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BIOLOGICAL EFFICIENCY OF MESOTRIONE 480 G/L AGAINST SUGAR CANE WEEDS (BIDENS PILOSA, AGERATUM CONYZOIDES, CYPERUS SPP.), IN BURKINA FASO

KAMBOU Georges[1] and BIHOUN Mounkuy Cyprien[2]
[1]INERA FARAKOBA. Research Laboratory. PO. Box. 403. Bobo-Dioulasso. Burkina Faso.
[2]Matourkou Polyvalent Agricultural Center, PO. Box 130. Bobo-Dioulasso

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ABSTRACT

A study of Amazing 480 SC (Mesotrione 480 g/l) biological efficiency against weeds (Bidens pilosa, Ageratum conyzoides, Cyperus spp., etc.) which caused big damage to sugar cane has been done at the site of SN-SOSUCO, sugar cane Company, in Burkina Faso. The experimental design was a completely randomized Fisher block of six treatments in four replications (untreated control, manual weeding, Chlorimuron-ethyl 250g/ha, Mesotrione 400 ml/ha, Mesotrione 800 ml/ha, Mesotrione 1333.33 ml/ha). Weeds counting and dry biomass weighing have been done using a 0.25 m2 quadrant according to Likov and al. (1985) method. The biological efficiency coefficients have been evaluated using Vilitsky (1989) formula. The coefficients efficiency of the three rates of Mesotrione 480 g/l varied from 62.01 to 100 according to their number of weeds and from 50.23 to 100 according to their dry biomass weight compared to the untreated control, during the sugar cane development. However, some weeds as Ageratum conyzoides, Mitracarpus villosus and Commelina benghalensis were resistant to different rates of Mesotrione 480 g/l. All these factors allowed to get, for the three rates of Mesotrione, respectively some yield increase of 178.70%; 207.17% and 242.76% in comparison to the untreated control. The one of Chlorimuron-ethyl 250 g/ha got an increase of 177.94% in comparison with the untreated control. For profitability' reasons, Mesotrione could be apply at the rate of 800 ml/ha.

Keywords: Mesotrione, Chlorimuron-ethyl, weeds, sugar cane, Burkina Faso.

1. INTRODUCTION

Sugar cane (Saccharum officinarum) is a plant of the Poaceae family, produced for the sweet juice contained in its stem. This plant is the largest source of sugar production in the world (Kambou et al, 2015). According to Cirad (2017), more than one hundred (100) countries in the world, produce sugar cane plant for more than 1.80 billion tons of cane or about one hundred eighty (180) million tons of sugar. The largest producers are Brazil, India and the European Union, which alone produce more than half of the world's production. If the increase in sugar cane production is due to the increasing consumption needs of the population, the production of ethanol-based biofuel is another reason, especially since 50% of Brazil's production is destined for this purpose (Cirad, 2017). Burkina Faso, although it remains a modest producer of sugar cane worldwide, intends to improve and increase its production in order to meet the increasingly demanding and growing local demand. Indeed, the New Sugar cane Society of Comoe (SN-SOSUCO) established since 1965 has made this culture one of the jewels of the landscape of the waterfalls region in particular and of the country in general. For an estimated production of 30,000 tons of sugar per year, this company employs more than 3,000 employees, making it the Burkina Faso's largest private employer. This sugar cane production, however, remains, like other crops, subject in recent years to several attacks due to pests like the stalk borer Eldana saccharina (Lepidoptera: Pyralidae) (Goebel et al. (2003); white grubs as well as to weeds which cause enormous production losses. Weeds alone, if not controlled, can cause damage in the range of 30-40% of sugar cane yields (Cirad, 2017). To reduce the harmful effects of these weeds, to an economically tolerable threshold, several means of control are used such as manual, mechanized and chemical weeding. Manual weeding has a dual role of weeding and improving soil structure, but is not always easy because it requires a very large workforce. Mechanized tillage, too, is not always an option due to soil destruction and its negative impact during the production process (Kambou et al, 2008). Notwithstanding the fact that poorly executed chemical control can lead to a severe ecological imbalance, it remains in the short term as a panacea, the best alternative to reduce the effect of weeds on food and industrial crops. For this reason, it is became necessary to study the biological efficacy of Amazing 480 SC (Mesotrione 480g/l) on sugar cane weeds (Saccharum officinarum).

