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OPTIMUM TIME FOR SAFE AND EFFECTIVE APPLICATION OF NICOSULFURON ON CASSAVA PLOT

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ABSTRACT: *Field experiment was carried out at the Teaching and Researching Farm of Ladoke Akintola University of Technology, Ogbomoso, Oyo State to establish the optimum time for safe and effective application of Nicosulfuron on cassava plot. There were six treatments namely: herbicide application at 3 WAP, 5 WAP, 7 WAP, 9 WAP, 11 WAP (weeks after planting), and hoe weeding as control in a Randomized complete block experiment with three replicates. The hoe weeding constituted the control treatment. Results of the experiment showed that hoe weeding produced the best response than other treatments. There was a significant difference (P = 0.05) in all parameters measured. The plants treated at advanced age were better than those treated earlier. Nicosulfuron is injurious to cassava at recommended rate in early cassava lives while the older cassava plants can tolerate it.*

KEYWORDS: Nicosulfuron, Cassava Plot, Weeding

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INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is a basic and important food crop for world food security because of its wide adaptability to marginal soil and irregular conditions that are limiting for most conventional crops (Adejebeng-Danquah & Safo-kantanka, 2013). It is a hardy crop that grows reasonably well on poor soils and in areas with low rainfall. Cassava is a popular crop among poor farmers because it requires few inputs besides labor to produce a reasonable yield. It is the second most important staple food crop after maize in terms of calories consumed (Nweke, 2004). It plays a vital role in the food economy of many African countries, including Nigeria. According to Donkor *et al*. (2017), cassava is a strategitic crop for poverty alleviation and also an essential source of industrial raw material for the production of starch. It can be processed into various secondary products such as starch, glucose syrup and alcohol. Plucknett *et al*. (2000) stated that industrially, cassava can be processed as a raw material in the coating of pharmaceutical products. It is a major source of income for rural households.

The root of sweet cassava varieties are eaten raw, roasted in an open fire, or boiled in water or oil. Dried cassava roots are stored or marketed as chips, balls and flour. Cassava leaves are edible and highly nutritious. Okigbo (1980) stated that cassava leaves contain valuable nutrients similar to other dark green vegetables. They contain proteins, iron, calcium, and vitamins A and C which help many people to compensate for the lack of protein and some minerals in the root.

Cassava production is faced with a wide range of constraints. Anikwe and Ikenganyin (2018) identified some of the constraints facing cassava production as pests and diseases, land degradation, shortage of planting material, and competition from weeds among others. Chikoye *et al*. (2001) and Ekeleme (2017) supported this by stating that poor weed control had been identified as a major cause of low yield of cassava production in Nigeria. Competition from weeds occurs at all stages of growth. Aye (2011) and Howeler (2007) stressed that weeds must be controlled in the first 1 to 3 months after planting if a good yield is expected. Akobundu (1980) and Melifonwu (1994) reported that the damaging effects of weeds on cassava occur in the first 3 to 12 weeks after planting, this being the critical stage for weed control.

Manual hoe weeding, which is labor-intensive and time-consuming, is the most common method of weed control in Nigeria. Farmers usually carry out 2 or 3 weedings at the early growth stage of cassava. These weedings, in most cases as Adigun and Lagoke (2003) put it, do not conform to the required and recommended weeding regime. Ghanessi (2010) stated that manual weeding is drudgery for farmers. This either delays work or prolongs the period of competition of weeds with the crop. The use of herbicides as an alternative weed control method in cassava production is increasingly becoming popular as it reduces the labor cost and manpower availability. Jubil (2004) stated that chemical control method is quick, more effective, time and labour saving. Various herbicides have been developed and introduced to cassava farmers. However, new products keep on evolving and being marketed with various claims of suitability, effectiveness and prices. Nicosulfuron, a selective herbicide, is becoming one of the most frequently used herbicides because of its high herbicidal activity and low application rate. It has been used to control broad-leaved weeds and sedges in cornfield at very low application rates. Since cassava is often cultivated in mixed cropping with maize, it is very essential to assess the performance of cassava on nicosulfuron treated soil and the best age of cassava as treatment point for effectiveness and crop safety.

