 90 days after planting
- **T3:** Atrazine@2kg/ha (PI) +2, 4-D 1.5kg/ha at 60 DAP +Paraquat 1000g/ha
- **T4:** Metribuzin@1.5kg/ha(PI)+ One hoeing at 60 DAP+2, 4-D at 90 DAP
- **T5:** Atrazine@2kg/ha (P I) + Glyphosat@1.2 l /ha at 45DAP between the row+ One hoeing
- **T6:** One hoeing+ Metribuzin@1.5kg (Post)/ha+ Glyphosat @1.2l /ha between the row
- **T7:** -One hoeing+ 2, 4-D Na at 60 DAP with 2% urea+ Glyphosat@1.2 l /ha between row
- **T8:** One hoeing+Ametryne@2.5kg/ha at 60 DAP+ Glyphosat@1.2 l /ha between row

A quadrant of one m2 was thrown randomly in each experimental plot trice and noted the total number of green weed plants and average taken for calculating the weed density. Treatment wise green weeds plants were harvested at the level of soil surface from the same site where quadrant kept for weed density in each treatment unit. Then weeds sample were air dried and weighed. Weed control efficacy was worked out as per equation given by Patel *et al* in 2013.Twenty five sugarcane mother plants in middle rows of each unit tagged and used to record number of tillers and millable cane and data converted in hectare. Randomly ten canes from each replication of the treatment collected from middle three rows and after toppling, canes were weighed to obtained cane yield (Panse and Sukhatme (1967) [2]. Year wise average recorded data taken for statistical analysis and average pooled data of both years described in the results. Economics of each treatment computed based on the existing per quintal state government price @Rs 275/q

Results and Discussion

Several weeds flora emerged during the period of experiment included among them Amaranthus species, Euphorbia species, Cyprus rotundus, Cynodon dactylon, Perthenium hysterophorus and Striga asiatica are created major problems on the growth and productivity of the sugarcane yield. It might be seen that majority of weeds emerged after 60 DAS and increased with length and number up to 90 DAS. Where as striga which is the root parasite appeared in the field in the lost week of June and continuously drawn the two times more nutrients from the canes resulted reduced the canes height and lastly affected canes completely dried. The pooled data of two years summarized in table 1 indicated that weed infestation as referred in term of total weed density and biomass were significantly affected by application of various pre-emergence and post- emergence herbicides. All the weed control treatments caused significant reduction in weed density and dried biomass as compaired to weedy check. The lowest weed density (36 weeds/m2) and dry biomass (10.75g) was observed under metribuzin +one hoeing +post application of 2,4-D(T4) closely followed by pre- application of atrazin +- post application of 2,4-D and para quit which were significantly lower than all other herbicidal treatments. The results were in conformity with the finding of Singh *et al* (2011) and Patel *et al* (2013). Pre-emergence application of metribuzin followed by post –emergence used of glyphosate gave better response than pre atrazin with post application of glyphosate. Weed control efficacy varied from 51.77 to 80.91 percent. Significantly higher Millable canes and yield were found in herbicidal treatments and hoeing plots in comparison to control. Among the treatments, highest cane yield (101.50 t/ha) was recorded under Pre-emergence application of metribuzin +one hoeing +post application of 2,4-D(T4) that was statistically at par with atraz in +- post application of 2,4-D and paraquit (99.85 t/ha) followed by pre application of atrazine and post sprayed of glyphosate+ hoeing(97.94 t/ha).Among the herbicides, lowest number of tillars, NMC and cane yield was observed with hoeing+ ametry+ glyphosate. In control there was only 71820 NMC and 48.48 t/ha cane yield. Similar results was reported by Raskar (2004) [5] and Singh *et al* in 2001. Singh *et al* in 2011 proved the effect of paraquat on destruction of weeds and enhanced the NMC and cane yield in sugarcane. It can thus be concluded that treatment with metribuzin+2, 4-D+hoeing proved its superiority in producing higher millable canes and cane yield with highest weed control efficacy.

Economics: Pooled data analysis revealed that weed free condition arise by the pre application of metribuzin +one hoeing + post emergence use of 2, 4-D (T4) yielded significantly more cane yield resulted in attaining maximum net return (Rs 233852/ha) and benefit cost ratio (5.24) over all other weed control methods which was closely followed by Atrazine +2, 4-D + Paraquata for obtaining net return (Rs 214913) and benefit cost ratio (4.93) (Table 2). The minimum net return (Rs133320) and benefit cost ratio (2.74) obtained in weedy check. The lower crop yield (48.6 t/ha) in control was the reason for lower net return in weedy check treatment.

Table 1: Efficacy of herbicides on weed management, yield components and yield of sugarcane (pooled data of two seasons)

Treatment	Weed density (No./m2)	Weed dry matter (g/m2)	Weed control efficacy (%)	Number of tillers (000/ha)	Number of millable canes (000/ha)	Sugarcane Yield (t/ha)	Yield gain over check (%)
T1	96.37	89.75	-	81 .32	71.82	48.48	-
T2	68.17	48.33	46.15	102.71	89.63	87.13	79.72
T3	42.45	15.75	82.45	109.23	96.02	99.85	105.96
T4	36.63	10.17	88.66	110.97	99.54	101.50	109.36
T5	48.27	24.45	79.44	106.56	87.45	97.94	102.02
T6	43.48	21.63	75.90	101.32	89.42	95.77	97.54
T7	51.39	29.43	67.20	103.62	93.15	96.84	99.75
T8	54.51	33.77	62.37	99.38	85.93	96.43	98.90
LSD(p=0.05)	5.13	4.37	-	4.53	5.67	6.43	-

Table 2: Economics of sugarcane production as influenced by herbicidal treatments

Treatment	Cane yield (t/ha)	Additional yield (t/ha)	Cost of cultivation (Rs/ha)	Grass income (Rs/h)	Net income (Rs/ha)	B:C Ratio
T1	68.48	-	48654	184896	133320	2.74
T2	97.13	28.65	63462	262251	198789	4.13
T3	99.85	31.37	54682	269595	214913	4.93
T4	107.05	38.57	55183	289035	233852	5.24
T5	97.94	29.46	56435	264438	208003	4.69
T6	95.77	27.29	55913	258579	202266	4.62
T7	96.84	28.36	56742	261468	204726	4.61
T8	96.43	27.95	56391	260361	203970	4.61

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