2.MATERIAL AND METHODS

2.1. Material

The plant material is sugar cane variety CO 997. It is the most produced variety on the sugar perimeter of SN SOSUCO with 36% of the area in 2018 but remains very sensitive to the weeds invasion. However, it has a very high state of plasticity (possibility of harvesting over a long period) with an average yield of 76 Tons of rods/ha (production department of SN SOSUCO, 2018). Plot plugging was carried out on the tractor with a disc plough followed by pulverizing and furrowing. A maintained pressure sprayer was used for the herbicides application in the plots to be treated. The young cuttings, from the nursery about six months old, are cut at intervals of two internodes and placed end to end in the furrows then closed by a light layer (3 to 5 cm) of soil. Immediately after planting, the sampled herbicide treatments have been applied with REBEL 250 WG (Chlorimuron-ethyl 250 g/l) at 250 g/ha as a control herbicide and three rates of AMAZING 480 EC (Mesotrione 480 g/l) as the experienced product. Mineral fertilization consisted of a fertilizer application of 500 kg/ha of NPK (16-6-18) +5S + 3MgO has been done in grooves before planting;

65 kg/ha of DAP (18-46-0) at 14 days after planting;

150 kg/ha KCl (0-0-60) at 14 days after planting;

148 kg/ha of urea (46-0-0) at 45 days after planting. Cultivation technics are those applied by SN SOSUCO.

2.2. Methods.

The experimental design was a completely randomized Fisher block of six treatments in four replications. The treatments were: Untreated control, manual weeding, Chlorimuron-ethyl 250 g/ha, Mesotrione 400 ml/ha, Mesotrione 800 ml/ha, Mesotrione 1333.33 ml/ha. The elementary plots are composed of 6 double-lines of 10.8 m long and 9. 25 m wide or an area of 100 m2. The distance between the blocks was 1.5 m and 2.5 m between the objects.

2.2.1. Phyto-toxicity.

After herbicides application, the phyto-toxicity on sugar cane has been evaluated by a visual scale of 0 to 10 (method of the European Biological Assays Commission). This has been done based on observed plants alterations (AFPP-CEB., 2015).

2.2.2. Effects of Mesotrione 480 g/l on the sugar cane weeds number.

The evaluation has been done by counting and grubbing weeds as soon as they appeared using a 0.25 m2 square placed around four strains at regular diagonal intervals, in each useful plot at the 7th, 15th, 30th, 45th, 65th, 90th and 120th day after herbicides application. The herbicide coefficients efficiency, in these periods, was evaluated using the Vilitsky formula, (1989) which is:

C = 100 – B0.100/BK

Where:

C = coefficient efficacy of herbicides compared to untreated control;

B0= number of weeds (feet/m2) or dry biomass weight (g/m2) on the treated plot;

Bk = number of weeds (feet/m2) or dry biomass weight (g/m2) on the untreated control plot.

2.2.3. Effects of Mesotrione 480 g/l on weeds dry biomass dynamic accumulation.

It has been done by drying and then weighing the weeds dry biomass, during sugar cane phenological stages, according to LIKOV (1985) method.

2.2.4. Effects of Mesotrione 480 g/l different rates on sugar canes weeds flora.

The identification of the different weeds have been done using Terry (1983) and Akobundu et al. (1982) keys.

2.2.5. Effects of Mesotrione 480 g/l on sugar cane development.

The number of productive tillers and machinable canes have been also evaluated at 2, 3, 4 months after herbicides applications. This allowed studying the herbicides impact on sugar cane development.

2.2.6. Statistical analysis.

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The obtained data were submitted to variance analysis (Dospiehov., 1985) at the 5% threshold, followed by Newman-Keuls test, using Genstat software. Means of the number and weight of dry biomass of weeds were previously transformed by the V-x+1 formula before being analyzed to reduce the large variability between the collected data. The correlations between some studied parameters were made using XLSTAT 2015 version software. Software such as Microsoft Word 2016 and Excel 2016 have been also used for text entry and table development

3. RESULTS

3.1. Phyto-toxicity of different rates of Mesotrione 480 g/l on sugar cane.

During the observations, there are no phyto-toxicity symptoms from Amazing 480 SC, on treated sugar cane plants compared to those of the untreated control.

3.2. Effects of different rates of Mesotrione 480 g/l on sugar cane weeds number.

At the 7th day after application, there was homogeneity of weed population in all treatments. The average effect of herbicides (1 foot/m2) therefore represents a 100% reduction in the number of weeds compared to the untreated control and the control product (Table I).

At the 15th day after insecticides application, there is a significant difference between the different objects. The average effect of herbicides (1 foot/m2) represents weeds reduction of 84.69% compared to the untreated control and 81.79% compared to the control herbicide chlorimuron-ethyl.

. At the 30th day, after herbicides application, the high and average rates of Mesotrione 480 g/l, do not differ from each other and from the control product. The average herbicides effect (2.79 feet/m2) is a reduction of 78.00 % in comparison with the untreated control. However, manual weeding treatment was more efficient with 92.11% reduction in comparison with the untreated control and a 32.89% reduction from the high rate of Mesotrione 480 g/l. The average rate, Mesotrione 400 ml/ha, was 76.10% lower than the untreated control.

