



Yield and Yield Components of Finger Millet (*Eleusine coracana* (L) Geartn) as Influenced by Pre-Emergence Herbicides in the Northern Guinea Savanna of Nigeria

Musa Gani 

Department of Crop Production and Protection, Federal University Wukari, PMB1020, Wukari, Nigeria

Nosch Gambo Daniel

Department of Crop Production and Protection, Federal University Wukari, PMB1020, Wukari, Nigeria

Suggested Citation

Gani, M. & Daniel, N.G. (2023). Yield and Yield Components of Finger Millet (*Eleusine coracana* (L) Geartn) as Influenced by Pre-Emergence Herbicides in the Northern Guinea Savanna of Nigeria. *European Journal of Theoretical and Applied Sciences*, 1(4), 1260-1266.
DOI: [10.59324/ejtas.2023.1\(4\).115](https://doi.org/10.59324/ejtas.2023.1(4).115)

Abstract:

Two field trials were conducted during the 2011 and 2012 wet seasons at the research farm of the Institute for Agricultural Research, Ahmadu Bello University, 2012 Zaria (Lat. 11° 11'N, Long. 07° 38'E and 686m above sea level) in the northern Guinea savannah zone of Nigeria, to evaluate pre emergence herbicides for weed control in finger millet (*Eleusine coracana* (L) Geartn). The trial consisted of 14 treatments. Atrazine (80WP) at rates of (0.4, 0.8, 1.2 and 1.6 kg a.i/ha), Raft[®] (500SC) (Atrazine 250 g/l + Terbutylazine 250 g/l) at rates of (0.25, 0.5, 0.75, and 1.0 kg a.i/ha) and Bullet[®] (700SC) (Atrazine 225 g/l + Terbutylazine 225 g/l + Acetochlor 250 g/l) at rates of (0.35, 0.75, 1.05 and 1.4 kg a.i/ha),

hoe weeded control at 3 and 6 WAS and a weedy check. The treatments were laid out in a Randomized Complete Block Design (RCBD), replicated 3 times. In both years, all herbicide treatments and hoe weeded control at 3 and 6 WAS significantly increased yield components and yield, consistently across the two years, weedy check gave lower yield characters and yield. Based on the results obtained from this study, 0.8 kg a.i/ha of atrazine or 0.5 kg a.i/ha of Raft gave season long weed control over hoe weeded check in finger millet which resulted into higher grain yield.

Keywords: *Finger millet, Atrazine, Bullet and Raft.*

Introduction

Finger millet (*Eleusine coracana* L.), is one of the neglected and underutilised crops of Africa. It is extensively cultivated in the tropical and subtropical regions of Africa and India. The crop is known to save the lives of poor farmers from starvation at times of extreme drought. World finger millet production is 4.5 million tonnes, of which about 2.5 million tonnes is produced by Africa. The origin of the crop is Africa where it has been cultivated for thousands of years in the

highlands of Uganda and Ethiopia. It was introduced to India at a very early date, probably over 3000 years ago. Burkill (1985) observed that, in West Africa, finger millet is cultivated in a wide geographical zone stretching from Senegal, Niger and Northern Nigeria. In Nigeria, finger millet is grown in very few states in the northern parts of the country particularly around Southern Kaduna and plateau (Anon, 1996), which is characterized with low yield reported to due to poor agronomics practices. One of such major constraints is poor weed management



practices (Anon, 1998). A yield loss due to uncontrolled weeds in the first 7 weeks of millet growth was reported to be about 44% (Balyan et al., 1987). The traditional method of manual hoe weeding and hand pulling is no longer appealing due to challenges of drudgery, time consumption and very expensive. Therefore, there is need to carry out research on alternative weed control methods such as the use of appropriate type and dosage of pre emergence herbicide use for weed control in other cereal crops, to be evaluated on finger millet with the aim of obtaining a season long weed control for ultimate yield of finger millet in Nigeria, necessitated this research.

