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Evaluation of Sulfonyl-Urea Herbicides for the Control of Itch Grass (*Rottboelia cochinchinensis* Clayton) on Grain Sorghum (*Sorghum bicolor* (L.) Moench) in Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author DBI conceived and designed the experiment. Author SHS laid out and establish the experiment on the field. Authors DBI and HC collected the data from the field while author MH did the statistical analysis of the data collected from the field. All authors read and approved the final manuscript.

Research Article

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ABSTRACT

Aims: To address the problem of low yield due to infestation of Itch grass (Rottboelia cochinchinensis).
Study Design: Randomized Block Complete Design (RCBD).
Place and Duration of Study: Two trials were conducted during 2010 and 2011 raining seasons on the farm of the Institute for Agricultural Research, Ahmadu Bello University, Samaru in Northern Nigeria.
Sample: Department of Agronomy, Faculty of Agriculture/Institute for Agricultural Research, Samaru Zaria, between June to December, 2010 and 2011.
Methodology: The experiment consisted of nine different doses of Sulfonyl-urea herbicides and Pendimenthalin which consisted of Cinosulfuron (Setoff) and Prosulfuron (CGA 152'005) each at 0.40, 0.60, 0.80 and 1.00kg a.i/ha all compared against Pendimenthalin which is the standard herbicide known for controlling itch grass in the Nigerian savanna at 2.5kg a.i/ha and a hoe-weeded control at 3, 6 and 9 WAS as well as a

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weedy control. There were a total of eleven treatments in the experiment; all were laid out in a Randomized Complete Block Design (RCBD) replicated three times. The gross and net plot sizes were 24.0m2 and 22.5m2, respectively. Sorghum seeds (variety SAMSORG 14) were sown on ridges 75cm at an intra-row spacing of 25cm. Five seeds were sown per hole and later thinned to one plant per stand at 10 days after sowing (DAS). The herbicides were applied using a conventional CP 15 knapsack sprayer at a pressure of 2.1kg/cm2 and discharge rate of 240L/ha. The herbicides were applied at pre- emergence at one day after sowing (DAS) the crop.
Fertilizers as 30KgN, 13KgP and 25kg K were applied same day as sorghum was sown. A second dose of 30kg N/ha was applied at 6 WAS. Weeding was done to the hoe-weeded control plot using manual hoe at 3, 6 and 9 WAS, which is the farmer's practice in the northern Guinea savanna ecological zone of Nigeria. The crop was harvested by cutting the stem at ground level with a hand hoe and the panicles were later cut off the stems and threshed on the floor. The grains were winnowed to remove chaff and cleaned grains were then obtained. The data collected were on crop stand counted, itch grass cover score using a scale of 1 to 9, cumulative itch grass dry weight, cumulative general weed dry weight and grain yield of sorghum.
Results: Among the various rates of the herbicides evaluated, application of 0.60kg a.i/ha of Cinosulfuron and 0.60 – 0.80kg a.i/ha of Prosulfuron gave better itch grass control, weed suppression, growth and yield of sorghum that were comparable to the hoe weeded control.
Conclusion: It can be concluded that, the 0.60kg a.i/ha dose of both herbicides which was the most economically efficient, can be adopted as an alternative to manual hoe-weeding of itch grass in Nigeria.

Keywords: Weed; herbicides; control; maize; sulfonyl-urea.

1. INTRODUCTION

Sorghum (*Sorghum bicolor* L.) is native to Africa, where they have been cultivated since ancient time. It ranks fifth in importance among the world cereals after wheat, rice, maize and barley [1]. It is however the second most important cereal crop after maize in Nigeria which occupy about 45% total land devoted to cereals production (Shebayan, 2002) [2]. It is the staple food for millions of people in the continent of Africa and Asia because it well adapted to growth in hot and semi-arid regions [3].