At the 45th day after application, the average effect of herbicides (4.90 feet/ha) is a weeds reduction of 65.97% compared to the untreated control. However, there is no significant difference between the manual weeding and the low rate of Mesotrione 480 g/l. The rate of Amazing 1333.33 ml/ha appears to be the most effective with a weed reduction of 70.83% compared to the untreated control.

At the 65th day after herbicides application, the average effect of herbicides (6.31 feet/m2) is a weeds reduction of 57.39% compared to the untreated control. There is no significant difference between the low rate of Mesotrione 480 g/l and the manual weeding. However, Mesotrione 1333.33 ml/ha is more efficient with a reduction of 63.54% compared to the untreated control and of 35.56% compared to the manual weeding.

At the 90th day after treatment, there is a significant difference between the treatments. The average effect of herbicides (5.06 feet/m2) is a weeds reduction of 51.06% compared to the untreated control. There is no significant difference between Chlorimuron-ethyl 250 g/l,

ISSN: 2456-8643

Mesotrione 400 ml/ha and Mesotrione 800 ml/ha. However, the control product which appears to be most effective shows a weeds reduction of 60.44% compared to the untreated control and of 29.85% compared to the manual weeding.

At the 120th day after application, the same trends were observed on all treatments. The average effect of herbicides (4.80 feet/m2) is a weeds reduction of 50.92% compared to the untreated control. There is no significant differences between manual weeding, Mesotrione 400 ml/ha, Mesotrione 800 ml/ha and Chlorimuron – ethyl 250 g/ha.

ISSN: 2456-8643

Table 1: Affects of different rates of Mesotrione 480 g/l on sugar cane weeds number (feet/m2).

Treatments	**Observations periods (DAA = Day After Application)**													
	7		**15**		**30**		**45**		**65**		**90**		**120**	
	No trans.	**After √x+1**	No trans.	**After √x+1**	No trans.	**After √x+1**	No trans.	**After √x+1**	No trans.	**After √x+1**	No trans.	**After √x+1**	No Trans.	**After √x+1**
Control	0.00	**1.00**	49.00	**6.53a**	175.75	**12.68a**	210.25	**14.40a**	222.25	**14.81a**	107.80	**10.34a**	94.75	**9.78a**
Manual weeding	0.00	**1.00**	32.25	**5.49b**	0.00	**1.00b**	39.25	**6.15b**	71.50	**8.38b**	35.50	**5.83bc**	26.50	**5.17bc**
Chlo- ethyl 250 g/ha	0.00	**1.00**	0.00	**1.00c**	6.25	**2.60c**	24.00	**4.56c**	31.25	**5.65c**	16.25	**4.09d**	18.50	**4.33c**
Mesotrione 400ml/ha	0.00	**1.00**	0.00	**1.00c**	16.00	**4.04d**	41.50	**6.17b**	59.50	**7.77b**	39.50	**6.29b**	36.00	**5.97b**
Mesotrione 800ml/ha	0.00	**1.00**	0.00	**1.00c**	10.00	**3.03c**	24.75	**4.67c**	41.00	**6.43c**	25.50	**5.04cd**	22.25	**4.71c**
Mesotri. 1333,3ml/ha	0.00	**1.00**	0.00	**1.00c**	1.50	**1.49b**	17.50	**4.20c**	31.50	**5.40c**	24.25	**4.81d**	17.00	**4.20c**
Average		**1.00**		**2.67**		**4.14**		**6.70**		**8.08**		**6.07**		**5.69**
CV (%)		**0.00**		**7.70**		**8.20**		**7.50**		**9.40**		**9.10**		**10.30**
Sed (df =15)		**0.00**		**0.21**		**0.34**		**0.50**		**0.76**		**0.55**		**0.29**
e.s.e (Sx)		**0.00**		**0.10**		**0.17**		**0.25**		**0.38**		**0.26**		**0.59**

N.B: no trans. = number without transformation.

3. Biological efficiency coefficients of Mesotrione 480g/l different rates, according to the number of weeds.

The coefficients efficiency of manual weeding varied between 24.76 to quantity of extractible sugar 100 with an average of 70. 98. The highest coefficients were observed at the 7th and 30th day after treatment and the lower coefficient is situated at the 22th day after observations (table 2).

Chlorimuron - ethyl 250 g/ha coefficients efficiency varied from 85.14 to 100 with an average of 92.87. The best coefficients were obtained at the 7th, 15th day after application and the lowest coefficient was observed at the 12 0th day after treatment. It presents with the high dose of Amazing, the highest averages of coefficients efficiency between all treatments.

With an average of 85.13, the coefficients of Mesotrione 400ml/ha varied from 62.01 to 100. The coefficients of Mesotrione 800 ml/ha varied between 76.52 and 100 with an average of 90.74. The highest coefficients were at the 7th and at the 15th day after herbicides application and the lowest were situated at 120th day of observation.