Materials and Methods

Two field trials were conducted during the 2011 and 2012 rainy seasons, at the research farm of the Institute for Agricultural Research (IAR), Ahmadu Bello University, 2012, Zaria. (lat. 11° 11' N, long 07° 38' E, 686m above sea level) northern Guinea savannah, ecology of Nigeria. Treatments consist of Atrazine 80WP at rate of (0.4, 0.8, 1.2 and 1.6 kg a.i./ha), Bullet® 700SC (Atrazine 225g/l +Terbuthylazine 225g/l +Acetochlor 250 g/l) at rate of (0.35, 0.70, 1.05 and 1.40 kg a.i./ha), Raft® 500SC (Atrazine 250 g/l + Terbuthylazine 250 g/l) at rate of (0.25, 0.5, 0.75 and 1.0 kg a.i./ha), hoe weeded control at 3 & 6 WAS and a weedy check. This was laid in a randomized complete block design (RCBD) with 3 replicates. The gross and net plots were 13.5m² and 10.5m². Sowing was done manually by dibbling at a spacing of 20cm by 10 cm respectively. Spraying was done immediately after sowing, using Knapsack sprayer fitted with a flat fan nozzle and volume of spray (250 L ha⁻¹) was determined by calibration using water on treatment basis. Basal application of Inorganic fertilizer at 90kg N, 45 kg P₂O₅ and 45 kg K₂O per hectare, was applied by broadcast. N was applied in two equal split doses with second half of N was applied as top dressing at 6WAS using urea (46% N). The crop was harvested at maturity when the panicle turned brownish in colour, indicated by freely squeeze between two fingers when the heads fingers are squeezed by hand. It is cut about 5cm above the ground using

knives, dried for 3days before threshing on a floor by beating with sticks and winnowed to remove the straws, foreign material and unfilled grains. The following observations were recorded during the course of the investigation; non-productive tillers per plant, panicle weight per plant, 1000-grain weight, grain weight per plant and grain yield, number of fingers per panicle length, productive tillers per plant non-productive tillers per, grain yield per hectare and grain yield. All data collected were subjected to statistical analysis of variance (ANOVA) as described by Gomez and Gomez (1984). The significant means were compared using Duncan's Multiple Range Test (Duncan, 1955).

Results

The number of fingers per panicle significantly affected by weed control treatment across the two years (Table 1 – Appendix 1). In 2011, the application of bullet at 1.4 kg a.i./ha produced significantly higher number of fingers but was at par with bullet at 1.05 kg a.i./ha, raft at 0.75 kg a.i./ha and 1.0 kg a.i./ha which in turn comparable with bullet at bullet at 0.70 kg a.i./ha. Weedy check produced significantly lower number of fingers per plant followed by all the rates of atrazine, rates at 0.25 and 0.50 kg a.i./ha, bullet at 0.35 kg a.i./ha and hoe weeded control. Similarly, in 2012, application of Raft at 0.75 kg a.i./ha produced significantly higher number of fingers per panicle of finger millet than weedy check and all the other herbicides treatments but were statistically at par with atrazine at 0.8 and 1.2 kg a.i./ha, raft at 0.5 and 1.0 kg a.i./ha, bullet at 1.05 kg a.i./ha and hoe weeded control.

Panicle length of finger millet significantly differed due to weed control treatments in both years. (Table 1 - Appendix 1). In 2011, the application of atrazine at 0.8 kg a.i./ha, produced significantly longer panicle but comparable with raft at 0.5 kg a.i./ha and hoe weeded control. Weedy check produced significantly shorter panicle than all the other herbicides treatments. Similarly, in 2012, hoe weeded control resulted in significantly longer panicle than weedy check and all other herbicides treatments which were statistically similar, except atrazine at 1.6 kg

a.i/ha, and raft at 0.5 kg a.i/ha, which produced shorter and comparable panicle length with the weedy check.

Panicle weight of finger millet in the years as influenced by weed control treatment (Table 1 - Appendix 1). In 2011, bullet at 0.70 kg a.i/ha produced significantly higher panicle weight per stand of finger millet but comparable with raft at 1.0 kg a.i/ha, bullet at 0.35 and 1.4 kg a.i/ha. Weedy check produced significantly lowest panicle weight. In 2012, hoe weeded control produced significantly heavier panicle weight per plant of finger millet than all the herbicide treatments. Weedy check gave lowest panicle weight but comparable with all the other herbicide treatments.