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MATERIALS AND METHODS

Field experiment was conducted at the Teaching and Research Farm of Ladoke Akintola University of Technology, Ogbomoso, Oyo State in the southern guinea savanna zone during the rainy season of 2021 and 2022. The rainfall pattern was bimodal with peaks in June and September of the season. The soil type was sandy loam (83.7% sand, 13.4% sand and 2.2% silt). The concentrations of essential nutrients in the soil are: N (0.29), P (5.55) and K (0.46). The organic carbon content was 1.74. The temperature ranged from 25–33^{o}C with humidity above 76% all the year round except in January when the dry wind blew from the North.

Ridges were made manually after marking out on 4m x 3m plots. There were four ridges per plot replicated three times with 2m space separating the replicates. Each replicates measured 31 x 4m. The experiment was laid out in a Randomized Complete Block Design with six herbicide treatments namely: Herbicide application at 3 weeks after planting (WAP), 5 WAP, 7 WAP, 9 WAP, 11 WAP and Hoe weeding as the control treatment. The herbicide was applied post-emergently to weeds in cassava plots using the knapsack sprayer with an application rate of 3ml/litre of water. Cassava stems were obtained from LAUTECH Teaching and Research Farm. Stem cuttings of 25cm length with 4 nodes were planted at roughly 45^o and covered with soil to 2/3 of their length pointing along the crest of the ridge. Harvesting was done at 15 weeks after planting. Data were collected on the growth and yield parameters of cassava as follows: survival percentage (%) at 2 weeks after treatment, by direct counting and later conversion to percentage; plant height and length of internode at 2 weeks after treatment was measured using measuring tape; number of leaves at 2 weeks after treatment (WAT) by direct counting; number of nodes at 2 WAT by counting and the leaf area at harvesting was determined using the formular; L X B X 0.48 X number of leaves / plant, where L=length of the leaf, B=breadth (Olasantan *et al*., 1997), weed density by randomly placed quadrat of 0.25m x 0.25m at a spacing of 30cm interval, while the wet weight of the weed was measured using weighing balance. Stem diameter was measured using Venier calipers and the root weight and plant vegetative weight were measured using sensitive scale at 15 weeks after planting. Mean data collected over the two years were subjected to analysis of variance (ANOVA) and the means were compared using Duncan Multiple Range Test (DMRT) at 5% probability level.

RESULTS

Table 1: Effects of Nicosulfuron on Cassava Seedling % Survival

Treatment	% Survival
T1 3 WAP herbicide application	71.43 a
T2 5 WAP herbicide application	61.86 b
T3 7 WAP herbicide application	70.43 a
T4 9 WAP	76.14a
T5 11 WAP	85.71a
T6 Hoe Weeding	95.29a

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Means followed by the same alphabets along the same column are not significantly different (P = 0.05) DMRT. T1 = Treatment at 3 weeks after planting, T2 = Treatment at 5 weeks after planting, T3 = Treatment at 7 weeks after planting, T4 = Treatment at 9 weeks after planting, T5 = Treatment at 11 weeks after planting, T6 = Control.

Table 2: Effects of Nicosulfuron on the Growth Parameters of Cassava at 15 WAP

Treatment	PLANT HEIGHT (cm)	NO OF LEAF	STEM DIAMETER (cm)	NO OF NODES	INTERNODE LENGTH (cm)	LEAF AREA (cm^2) AT HARVESTING
T1	36.30b	15.33b	1.20b	17.67bc	1.07b	4552.64ab
T2	19.33c	12.33b	1.20b	14.33c	1.63b	1366.50b
T3	36.17b	13.67b	1.43b	22.00bc	1.87b	2900.55b
T4	31.50bc	13.00b	1.53ab	15.33c	2.93a	2149.27b
T5	36.47b	17.67b	1.50ab	25.00b	2.47a	4721.39ab
T6	67.33a	27.67a	2.00a	39.00a	2.53a	7370.41a

Means followed by the same alphabets along the same column are not significantly different (p = 0.05) DMRT.