The efficiency coefficients of Mesotrione 1333.33 ml/ha varied between 82.10 and 100 with an average of 92.23. It has the highest average coefficient efficiency between the treatments.

Table 3: Biological efficiency coefficients of Mesotrione 480 g/l different rates according to the number of weeds.

Treatments	**Observations periods (DAA = Day After Application)**						
	7	**15**	**30**	**45**	**65**	**90**	**120**
Untreated control	–	–	–	–	–	–	–
Manual weeding	100.00	34.18	100.00	81.33	65.99	83.12	72.03
Chlorimuron – ethyl 250 g/ha	100.00	100.00	96.44	88.59	85.14	92.27	80.48
Mesotrione 400ml/ha	100.00	100.00	90.90	80.26	71.70	81.21	62.01
Mesotrione 800ml/ha	100.00	100.00	94.31	88.23	80.50	87.87	76.52
Mesotrione 1333,3ml/ha	100.00	100.00	99.15	91.68	85.02	88.47	82.10

3.4. Affects of Mesotrione 480 g/l different rates on weeds flora.

At the 90th JAT, the weeds flora of the experimental test is diversified. In fact, the inventory carried out at this date shows twelve (12) species found in seven (7) botanical families (Table 3).

The most commonly evaluated species are Ageratum conizoides, Bidens pilosa, Commelina bengalensis, Cyperus ssp and Mitracarpus villosus. Other families of weeds appeared but in relatively small numbers.

The most important floristic diversity was found in the untreated control, manual weeding and Mesorione 400 ml / ha, each of which had nine (9) species, followed by the control product with eight (8) species, finally the recommended and high dose. Mesotrione has shown the smallest diversities with each six (6) species of weeds.

According to their density, the untreated control with 107.5 feet / m² has the highest weed density with a predominance of Asteraceae (Bidens pilosa and Ageratum conyzoides) for 91.63% of weeds.

The manual weeding with 35.5 feet / m² also displays the same trends as the untreated control. The predominant species are mainly Bidens pilosa with 68.31% and Ageratum conyzoides with 21.13% of weeds. No less important species such as Kyllinga pumila (2.82%) and Cyperus sp. (2.11%) also exist.

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In the plots of the control product (Chlorimuron -ethyl 250g / ha), eight (8) species in six (6) botanical families were counted. The most abundant species is Ageratum conizoides with 44, 62% of weeds then, comes Commelina benghalensis with 16, 92% of weeds..

In the plots treated with Mesotrione at the rate of 400ml / ha, nine (9) species distributed in six (6) families were identified during the inventory. Ageratum conizoides is the most common species in these plots and constitutes 31.01% of their number. Commelina benghalensis and Mitracarpus vilosus each have 22.78% of the weeds counted. However, this treatment has reduced the number of Ageratum conizoides by 15.65 times compared to the untreated control, but remains ineffective against Commelina benghalensis and Mitracarpus villosus where there is a significant increase in the number of weeds (12 times) compared to the untreated control.

In the plots treated with Mesotrione 800 ml / ha, six (6) species belonging to four (4) botanical families are observed. Ageratum conizoides is still the most abundant species according to the relative inventory with 38.00%, then comes Mitracarpus vilosus with 30.00%, then Commelina benghalensis with 17.00% of weeds. This dose of Mesotrione had an influence on the Bidens pilosa species with a significant reduction compared to the untreated control.

In the plots treated with Mesotrione 1333.33 ml / ha, six (6) species of four (4) botanical families were counted during the inventory. The dominant species is M. vilosus with 26.04% followed by Cyperus sp. with 19.79% and finally C. benghalensis with 15.63% of weeds.

Table 3. Effects of Mesotrione 480 g/l different rates on sugar canes weeds flora.

Genus Species	Families	Untreated control	Manual weeding	Chlorimuron 250 g/ha	Mesotrione 400 ml/ha	Mesotrione 800 ml/ha	Mesotrione 1333.3ml/ha
Ageratum conyzoides	Asteraceae	34	30	29	49	38	25
Bidens pilosa	Asteraceae	360	97	9	23	6	9
Cleome rutidosperma	Cleomaceae	2	0	1	0	0	0
Commelina benghalensis	Commelinaceae	3	2	11	36	17	15
Cyperus ssp	Cyperaceae	11	3	6	3	6	19
Digitaria horizontalis	Poaceae	0	1	6	1	0	0
Eleusine indica	Poaceae	8	2	0	1	0	0
Ipomoea involucrata	Convolvulaceae	0	0	0	1	0	0
Kyllinga pumila	Cyperaceae	0	4	0	0	0	0
Mitracarpus villosus	Rubiaceae	3	0	1	36	30	25
Oldenlandia corymbosa	Rubiaceae	6	1	2	8	3	3
Pycreus lanceolatus	Cyperaceae	3	2	0	0	0	0
Total		**430**	**142**	**65**	**158**	**100**	**96**
Mean		**107.50**	**35.50**	**16.25**	**39.50**	**25.00**	**24.00**

3.5. Effects of different rates of Mesotrione 480g/l on sugar cane weeds dry biomass.

At the 7th day after application of herbicides, there is no significant difference between the different treatments including untreated control and manual weeding at the 5% level by the Newman-Keuls test (Table 4).