The effects of weed control treatments significantly influenced productive tillers per plant of finger millet across both years (Table 1 - Appendix 1). At 2011, application of bullet at 1.05 kg a.i/ha produced significantly higher numbers of productive tillers per plant but was comparable with atrazine at 0.80 kg a.i/ha, bullet at 1.4 kg a.i/ha and hoe weeded control. Weedy check and raft at 0.75 kg a.i/ha produced significantly higher number of productive tillers per plant of finger millet but at par with atrazine at 0.4 and 0.80 kg a.i/ha which was in turn comparable with atrazine at 1.60 kg a.i/ha.

The influenced of weed control treatment on non-productive tillers per plant of finger millet significantly differed in both locations. Table 1 (Appendix 1). In 2011, bullet at 1.40 kg a.i/ha gave significantly higher number of non-productive tillers per plant of finger millet but comparable with bullet at 1.05 kg a.i/ha. This was followed by raft at 1.00 kg a.i/ha and bullet at 0.35 and 0.70 kg a.i/ha. Weedy check, hoe weeded control, atrazine at 0.40 kg a.i/ha and raft at 0.25 kg a.i/ha gave significantly least non-productive tiller per plant of finger millet which was in turn comparable to raft at 0.5 kg a.i/ha. At 2012, application of bullet at 0.35, 0.70 and 1.05 kg a.i/ha and atrazine at 0.4 kg a.i/ha resulted in significantly more number of non-productive tillers per plant of finger millet but comparable with bullet at 1.05 kg a.i/ha than the weedy check, hoe weeded control and all the

other herbicide treatments which were statistically similar.

The grain weight per plant of finger millet differed significantly in both locations due to weed control treatments (Table 2 - Appendix 1). In 2011, application of atrazine at 0.40 and 0.80 kg a.i/ha, raft at 0.5 and 1.0 kg a.i/ha all rates of bullet and hoe weeded control resulted in significantly higher grain weight per stand of finger millet. This was followed by atrazine at 1.20 and 1.60 kg a.i/ha, rafts at 0.25 and 0.75 kg a.i/ha. Weedy check gave significantly the lowest grain yield. In 2012, hoe weeded control resulted in significantly heavier grain weight per stand of finger millet than weedy check and all the herbicide treatments. Atrazine at 0.40 kg a.i/ha, raft at 0.25 and 0.5 kg a.i/ha gave lowest grain weight per plant of finger millet which was in turn comparable with atrazine at 1.20 kg a.i/ha and the weedy check.

Panicle weight of finger millet in both years as influenced by weed control treatment (Table 2 - Appendix 1). In 2011, bullet at 0.70 kg a.i/ha produced significantly higher panicle weight per stand of finger millet but comparable with raft at 1.0 kg a.i/ha, bullet at 0.35 and 1.4 kg a.i/ha. Weedy check produced significantly lowest panicle weight. In 2012, hoe weeded control produced significantly heavier panicle per plant of finger millet than all the herbicide treatments. Weedy check gave the lowest panicle weight but comparable with all the other herbicide treatments.

The effects of weed control treatments on 1000-grain weight across the two years are shown on (Table 2 - Appendix 1).

The influence of weed control treatments on 1000-grain weight of finger millet was significant at both locations.

In 2011, application of bullet at 1.05 and 1.4 kg a.i/ha gave significantly higher 1000-grain weight of finger millet which were comparable with raft at 0.5 and 0.75 kg a.i/ha, bullet at 0.35 and 0.70 kg a.i/ha and hoe weeded control. Weedy check gave the lowest 1000-grain weight in the trial. At 2012, hoe weeded control produced significantly heavier 1000-grain weight

of finger millet than all the herbicide treatments and weedy check which were statistically at par.

The effects of weed control treatment significantly influence panicle weight of finger millet in both locations (Table 2 - Appendix 1).