In Nigeria, weed infestation is the greatest limiting factor of Sorghum production. This is because an average yield reduction due to uncontrolled weed growth in sorghum is between 60 to 80% loss in the potential yield [4]. Among the weed species now, the most prevalence is itch grass (Rottboelia sp.) especially in the savanna ecology. A survey on the occurrence of weed species on all the farming fields at Samaru in the northern Guinea savanna indicated that 40 – 60% of the types of weed species that ravage agricultural lands in northern Guinea savanna was itch grass (Rottboelia cochinchinensis) [4]. This high infestation of itch grass in almost all the farmer's fields has caused vast areas of land to be completely abandoned by farmers. This is because both farmers and laborers do refuse entry into fields infested by this weed species to work because of its itching effect that ultimately causes a skin disease known as Inflammatory Dermatitis and thereby reducing land area put under agricultural crop cultivation [5]. Since the control of this weed using manual hoe-weeding which is the most prevalent method of weed control in Nigeria is

impracticable due to itching and skin disease effect. Therefore a better control method of this weed which is threatening food production and health of farmers in Nigeria, must be invented in order to improve the productivity of sorghum as well as to reclaim all abandoned lands due to this weed to be able to cultivate the reclaimed lands. Chemical weed control of itch grass which requires less labour, it is also less tedious, without any drudgery and less risk to human health, may serve as the best alternative of controlling this weed. It is in view of that, that the experiment was designed with the objective of evaluating some sulfonyl-urea herbicides for the control of itch grass (Rottboelia cochinchinensis) on grain sorghum.

2. MATERIALS AND METHODS

Two field trials were conducted during the raining seasons of 2010 and 2011 to evaluate some sulfonyl-urea herbicides for the control of itch grass (*Rottboelia cochinchinensis* Clayton) in sorghum field at Samaru (11o11' N; 07o 38' E) in the northern Guinea savanna ecology of Nigeria.

The soil at the site of the experiment was sandy loam with pH of 5.8, organic carbon 66%, total Nitrogen of 0.19 and CEC of 4.9OC mole per kg.

The dominant weed species that were prevalent at the site of the trial were Rottboelia sp. Cynodon dactylon and Cyperus esculentus but *Rottboelia cochinchinensis* was the most dominant among all other species. The experiment consisted of nine different doses of sulfonyl-urea herbicides and Pendimenthalin which consisted of Cinosulfuron (setoff) and Prosulfuron (CGA 152'005) each at 0.40, 0.60, 0.80 and 1.00kg a.i/ha all compared Against Pendimenthalin which is the standard herbicide known for controlling itch grass in the Nigerian savanna at 2.5kg a.i/ha and a hoe-weeded control at 3, 6 and 9 WAS as well as a weedy control. There were a total of eleven treatments in the experiment, all were laid out in a Randomized Complete Block Design (RCBD) replicated three times. The gross and net plot sizes were 24.0m2 and 22.5m2, respectively. Sorghum seeds (variety SAMSORG 14) were sown on ridges 75cm at an intra-row spacing of 25cm. Five seeds were sown per hole and later thinned to one plant per stand at 10 day after sowing (DAS).

The herbicides were applied using a conventional CP 15 knapsack sprayer at a pressure of 2.1kg/cm2 and discharge rate of 240L/ha. The herbicides were applied at pre-emergence at one day after sowing (DAS) the crop.

Fertilizer as 30kg N, 13kg p and 25kg k were applied same day as sorghum was sown and a second dose of 30kg N/ha was applied at 6 WAS.

Weeding was done to the hoe-weeded control plot using manual hoe at 3, 6 and 9 was, which is the farmer's practice in the northern guinea savanna ecological zone of Nigeria. The crop was harvested by cutting the stem at ground level with a hand hoe and the panicles were later cut off the stems and threshed on the floor. The grains were winnowed to remove chaff and cleaned grains were then obtained.

The data collected were:

2.1 Crop Stand Count

This was taken by counting the number of crop stands in the net plot at 3 WAS and at harvest.

2.2 Crop Vigour Score

This was assessed visually using a scale of 1 to 9 where, 1 represented completely death plants and 9 represented the most vigorous plants at 6 and 9 WAS. The features used were size of stem, greenness of the leaves and size of the leaves.