At the 15th day after herbicides application, the average herbicide effect (1 g/m2) is a reduction of 64.41% dry biomass weight compared to the untreated control. However the different rates of Mesotrione 480 SC do not differ from each other and from the control product. The manual weeding (2.38g/m2) represents a 15.30% reduction in dry biomass compared to the untreated control.

At the 30th day after application, the average herbicide effect (2.17 g/m2) is a dry biomass reduction of 70.75% compared to the untreated control. There is no significant difference between the control product and the average dose Mesotrione 400 ml/ha. However, manual weeding (1g/m2) was more effective with an 86.52% reduction of weed dry biomass compared to the untreated control.

At the 45th day after application, the same trends are observed between the different treatments at the level of 5% by Newman Keuls test. The average herbicide effect (3.85g/m²) is a 71.33% reduction in the amount of dry biomass compared to untreated control. There is no significant difference between the high and average doses of Mesotrione 480 g/l and the control product. However Mesotrione 1333.33 ml/ha is more effective with a reduction rate of 77.59% compared to the untreated control. Manual weeding represents a 63.29% reduction in dry biomass compared to the untreated control.

At the 65th day after application, there was also a significant difference between the objects. The average herbicide effect (8.77g/m2) is a 60.62% reduction of dry biomass compared to the untreated control. There is no difference between the manual weeding and Mesotrione 200 ml/ha. However Mesotrione 1333.33 ml/ha appears to be the most efficient with a reduction of 68.84% compared to the untreated control and of 41.34% compared to the manual weeding

Table 4: Affects of different rates of Mesotrione 480 g/l on the weight of sugar cane weeds dry biomass (g/m²).

Treatments	Observations periods (DAA = Day After Application)													
	7		15		30		45		65		90		120	
	No trans.	After √x+1	No trans	After √x+1	No trans.	After √x+1	No trans	After √x+1	No trans	After √x+1	No trans.	After √x+1	No trans	After √x+1
Control	0.00	**1.00**	7.12	**2.81a**	63.63	**7.42a**	187.53	**13.43a**	519.23	**22.27a**	581.25	**22.63a**	268.05	**16.35a**
Manual weeding	0.00	**1.00**	5.04	**2.38b**	0.00	**1.00d**	24.79	**4.93b**	159.67	**11.83b**	113.12	**9.90b**	8.79	**3.12d**
Chlorim-Ethyl 250g/ha	0.00	**1.00**	0.00	**1.00c**	4.97	**2.17c**	10.16	**3.28c**	61.80	**7.75cd**	71.60	**7.53c**	34.08	**5.39c**
Mesotrione 400ml/ha	0.00	**1.00**	0.00	**1.00c**	10.78	**3.13b**	27.42	**5.12b**	147.89	**11.81b**	169.29	**12.70d**	133.41	**9.81b**
Mesotrione 800ml/ha	0.00	**1.00**	0.00	**1.00c**	3.92	**2.17c**	16.50	**3.99bc**	75.04	**8.56c**	71.13	**8.05c**	43.52	**6.14c**
Mesotrione 1333,3ml/ha	0,00	**1.00**	0.00	**1.00c**	0.53	**1.20d**	9.08	**3.01c**	66.45	**6.94d**	59.37	**7.14c**	31.56	**5.07c**
Mean		**1.00**		**1.53**		**2.85**		**5.63**		**11.53**		**11.33**		**7.65**
CV (%)		**0.00**		**17.30**		**12.10**		**11.20**		**6.80**		**9.10**		**9.60**
S.e.d (df =15)		**0.00**		**0.27**		**0.34**		**0.63**		**0.78**		**1.03**		**0.74**
e.s.e (Sx)		**0.00**		**0.13**		**0.17**		**0.32**		**0.39**		**0.51**		**0.37**

At the 90th day after application, the average herbicide effect (8. 86 g/m^2) is a reduction of 60.84% in comparison with the untreated control. There is no significant difference between Mesotione 400 ml/ha, Mesotrione 1333.33 ml/ha, and Chlorimuron-ethyl 250g/ha. However Mesotrione 1333.33 ml/ha is the most efficient with a dry biomass reduction rate of 68.45% compared to the untreated control and of 27.88% compared to manual weeding. The control product, on the other hand, had a reduction in dry biomass weight of 66.73% compared to the untreated control.