Table 3: Effect of Nicosulfuron on Cassava Root and Vegetative Yield Parameters at 15 WAP

Treatment	ROOT WEIGHT (g)	VEGETATIVE WEIGHT (g)
T1	193.33bc	269.83c
T2	140.33c	158.50c
T3	370.33b	558.00b
T4	362.83b	478.17b
T5	310.83bc	344.00bc
T6	783.33a	931.33a

Means followed by the same alphabets along the same column are not significantly different (p = 0.05) DMRT.

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Table 4: Effects of Nicosulfuron on Weed Population and Weed Biomass at 13 WAP

Treatment	WEED POPULATION (g/m^2)	WE WEED BIOMASS (g/m^2)
T1	3.81a	32.64a
T2	3.30ab	31.34a
T3	2.96b	24.33ab
T4	2.88b	20.05ab
T5	2.96b	31.18ab
T6	2.85b	16.90b

Means followed by the same alphabets along the same column are not significantly different (p = 0.05) DMRT.

The effect of Nicosulfuron on the percentage survival of cassava seedlings at 2 WAT a is presented in Table 1. The highest percentage of survival (95.29) was obtained from the control plots, while the least (61.86) was recorded at Treatment at five weeks after planting (T2). At P = 0.05 level of significant, there was no significant difference among the treatments.

Table 2 shows the effect of Nicosulfuron on the growth parameters of cassava plant. There was significant difference in plant height across the treatments (P = 0.05). The highest plant height (67.33 cm) was obtained from the control plot while the least height (19.33 cm) was recorded from other treatments which were not significantly different (P = 0.05). The control treatment had the highest number of leaf (27.67) which is superior to other treatments which were comparable to one another. The stem diameters were not significantly different (P = 0.05) across the treatments except the control which was better significantly. The control treatment was also superior to the treatments in stem diameter, number of nodes, length of internode and leaf area respectively. However, herbicide performance at 11 weeks after treatment has similar effect on cassava length internode and leaf area. Similarly, the leaf area of cassava treated at 3 WAP was comparable to the control at harvesting.

The effect of Nicosulfuron on the cassava fresh root and vegetative yield at 15 WAP is presented in Table 3. The fresh root yield of cassava was significantly affected (P = 0.05) by the treatments. The average weight of fresh root yield at 15 WAP was higher in the control plot (783.33g) while the least was recorded in treatment at 5 WAP (140.33g). Similarly, the vegetative yield was significantly influenced (p = 0.05). The highest average vegetative yeild (931.33g) was recorded in the control plot while the least (158.50g) was observed on cassava plants treated at 5 WAP.

Table 4 shows the effects of Nicosulfuron on both the weed population and fresh weed biomass. The weed population was the highest on cassava plot treated at 3 WAP (3.81/m^2) while the least was obtained from the control plot (2.85/m^2). Similarly, the fresh weed biomass was highest (32.64 g m^{-2}) on plot treated at 3 WAP and lowest (16.90gm^{-2}) on the control plot.

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DISCUSSION

Herbicides have been reported to influence plant survival (Ndaeyo *et al.,* 2013). This might be due to the dosage and plant age at the time of application. In the present study, there was a negative influence of Nicosulfuron application on all the parameters and characteristics evaluated. This reveals that at the lower age of the cassava plant, Nicosulfuron is injurious and can be detrimental in effect on the growth of the crop. However, according to Bhowmik *et al*. (1992) and Bruce and Kelis (1997), the efficacy and effects of Nicosulfuron depends on dosage and time of application. The present results agree with the findings of Agostinetto *et al*. (2002) who reported that herbicide application can result in detrimental effects on the growth of young crops including their biomass. In similar studies carried out by Silva *et al*. (2017) and Agostinello *et al*. (2002), it was found that nicosulfuron showed high value of visual toxicity as in the case of the present study. The visual analysis showed injuries such as curling of leaves, wilting and partial chlorosis on the plot treated with Nicosulfuron. In a study, Olivera junior and Inoue (2011) had also reported that crop age affects the absorption, translocation and activity of herbicide in plants, implying that young plants are more susceptible to the damage than the older plants. Thus, it can be concluded from this study that Nicosulfuron application may not be visible in young cassava plots especially where planted sole. However, application of herbicide in older plants not younger than fifteen weeks (15 WAP) may be practicable.

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