2.3 Itch Grass Cover Score

This was also assessed only for itch grass visually, using a scale of 1 to 9 where, 1 represented plots without itch grass and 9 represented plots completely covered with the weed species.

2.4 Cumulative Itch Grass Dry Weight

This was taken from the itch grass weed samples at random in 1 x 1m quadrant from each plot. The weed samples were oven dried to a constant weight at 70oc before weighing.

2.5 Cumulative General Weed Dry Weight

This was also taken from all weed samples present on the field at random in 1 x 1m quadrant from each plot. The general weed samples were dried in an oven to a constant weight at 70oc before weighing.

2.6 Grain Yield

This of sorghum was taken by measuring the sorghum grains obtained from each net plot on a mettler balance after threshing and winnowing in the air. All data collected were subjected to analysis of variance and the treatment means were separated using Duncan Multiple Range Test.

3. RESULTS AND DISCUSSION

3.1 Effect of Sulfonyl-urea Herbicides on Growth of Sorghum

3.1.1 Effect of sulfonyl-urea herbicides on crop stand count of sorghum

The results in Table 1 show that, the application of Cinosulfuron and Prosulfuron significantly influenced the crop stand count of sorghum at 2 weeks after sowing (WAS) and at harvest. The application of 0.60 to 1.00kg a.i/ha of Cinosulfuron and also Pendimenthalin at 2.5kg a.i./ha resulted in higher crop stand count of sorghum than the lowest dose (0.40kg a.i/ha) of Cinosulfuron and the weedy control at 2 WAS, but were comparable to all the doses of Prosulfuron in both the years.

Table 1. Effect of sulfonyl-urea herbicides on the crop stand count of sorghum in 2010 and 2011 raining seasons at Samaru, Nigeria

Treatments	Rate in kg a.i/ha	Crop Stand Count of Sorghum					
		At 2 WAS*			At Harvest		
		2010	2011	Mean	2010	2011	Mean
Cinosulfuron	0.40	74.0b*	84.0b	79.0b	75.0b	84.0c	79.5bc
Cinosulfuron	0.60	81.7a	91.7a	86.7a	79.0ab	78.0d	78.5bc
Cinosulfuron	0.80	81.7a	90.3a	86.0a	79.0ab	90.3ab	84.7ab
Cinosulfuron	1.00	79.3a	89.7a	84.5ab	79.0ab	88.7ab	83.9ab
Prosulfuron	0.40	78.3ab	87.0ab	82.7ab	78.3ab	87.0abc	82.5ab
Prosulfuron	0.60	76.3ab	86.0ab	81.2ab	76.3ab	85.0bc	82.7ab
Prosulfuron	0.80	76.7ab	86.0ab	81.3ab	76.7ab	85.5bc	80.9bc
Prosulfuron	1.00	74.3ab	84.0ab	79.2b	70.3b	84.0c	77.2c
Pendimenthalin	2.5	79.3a	91.0a	85.2ab	78.3ab	91.0a	84.5ab
Hoe-weeded control at	3, 6 and 9 WAS	81.7a	91.0a	86.4a	80.7.a	90.0ab	85.4a
Weed Control		70.7b	70.3b	70.5c	61.7b	58.3e	60.0d
S.E. ±		2.46	2.31	2.38	1.99	2.01	1.99

** WAS = Weeks after sowing*

**Mean in a column of any set of treatments followed by unlike letter(s) are significantly different at P= .05 Using DMRT.*

Similarly, the application of higher doses of (0.80-1.00kg a.i/ha) of Cinosulfuron and 0.60kg a.i/ha of Prosulfuron resulted in more crop stand count than 0.40kg a.i/ha of Cinosulfuron and Prosulfuron at 0.80-1.00kg a.i/ha at harvest in 2011 and the mean. The weed control gave the least crop stand count of sorghum compared with all other herbicide treatments evaluated at the same sampling period and years (Table 1).