At the 120th day after herbicides application, the average herbicide effect (6.60 g/m^2) is a reduction of 59. 63% compared to the untreated control. There is no significant difference between the average, the high doses of the tested product and with the control product. However Mesotrione 1333.33 ml/ha is the most efficient with a dry biomass reduction of 69.00% compared to the untreated control.

3.6. Biological efficiency coefficients of the different rates of Mesotrione 480 g/l according to weeds dry biomass.

The manual weeding coefficients varied from 8.27 to 100 with an average of 68.12 (Table 5).

The coefficients of chlorimuron - ethyl varied from 84.03 to 100 with an average of 92.41. Those of Mesotrione 400 ml/ha dose varied from 50.23 to 100 with an average of 74.82. The coefficients of Mesotrione 800 ml/ha varied from 74.07 to 100.00 with an average of 78.44.

The coefficients of Mestrione 1333.33 ml/ha varied from 85.73 to 100 with an average 92.57.

Table 5: Biological efficiency coefficients of the different rates of Mesotrione 480 g/l according to weeds dry biomass.

Treatments	**Observations periods (DAA = Day After Application)**						
	7	**15**	**30**	**45**	**65**	**90**	**120**
Untreated control	_	_	_	_	_	_	_
Manual weeding	100.00	29.20	100.00	61.05	69.25	80.54	96.72
Chlorimuron-ethyl 250 g/ha	100.00	100.00	92.18	84.03	88.10	87.68	87.29
Mesotrione 400 ml/ha	100.00	100.00	83.06	56.91	71.52	70.88	50.23
Mesotrione 800 ml/ha	100.00	100.00	93.84	74.07	85.55	87.76	83.76
Mesotrione 1333,3 ml/ha	100.00	100.00	99.17	85.73	87.20	89.79	88.22

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3.7. Effects of different doses of Amazing 480 SC on sugar cane tillers development.

Seedling emergence occurred around the 15th day of observation. At this stage, the average effect of herbicides (10.99 tillers / m^2) corresponds to an increase of 33.21% in tillers compared with the untreated control and 12.72% compared to manual weeding. There is no significant difference between the low and high doses of the experimented product (Table 6).

At the 30th day, the average effect of herbicides (17.69 tillers / m^2) corresponds to a 24.14% increase of tillers compared to the untreated control. There is not a significant difference between all treatments and the control except the recommended dose which shows a tillers increase rate of 40.35% compared to the untreated control.

At 45th day, the average effect of herbicides (36.81 tillers / m^2) corresponds to an increase of 116.53% compared to the untreated control. Mesotrione 800 ml/ha and 1333.33 ml/ha got the largest numbers of tillers respectively 39.25 m^2 and 40.00 tillers / m^2. The manual weeding which is not different with Chlorimuron-ethyl showed an increase of 94.12% in comparison with the untreated control.

At 65th day the average effect of herbicides (48.19 tillers / m^2) is an increase of 109.52 % compared to the untreated control. The high dose of Mesotrione 480 SC and the control product showed the highest number of tillers (49.75 tillers / m^2), which corresponds to an increase of 116.30% compared to the untreated control.

Table 6: Effects of Mesotrione 480 g/l different rates on sugar cane development (tillers/m²).

Treatments	Observations periods (DAA = Day After Application)				
	7	15	**30**	**45**	**65**
Untreated control	0.00	8.25 a	14.25 c	17.00 d	23.00 c
Manual weeding	0.00	9.75 b	16.00 b	33.00 c	43.50 b
Chlorimuron - ethyl 250 g/ha	0.00	9.50 b	16.75 b	33.00 c	49.75 a
Mesotrione 400 ml/ha	0.00	12.00 c	17.00 b	35.00 b	47.00 ab
Mesotrione 800 ml/ha	0.00	10.75 d	20.00 a	39.25 a	46.25 ab
Mesotrione 1333.3 ml/ha	0.00	11.75 c	17.00 b	40.00 a	49.75 a
Mean	0.00	10.33	16.83	32.88	43.21
CV(%)	0.00	5.80	6.80	4.50	4.60
S.e.d (df =15)	0.00	0.60	1.15	1.49	1.98
e.s.e (Sx)	0.00	0.30	0.60	0.75	0.99

3.8. Effects of the different rates of Mesotrione 480 g/l on sugar cane yield components and yield.

The manual weeding showed an increase in the number of machinable rods by 54.64% compared to the untreated control (Table 7).

Mesotrione 400 ml / ha, for its part, showed a machinable cane increase of 42.14% compared to the untreated control. Mesotrione 800 ml / ha led 55.64%. The higher rate of Mesotrione is an increase of 60.76% over the untreated control. This is not so different with Chlrimuron-ethyl 250 g/ha. According to the yield, the average affect of herbicides (61.47 T/ha) is an increase of 210.30% in comparison with the untreated control and of 11.64 % in comparison with manual weeding.

Table7: Effects of Mesotrione 480 g/l different rates on sugar cane yield components and the yield.