At 2011, hoe weeded control and raft at 0.50 kg a.i/ha resulted in significantly heavier panicle weight but was comparable with atrazine at 0.80 kg a.i/ha. Bullet at 0.35 and 1.40 kg a.i/ha gave least but comparable panicle weight. Similarly, in 2012, hoe weeded control gave significantly heavier panicle weight than all the herbicide treatments and weedy check. This was followed by raft at 0.25 kg a.i/ha atrazine at 0.80 kg a.i/ha. Raft at 1.0 kg a.i/ha, bullet at 0.35 and 1.4 kg a.i/ha gave the lowest panicle weight but comparable with bullet at 0.70 kg a.i/ha.

The grain yield of finger millet as influenced by weed control treatments across the two locations are presented in (Table 2 - Appendix 1).

The effect of weed control treatment on grain yield of finger millet was significant at both years.

In 2011, among the herbicides treatments evaluated, application of atrazine at 0.8 kg a.i/ha, Raft at 0.5 kg a.i/ha and hoe weeded control, produced significantly higher grain yield which were statistically at par. This was followed by atrazine at 0.40 kg a.i/ha and raft at 0.25 kg a.i/ha. Raft at 1.00 kg a.i/ha and all rates of bullet produced comparable and lower grain yield. In 2012, hoe weeded control gave significantly higher grain yield than weedy check and all herbicide treatments, this was followed by Raft at 0.50 and 0.75 kg a.i/ha. All the Bullet treatments and Raft at 1.0 kg a.i/ha produced consistently lowest grain yield across the two year.

Discussion

In 2012, hoe-weeded control gave higher yield components such as length of panicle, panicle weight per plant, 1000-grain weight, grain weight per plant and grain yield than all the herbicide treatments evaluated and the weedy check. This could probably be due to the fact that weed

interference was prevented from the crops therefore, better utilization of growth factors by the crop hence promoted greater growth parameter, yield characters and yield. This is in conformity with the finding of Kulmi (1991) that yield increases with effective weed control and that the high yield obtained from two and three hoe weeding was due to effective weed control which reduced weed interference and enhanced the formation of more tillers, an important attribute of grain yield. While the reduction of the phytotoxicity effect of the herbicides by the early rainfall after application led to higher weed competition with the crop.

In 2011, it was observed that, application of atrazine at 0.80 kg a.i/ha and raft at 0.50 kg a.i/ha produced long finger millet panicle, heavier panicle weight, 1000-grain weight, with yield increase of 94.2 and 90.5% respectively, when compared to the hoe weeded control treatment at 3 and 6WAS. This herbicide demonstrated low phytotoxic effect on the crop, better manifestation of growth, good selectivity performance and better weed suppression exhibited by these herbicides, with the weeds further smothered by tillers produced by this crop. Therefore, better utilization of available growth resources, hence highest grain yield was produced. This is in conformity with the findings of Yadav (1971) who observed that atrazine applied at the rate of 1 kg a.i/ha as pre-emergence reduced dry weight of weeds by 67% and increased the grain yield of sorghum by 103%. Hand weeding and application of 0.5 kg a.i/ha of atrazine were next best, giving increases in yield of 95 and 91% respectively. Also Das (2008) reported that some herbicides have growth regulatory action on the crop plants and can boost their growth and subsequently yield better than in weed-free check or hand weeding. Jam et al. (1976) found atrazine applied at 0.75 kg a.i/ha to increase the yield of pearl millet, Prusty et al. (1988) reported that herbicides boost crop yield due to effective control of the weeds.

Generally, the results observed with the application of atrazine at 0.80 kg a.i/ha and raft at 0.50 kg a.i/ha indicated that these herbicides rates can replace twice or thrice hoe weeding during finger millet cultivation. This agrees with

Akobundu (1987) who reported the use of herbicide is said to be less strenuous, less labour demanding and does not disturb the soil which reduces erosion.