The more stand count due to higher rates of the herbicides is a clear indication that the sorghum crop was able to overcome the initial phytotoxicity induced by the herbicides on the crop at a later stage of the crop growth while, the low stand count due to lower rates indicated that they were not good enough to control weed. Hence the loss in some stands of the crop due to weed infestation.

3.1.2 Effect of sulfonyl-urea herbicides on the crop vigour score of sorghum

The application of both Cinosulfuron and Prosulfuron was significant on the crop vigour score of sorghum (Table 2).

At 6 WAS, the application of 0.40 and 0.60kg a.i/ha resulted in better crop vigour score of sorghum than Prosulfuron at 0.40 and the weedy control in 2010. Also the same doses (0.40 and 0.60kg a.i/ha) of both Cinosulfuron and Prosulfuron gave better crop vigour score of sorghum than the weedy control in 2011 and the mean data, but were statistically at par with all other herbicide treatments evaluated.

Similarly at 9 WAS, the application of the same doses of 0.40 and 0.60kg a.i/ha of Cinosulfuron resulted in better crop vigour score than 1.00kg a.i/ha of Prosulfuron and the weedy control, but were statistically the same with all other herbicide treatments and the hoe-weeded control in both 2010 and the mean data (Table 2). The better crop vigour due the application of 0.40 and 0.60kg a.i./ha of Cinosulfuron was a clear indication that the crop tolerated these doses of the herbicides than the most injured higher rate of Prosulfuron. The results also confirmed the earlier report of [6] that, after application of Cinosulfuron and Prosulfuron at 40g a.i/ha on rice, chlorosis and necrosis symptoms were initially noticed on the plants but were overcome at a later stage of the crop growth.

3.2 Effect of Sulfonyl-urea Herbicides on Weed Infestation of Sorghum

3.2.1 Effect of sulfonyl-urea herbicides on weed cover score of itch grass

Table 3 show that, the influence of the application of both Cinosulfuron and Prosulfuron was significant on the cover score of itchgrass. in both the years.

At 6 WAS, application of all doses of both Cinosulfuron and Prosulfuron with the exception of only 0.40kg a.i/ha of Cinosulfuron, gave lower weed cover score of itch grass than the weedy control in 2010 and the mean data. The hoe-weeded control at 3, 6 and 9 WAS also gave lower itch grass cover score than the weedy control.

At 9 WAS, similar results were obtained during which the application of all doses of both Cinosulfuron and Prosulfuron with the exception of only 0.40kg a.i/ha resulted in higher itch grass cover score than the weedy control in 2010 and the mean data. In 2011 however, it was the application of 0.40kg a.i/ha of both Cinosulfuron and Prosulfuron that gave higher itch grass cover score than all other herbicide treatments but were statistically at par with 0.60kg a.i/ha of Prosulfuron and the weedy control (Table 3). The results show clearly that,

application of all herbicides reduced the infestation of itch grass than the weedy control. The weed suppression by all the herbicide treatments applied when compared with the weedy control was a clear indication that the sulfonyl-urea herbicides were able to suppressed weeds including *Rottboelia cochinchinensis* during the trials. This results corroborates the earlier findings by Valverde et. al. [7] who reported that, sulfonyl-urea herbicides (Cinosulfuron and Nicosulfuron) applied at 0.40kg a.i/ha controlled itchgrass (Rottboelia sp.) and *Sorghum halepense* in maize field.*

3.2.2 Effects of sulfonyl-urea on itch grass cumulative dry weight

The effect of application of Cinosulfuron and Prosulfuron was significant on the itch grass cumulative dry weight of sorghum (Table 4). At 6 WAS, application of all doses (0.40 – 1.00kg a.i/ha) of both Cinosulfuron and Prosulfuron and the hoe-weeded control treatment, resulted in lower itch grass cumulative dry weight than the weedy control in both years and the mean. Application of higher doses of the herbicides (0./60 to 1.00kg a.i/ha) also gave lower itch grass cumulative dry weight than the lower dose (0.40kg a.i/ha) of both herbicides.