Treatments	**Number of machinables rods (number/useful plot)**		**Yield (T/ha)**	**Quantity of extractible sugar (T/ha)**	**Sucrose content (%)**
	Without Transf.	**After √x+1**			
Untreated control	35.00	**18.96 c**	19.81 c	2.33 c	12.82 a
Manual weeding	867.25	**29.32 ab**	55.06 b	6.13 b	12.45 a
Clorimuron – ethyl 250 g/ha	938.00	**30.59 a**	61.90 ab	7.52 ab	13.28 a
Mesotrione 400 ml/ha	728.75	**29.51 ab**	55.22 b	6.46 b	12.89 a
Mesotrione 800 ml/ha	878.25	**29.51 ab**	60.85 ab	7.19 ab	13.47 a
Mesotrione 1333.33 ml/ha	938.00	**30.48 a**	67.90 a	8.29 a	13.28 a
Mean		**27.64**	53.50	6.32	13.03
CV (%)		**5.40**	9.80	13.20	3.70
S.e.d (df =15)		**1.48**	5.24	0.84	0.48
e.s.e (Sx)		**0.74**	2.62	0.42	0.24

Between Chlorimuron –ethyl 250 g/ha, mesotrione 800 ml/ha and Mesotrione 1333,33 ml/ha there is no significance difference and they led to a yield icrease of 212,47%; 207,17 % and 242.76 % respectively. There are the same trends according to the quantity of extractible sugar. The average affect of herbicides (7.37 T/ha) is an increase of 216, 31 % in comparison with untreated control. Between Chlorimuron –ethyl 250 g/ha, mesotrione 800 ml/ha and Mesotrione 1333, 33 ml/ha there is no significant difference and they led to a quantity of extractible sugar increase of 222. 75%; 208.58 % and 255.79 % respectively. According to sucrose content criteria there is no significant difference between the studied objects.

3.9. Correlations between some studied parameters.

Studied Correlations between the number of weeds and the number of machinable canes; between the weeds dry biomass and the number of machinable canes at the 30th and at the 90th days after herbicides application, clearly show that the yield of sugarcane decreases when weeds increase in number and weight of weeds dry biomass (Figure 1, 2, 3, 4).

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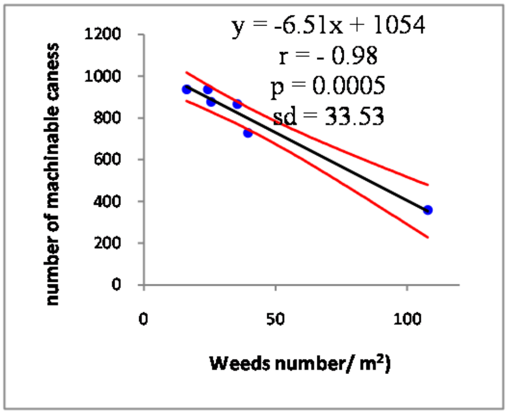
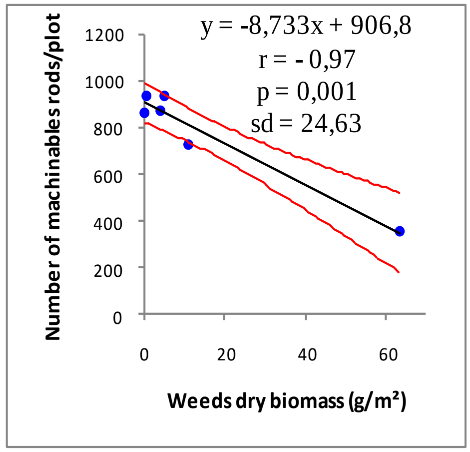
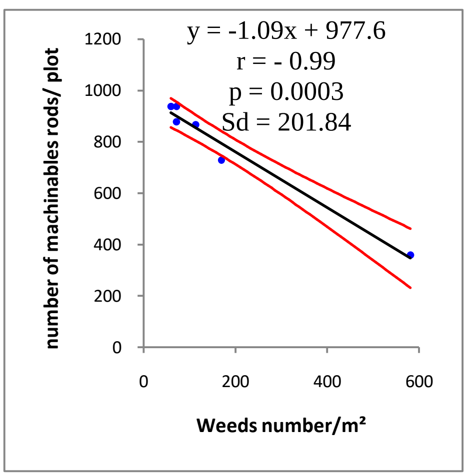
Figure 1: correlation between the number of weeds and the number of machinables canes at 30th day.

Figure 2: correlation between weeds dry biomass and the and number of machinables canes at 30th day.