All Bullet treatments and Raft at 1.0 kg a.i./ha produced lowest yield than even the weedy check. This could be due to the fact that, these herbicide rates were highly phytotoxic to the crop, resulting to a very few stands count per plot. This finding is in line with Joshua *et al.* (2001a) who reported that, atrazine at (2.0-3.0 kg a.i./ha), Primextra and Dual (2.0-2.5kg a.i./ha) controlled weeds more effectively but reduced yields in millet and cowpea mixture. The higher herbicides rates were phytotoxic to millet and consequently reduced grain yields. Ndahi (1981) reported that atrazine, a common herbicide used in sorghum production, appeared to have depressed the grain yield of millet when applied at the rate of 2.42 kg a.i./ha.

Conclusion

Based on the results obtained from this study, weed control was obtainable in finger millet by the application of atrazine pre emergence at the rate of 0.8 kg a.i./ha or the use of Raft pre emergence at 0.5 kg a.i./ha gave season long weed control over hoe weeded check in finger millet.

References

- Akobundu, I.O. & Fagade, S.O. (1986). *Weed Problems in African rice lands. Rice in Africa*. New Academic Press.
- Burkill, H M. (1985). *The useful plants of Tropical West Africa*. UK: Royal Botanic Gardens, Surrey.
- Das, T.K. (2008). *Weed Science: Basics and Application*. New Delhi Jain Brothers.
- Duncan, D.B. (1955) Multiple Range and Multiple F-Tests. *Biometrics*, 11, 1-42. <http://dx.doi.org/10.2307/3001478>
- Gomez, A.A. (1984). *Statistical Procedure for Agricultural Research*, 2nd Edition. New York: John Willey and sons.
- Joshua, S. D., & Gworgwor, N.A. (2001). Effect of cropping pattern and herbicides on weed control and yield of millet-cowpea intercrop in the Sudan Savanna Zone of Nigeria. *Nigerian Journal of Weed Science*, 14, 25-32.
- Kulmi, G.S. (1991). Cultural and Chemical weed control in transplanted rice. *Crop Research (Hisam)*, 3(2), 151-154.
- Ndahi, W.B. (1981). *Zonal herbicide evaluation in sorghum*. Notes on Cereal Improvement programme, Cropping Scheme Meeting. Ahmadu Bello University, Zaria.
- Prusty, J. C., Bahera B. & Parida A.K. (1988). Integrated weed management in lowland rice. *Biometrics*, 25, 329-331.
- Yadav, D. S. (1971). *Chemical weed control in pearl millet under rainfed conditions*. Paper presented at Weed Science Conference.

Appendix 1

Table 1. Effect of Weed Control Treatments on Yield Components of Finger Millet in 2011 and 2012 Wet Seasons

Treatment	Rate (kg a.i/ha)	Number of Fingers per Panicle		Panicle Length (cm)		Productive Tillers per Plant		Non-productive Tillers per Plant	
		2011	2012	2011	2012	2011	2012	2011	2012
Atrazine	0.40	7.3d ¹	7.2cd	11.3c	5.9bc	3.0c	1.0f	0.3e	2.4a
Atrazine	0.80	7.5cd	7.5a-d	12.2a	6.3b	3.7ab	1.0f	0.7de	1.0b
Atrazine	1.20	7.2d	7.7ab	10.4ef	5.9bc	3.0c	1.7de	1.0cd	1.0b
Atrazine	1.60	7.1d	7.2cd	10.6de	5.3d	2.3de	1.3ef	1.3cd	1.0b
Raft	0.25	7.0d	7.4bcd	11.2cd	5.5bc	2.7cd	1.7de	0.3e	0.7b
Raft	0.5	7.4cd	7.6abc	11.5ab	5.3d	3.3bc	1.7de	0.7de	1.0b
Raft	0.75	7.9abc	7.9a	9.7f	5.6bc	1.7e	2.0cd	1.3c	0.7b
Raft	1.0	8.0ab	7.6abc	9.9f	5.5bc	2.7cd	2.7ab	2.3b	0.7b
Bullet	0.35	7.3d	7.4bcd	10.7de	5.5bc	2.7cd	2.0cd	2.3b	2.0a
Bullet	0.70	7.8b	7.1d	9.6f	5.6bc	2.7cd	2.3abc	2.3b	2.0a
Bullet	1.05	8.1ab	7.6abc	8.7g	5.5bc	4.3a	2.3bc	2.7ab	2.0a
Bullet	1.4	8.3a	7.4bcd	8.6g	5.5bc	3.7ab	3.0a	3.0a	1.7ab
Hoe Weeded at 3 & 6 WAS ²		7.1d	7.6abc	11.9ab	10.9a	3.7ab	1.7de	0.0e	0.7b
Weedy Check		5.9e	7.3bcd	5.0h	4.6d	2.0e	1.0f	0.0e	0.7b
SE $\pm$		0.16	0.14	0.20	0.30	0.21	0.14	0.19	0.28
Significance		*3	*	*	*	*	*	*	*