At 9 WAS however, the application of 0. 60kg a.i/ha of Cinosulfuron and all rates of Prosulfuron also gave lower cumulative itch grass dry weight in 2010 while, in 2011 the same Cinosulfuron at 0.60kg a.i./ha and the hoe-weeded control gave lower itch grass cumulative dry weight than the weedy control (Table, 4). The itch grass dry weight suppression due to the application of the herbicides especially the higher doses, corroborates the earlier findings by Valverde *et. al*., (2010)[7] who reported that, sulfonyl-urea herbicides (Cinosulfuron and Nicosulfuron) applied at 0.40kg a.i/ha controlled itchgrass (Rottboelia sp.) and *Sorghum halepense* in maize field.

3.2.3 Effect of sulfonyl-urea herbicides on the general cumulative weed dry weight of sorghum

Table 5 show that the influence of the application of both Cinosulfuron and Prosulfuron was significant on the general weed cumulative weed dry weight of sorghum in both 2010 and 2011.

The application of 1.00kg a.i/ha of Cinosulfuron in both years as well as 0.60 – 0.80kg a.i/ha of Prosulfuron in 2010 resulted in lower general weed cumulative dry weight compared with the weedy control.

All other herbicide treatments evaluated gave similar general weed cumulative dry weight of sorghum with the weedy control (Table 5). The better suppression of general weeds dry weight in the trials due to application of 0.60kg a.i/ha of Cinosulfuron and 0.60 – 0.80kg a.i/ha of Prosulfuron indicated that, these two doses suppressed the weeds better in the sorghum field. The results also is in line with the earlier report of [8] that, application of Cinosulfuron at 10 to 40kg a.i/ha controlled weeds like *Cynodon dactylon*, *Cyperus rotundus,* Sida acuta, *Commelina benghalensis* and Rottboelia spp.

Table 2. Effect of sulfonyl-urea herbicides on the crop vigour score of sorghum in 2010 and 2011 wet seasons at samaru

Treatments	Rate in kg a.i/ha	*Crop Vigour Score of Sorghum					
		At 6 WAS*			At 9 WAS		
		2010	2011	Mean	2010	2011	Mean
Cinosulfuron	0.40	6.33a	7.33a*	6.83a	8.00a	8.33ab	8.17a
Cinosulfuron	0.60	6.33a	8.00a	7.17a	8.00a	9.00a	8.50a
Cinosulfuron	0.80	5.67ab	7.00ab	6.34ab	7.67ab	8.67ab	8.17a
Cinosulfuron	1.00	5/67ab	7.00ab	6.34ab	6.33ab	8.00ab	7.17ab
Prosulfuron	0.40	5.00b	8.00a	6.50ab	6.00ab	8.33ab	7.17ab
Prosulfuron	0.60	7.00a	7.33a	7.17a	7.33ab	8.33ab	7.83ab
Prosulfuron	0.80	5.67ab	7.00ab	6.34ab	7.00ab	8.00ab	7.50ab
Prosulfuron	1.00	5.00ab	4.33b	5.67ab	6.00b	6.00abc	5.00b
Pendimenthalin	2.5	7.00a	7.00ab	7.00a	8.00a	7.33ab	7.67ab
Hoe-weeded control at	3, 6 and 9 WAS	7.0-0a	7.00ab	7.00a	8.00a	8.00ab	8.00a
Weed Control		5.00b	4.00b	4.50c	6.00ab	4.33c	5.17b
S.E. ±		0.503	0.927	0.715	0.735	1.108	0.922

**WAS = Weeks after sowing;*

**Crop vigour score using a scale of 1 to 9 where 1 = death plants and 9 = most vigorous plants.*

**Mean in a column of any set of treatments followed by unlike letter(s) are significantly different P=.05 using DMRT.*

Table 3. Effect of sulfonyl-urea herbicides on the rottboelia sp. cover score of sorghum in 2010 and 2011 wet seasons at samaru