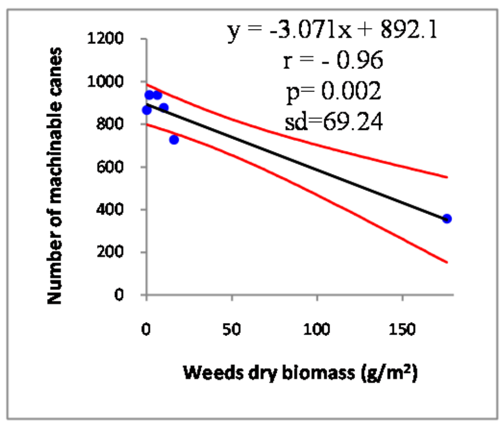


Figure 3: correlation between the weeds number and the number of machinables canes at 90th day

figure 4: correlation between weeds dry biomass and the number of machinables canes at 90th day.

4. DISCUSSION

The results of this study, however, did not reveal cases of mesotrione phytotoxicity on sugar cane. This show that this sugar cane variety has some enzymes which are able to degraded Mesotrione active ingredients. Weeds negatively affect the sugar cane yield (CIRAD 2005).

This negative affection, as shown by the correlations between some studied factors and the number of machinable rods, begins at the 30th day after application and extends until 90th day after application. The correlations between the studied factors (numbers of weeds, dry biomass of weeds) and the yield components as machinables rods gave negative coefficients correlation at the 30th, 90th day after herbicides application. These results are in line with those of Antoir *et al*, (2016) who, after conducting trials, to evaluate the weed's harmful effects on sugar cane yields in the Reunion island, stated that, from the second month of cultivation when a plot is totally grassed, the loss of cane yield is 300 kg to 500 kg / ha / day; a loss of 9 to 15 T / ha for one month of weeding delay. These same tests showed that after four months, if the canopy is closed, the emergence of new weeds no longer affected sugarcane production. Marion *et al*. (1991); Marnotte *and al.* (2008) showed that sugar cane is very vulnerable to weeds during the first months of cultivation until the closure of the canopy, with yield losses of up to 15 T/ month of competition.

The more or less slow recovery of weeds (15th day after application) may be due in part to the quality of the plowing performed but especially to the long duration of action and the efficiecy of herbicides. Indeed Mesotrione is a herbicide that belongs to the family of Callistemones. The active ingredient has a foliar activity, root, anti-germinative and is transferred quickly into the plant by root system. It works by blocking the HPPD enzyme in the chloroplasts which causes a bleaching of these weeds. It is effective on a broad range of broadleaf weeds as well as on some annual grasses (ACTA, 2014). These herbicides have significantly reduced the number of weeds in the plots, as showed by the weeds reduction that have ranged from 62.01 to 100%. The same is true for dry biomass weeds. However, some weed species as *Ageratum conyzoides, Mitracarpus villosus* and *Commelina benghalensis* have not been destroyed by these herbicides. This could be due to a resistance effect of these weeds on herbicides. The Bourgeois *et al.* (2002) explain this situation on the one hand, by the fact that these species are not part of the efficiency spectrum of the product used and on the other hand, by the fact that some individuals of these species have not affected by the product at the time of spraying. These results are increased by a CIRAD test network set up on the island of REUNION in 2005, which tested the efficiency of several active ingredients including mesotrione on sugar cane. Their results show relative resistance of some weeds as *Bidens pilosa* and *Ageratum conyzoides*. The excess yield of Chlorimuron –ethyl 250 g / ha, control product (+ 5.70%) over the recommended rate of Mesotrione 800 ml / ha could be explained by the fact that, unlike Mesotrione where three (3) species of weeds were resistant, Chlorimuron ethyl of the family of sulfenylureas was effective against most species present except two namely *Ageratum conyzoides* and *Commelina benghalensis.* This has allowed him to reduce the incidence of competition of these weeds from cane plants, on the occupation of space and the removal of nutrients from the soil. For this purpose, Spanisha *et al.* (2017) propose that beyond its broad spectrum of action, mesotrione should be supplemented with other active ingredients to obtain a broader spectrum controlling both, the main dicotyledons and grasses. Nevertheless, the different rates of mesotrione made it possible to obtain an excess of machinable rods ranging from 42.14 to 60.67% and yieds increase in comparison to the untreated control.

5.CONCLUSION

The different herbicides applied negatively affected the development of weeds as well as the weight of their dry biomass. Some weeds such as broadleaf weeds have been greatly reduced, while others have shown some resistance to the image of *Ageratum conyzoides*, *Mitracarpus villosus* and *Commelina benghalensis*. The different doses of Amazing 480 SC studied were also not phyto-toxic for sugar cane plants. In addition, these different doses had a positive impact on the yield components, thus making it possible to obtain 42.14% surplus of machinable canes at a dose of 400 ml/ha, and 55.64% at the recommended dose (Amazing 800 ml/ha) and 60.76% at the higher dose (Amazing 1333.33 ml / ha) compared to the untreated control. Amazing 480 SC, for reasons of economic profitability could therefore be applied at the rate of 800 ml/ ha.

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