Note: ¹means within a column of treatments followed by unlike letter(s) are significantly different at 5% level of significance using DMRT. ²week After Sowing ³Significance at 5% level of probability. Raft (Atrazine + Terbutylazine), Bullet (Atrazine + Terbutylazine + Acetochlor)

Table 2. Effect of Weed Control Treatments on Number of Fingers of Finger Millet in 2011 and 2012 Wet Seasons

Treatment	Rate (kg a.i./ha)	Panicle Weight per plant (g)		1000-grain weight (g)		Grain Weight per Plant (g)		Grain Yield (kg/ha ¹)		
		2011	2012	2011	2012	2011	2012	2011	2012	Combined
Atrazine	0.40	17.1cd	6.5de	2.65de	1.87b	6.9a ¹	3.0f	1610.3b ¹	1345.0	1477.7b
Atrazine	0.80	18.6bc	7.8b-e	2.77ab	1.98b	7.5a	3.8cd	1832.3a	1900.8ab	1866.6a
Atrazine	1.20	14.7d	7.6b-e	2.61e	1.98b	6.1b	3.3def	1370.0c	1112.6d	1241.3cd
Atrazine	1.60	16.1cd	8.2b-e	2.72bc	2.13b	6.4b	3.7cde	1040.0d	1305.4c	1172.7d
Raft	0.25	16.5cd	6.8cde	2.64de	1.87b	6.4b	3.0f	1588.0b	1262.0c	1425.0b
Raft	0.5	18.5bc	6.5de	2.74abc	2.19b	7.4a	2.8f	1936.5a	1789.7b	1863.1a
Raft	0.75	15.9cd	7.7b-e	2.70cd	2.14b	6.3b	3.8cd	1327.1c	1389.8c	1359.5bc
Raft	1.0	21.8ab	8.6b-e	2.68cd	2.14b	7.4a	4.5b	242.6f	209.8e	226.2f
Bullet	0.35	21.7ab	9.5bc	2.70cd	2.10b	7.5a	4.2b	182.4f	216.6e	199.5f
Bullet	0.70	23.3a	9.8b	2.65de	2.20b	7.6a	4.5b	262.6f	265.4e	264.0f
Bullet	1.05	19.0bc	8.8bcd	2.66de	1.87b	7.4a	4.0b	238.5f	248.4e	243.5f
Bullet	1.4	20.8ab	8.2b-e	2.62e	2.08b	7.5a	3.9c	194.9f	208.6e	201.8f
Hoe Weeded at 3 & 6 WAS		19.2bc	24.9a	2.81a	2.80a	7.5a	10.30a	1945.5a	1960.5a	1953.0a
Weedy Check		10.2e	5.7e	2.40f	1.98b	4.3c	3.17ef	611.0e	223.4e	417.2e
SE±		1.20	1.00	0.02	0.085	0.28	0.19	42.0	45.8	43.9
Significance		*	*	*	*	* ³	*	*	*	*

Note: ¹means within a column of treatments followed by unlike letter(s) are significantly different at 5% level of significance using DMRT. ²week After Sowing ³Significance at 5% level of probability .Raft (Atrazine + Terbutylazine), Bullet (Atrazine + Terbutylazine + Acetoch