Treatments	Rate in kg a.i/ha	*Rottboelia Sp. Cover Score					
		At 6 WAS*			At 9 WAS		
		2010	2011	Mean	2010	2011	Mean
Cinosulfuron	0.40	4.60a*	1.67ab	2.64b	6.00ab	4.50ab	5.25ab
Cinosulfuron	0.60	1.33ef	1.00b	1.17d	4.00cd	2.33c	3.17c
Cinosulfuron	0.80	1.60d-f	1.00b	1.30d	4.67bc	2.60c	3.64c
Cinosulfuron	1.00	1.67de	1.00b	1.34d	4.00cd	2.67c	3.34c
Prosulfuron	0.40	2.67b	1.33ab	2.00bc	5.33b	3.67ab	4.50b
Prosulfuron	0.60	2.33bc	1.33ab	1.83cd	2.67d	3.33b	3.00c
Prosulfuron	0.80	1.33ef	1.00b	1.17d	3.00cd	2.33c	2.67cd
Prosulfuron	1.00	1.33ef	1.00b	1.17d	3.00cd	2.33c	2.67cd
Pendimenthalin	2.5	1.00f	1.00b	2.00bc	2.00f	2.00c	2.00d
Hoe-weeded control at	3, 6 and 9 WAS	2.00cd	1.00b	1.50cd	1.00g	3.00bc	2.00d
Weed Control		4.33a	2,67a	3.50a	6.33a	5.33a	5.83a
S.E. ±		0.312	0.152	0.232	0.351	0.312	0.332

**Rottrboelia Sp. cover score using a scale of 1 to 9 where 1 = no Rottboelia Sp. and 9 = completely covered by Rottboelia Sp.*
**WAS = week after sowing*
**Mean in a column of any set of treatments followed by unlike letter(s) are significantly different at P=0.05 using DMRT*

Table 4. Effect of Sulfonyl-Urea Herbicides on the Rottboelia Cumulative Weed Dry Weight (g/m^2) of Sorghum in 2010 and 2011 Wet Seasons at Samaru

Treatments	Rate in kg a.i/ha	Rottboelia Cumulative Weed Dry Weight (g/m^2)					
		At 6 WAS*			At 9 WAS		
		2010	2011	Mean	2010	2011	Mean
Cinosulfuron	0.40	94.0b*	81.0b	87.5b	149.3ab	122.3a	135.8ab
Cinosulfuron	0.60	67.0d	70.0c	53.5d	118.3b	104.7b	112.5ab
Cinosulfuron	0.80	72.0cd	77.0b	74.5b	126.8ab	114.7ab	120.8ab
Cinosulfuron	1.00	61.0d	72.0b	66.5c	120.0b	112.0ab	116.0ab
Prosulfuron	0.40	94.0bc	88.0b	90.0b	148.0ab	118.7ab	133.4ab
Prosulfuron	0.60	69.0d	71.0b	70.0bc	120.0b	114.7ab	117.4ab
Prosulfuron	0.80	61.0d	70.0b	65.5c	109.7b	113.3ab	111.5ab
Prosulfuron	1.00	61.0d	71.0b	66.0c	102.3b	112.0ab	107.2ab
Pendimenthalin	2.5	35.0e	40.0c	37.5d	63.3b	93.3b	78.3b
Hoe-weeded control at	3, 6 and 9 WAS	36.0e	45.0c	40.5d	72.7b	93.3b	83.0b
Weed Control		151.0a	149.0a	150.0a	255.1a	122.7as	188.9a
S.E. ±		7.354	8.112	7.733	44.060	13.779	28.919

WAS = week after sowing Mean in a column of any set of treatments followed by unlike letter(s) are significantly different at P=.05 using DMRT.

Table 5. Effect of Sulfonyl-Urea Herbicides on the Cumulative General Weed Dry Weight (g/m^2) of sorghum at 9 WAS in 2010 and 2011 Wet Seasons at Samaru

Treatments	Rate in Kg a.i./ha	Cumulative general weed dry weight (g/m^2)		
		2010	2011	Mean
Cinosulfuron	0.40	700.6ab[2]	519.3ab	609.7ab
Cinosulfuron	0.60	566.7ab	401.0ab	483.5ab
Cinosulfuron	0.80	700.0ab	370.3ab	535.2ab
Cinosulfuron	1.00	366.7b	284.7ab	325.7b
Prosulfuron	0.40	566.7ab	464.0ab	515.4ab
Prosulfuron	0.60	366.7b	393.3ab	380.0ab
Prosulfuron	0.80	733.7b	504.0ab	618.7ab
Prosulfuron	1.00	533.3ab	429.3ab	481.3ab
Pendimenthalin	2.5	566.0ab	233.3b	399.7ab
Hoe-weeded control at	3, 6 and 9 WAS[1]	533.0ab	230.0b	381.5ab
Weedy Control		866.7a	546.3a	706.5a
S.E. ±		133.94	85.82	109.88

**WAS = week after sowing;*

**Mean in a column of any set of treatments followed by unlike letter(s) are significantly different at P=.05 using DMRT.*

3.4 Effect of Sulfonyl-urea Herbicides on the Grain Yield of Sorghum

The application of the sulfonyl-urea herbicides, Cinosulfuron and Prosulfuron significantly influenced the grain yield of sorghum in both the years (Table 6).

Application of 60kg a.i/ha of both Cinosulfuron and Prosulfuron resulted in better grain yield of sorghum than 0.40kg a.i/ha of Cinosulfuron and Prosulfuron at 0.80 to1.00kg a.i/ha as well as the weedy control but was comparable to all other herbicide treatments and the hoe weeded control in 2010 and the mean. This is probably due to the fact that, the lowest dose (0.40kg a.i/ha) of the herbicides was not sufficient dose in controlling weeds while the higher rates induced serious initial phytotoxicity on the crop which the plants couldn't recover at the later stage of their growth. It was clearly shown that 0,60kg of the herbicides has however better suppressed weeds including Rottboelia sp. and therefore inhibited weed interference with the crop and thus resulted in more grain yield of the sorghum than the lowest dose of 0.40kg a.i/ha. This results also is in line with the earlier report of [9] that, application of higher rates (0.40 – 0.60kg a.i/ha) of Cinosulfuron in rice gave significantly higher paddy rice yield than the lower rates (0.10 to 0.30kg a.i/ha).

The weedy control however, gave the least grain yield of sorghum than all the herbicide treatments evaluated and the hoe weeded control (Table 6). This was a clear indication of yield depression due to weed interference with the crop plants in the weedy control plot. This is also in line with the earlier report of [10] that, Prosulfuron when applied to control weed in different rice production system, suppressed weeds and gave better yield of rice compared with the weedy control plot.

Table 6. Effect of Sulfonyl-Urea Herbicides on Grain Yield of sorghum at 9 WAS in 2010 and 2011 Wet Seasons at Samaru

Treatments	Rate in Kg a.i./ha	Grain Yield of Sorghum (kg/ha)		
		2010	2011	Mean
Cinosulfuron	0.40	2691bc*	2437cd	2564b
Cinosulfuron	0.60	3991a	3603ab	3797a
Cinosulfuron	0.80	3146abc	2989bc	3068ab
Cinosulfuron	1.00	3333an	3212ab	3273ab
Prosulfuron	0.40	2636bc	2347cd	2492b
Prosulfuron	0.60	3809a	2365cd	3087ab
Prosulfuron	0.80	2135c	3423ab	2779b
Prosulfuron	1.00	2495c	3087abc	2791b
Pendimenthalin	2.5	3717a	3498ab	3608a
Hoe-weeded control at	3, 6 and 9 WAS	3836a	3792a	3814a
Weedy Control		1103d	937e	1020c
S.E. ±		284.13	259.03	271.50

**Mean in a column of any set of treatments followed by unlike letter(s) are significantly different at P=.05 using DMRT.*

4. CONCLUSION

From the results of this experiment, it can be concluded that application of 0.60kg a.i/ha of both Cinosulfuron and Prosulfuron which gave better growth, suppression of itch grass and grain yield of sorghum, can be adopted by sorghum farmers as an alternative to manual hoe-weeding for the control of itch grass (*Rottboelia cochinchinensis)* in Nigeria.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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