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ECONOMIC ANALYSIS OF WEED MANAGEMENT STRATEGIES ON WEED ATTRIBUTES AND POD YIELD OF GROUNDNUT VARIETIES IN SOUTHERN GUINEA SAVANNA OF THE GAMBIA

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ABSTRACT

Field trials were conducted in 2018 rainy season at National Agricultural Research Institute Banjulinding and Teaching and Research Farm of the University of The Gambia Faraba Banta to determine the effect of various weed management strategies and groundnut varieties on weed attribute and economics of ground production in southern Gambian. The experiment consisted of three groundnut varieties (Senegal 28/206, Fleur 11 and Samnut 24) and ten levels of weed management strategies (Pendimethalin at 1.0kg a.i h^{-1}, Pendimethalin at 1.5kg a.i ha^{-1}, Quizalofop-P-Ethyl at 1.0kg a.i ha^{-1}, Quizalofop-P-Ethylat at1.5kg a.i ha^{-1}, Pendimethalin at 1.0kg a.i ha^{-1} followed by Quizalofop-P-Ethyl at 1.0kg a.i ha^{-1}, Pendimethalin at 1.0kg a.i ha^{-1} followed by supplementary hoe weeding at 6 weeks after sowing, Manual hoe weeding at 3 and 6 weeks after sowing, Pendimethalin at 1.5kg a.i ha^{-1} followed by supplementary hoe weeding at 6 weeks after sowing, Pendimethalin at 1.5kg a.i ha^{-1} followed by Quizalofop-P-Ethyl at 1.5kg a.i ha^{-1} and Weedy check). The experiment was laid out in a Split plot design, replicated three times with the weed management strategies as the main plots while the groundnut varieties as the sub plots. The results revealed that, manual hoe weeding at 3 and 6 weeks after sowing recorded the lowest weed density and highest weed control efficiency in both locations. Weedy check had the lowest weed control efficiency (11.1 & 17.5%) in both locations. Application of pendimethalin at 1.5kg a.i ha^{-1} followed by post-emergence application of quizalofop-p-ethyl at 1.5kg a.i ha^{-1} had higher pod yield (1149 kg ha^{-1}) at Banjulinding. Pendimethalin at 1.5 kg a.i.ha^{-1} had the highest at UTG Faraba Banta. These strategies of weed management proves to be

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more economical than the other strategies. Samnut 24 out yielded other local varieties tested and has an added advantage of competing with weed better than the other varieties. Further research on the effect of these weed managements strategies on the oil content and the acceptability of this introduced variety in The Gambian is recommended.

Keywords: Groundnut, Weed, Management strategies, Herbicides, Economics of weed management.

1. INTRODUCTION

Groundnut is a major cash crop in The Gambia and the most important export crop in the country. It is the most important crop; occupying 40-50% of the cultivated area followed by early millet (25%), rice (8%), sorghum and maize (7% each) (Permanent Interstates Committee for Drought Control in the Sahel, 2008). According to Vara Prasad *et al*. (2017), the world groundnut harvested area in 2007 stood at 23.4 million ha with a total production of 34.9 million metric tons (Mt). Thus, the total harvested area in 2007 increased by 3.7 million ha when compared to 1990, while production increased by 11.7 million Mt. It is mainly grown in developing countries (Africa), where the crop finds the appropriate climates for optimum production (Romain, 2001). Groundnut production in The Gambia was estimated at 151,069 metric tons in 2001 and 71,526 metric tons in the following year giving a 53% decline. A thirty percent increase in groundnut production was recorded between 2002 and 2003. The nuts are eaten fresh, boiled or grilled and preparation of soup. Groundnut kernels are processed into a wide variety of edible products such as edible oil, groundnut butter, salted groundnut, etc. About two- thirds of the world production is used for produce edible oil which provides a good salad and cooking oil used in the margarine production. Groundnut also provides cake used for human and animal consumption. The haulm is used as animal feeds and has about the same nutritional value as hay. The shells are used as fuel and fertilizers. Other non-food used of groundnuts includes soap, cosmetic and for medicinal purposes (Romain, 2001).The production of groundnut in The Gambia is however, constrained by lack of improved cultural practices, inadequate rainfall, soil fertility, low yielding varieties and lack of appropriate weed control strategies (Jallow, 2012). The presence of weeds as pest is more pernicious and serious because it can drastically reduce the growth of groundnut. According to Ayomide (2010), weed caused much damage to the groundnut crop during the first 45 days of its growth. The most critical period of weed competition is between 3-6 weeks after sowing (Sathya Priya *et al.*,2013). Weeds can deplete 30 – 40 kg of Nitrogen per hectare, 10-15kg of phosphorous per hectare and 20-40kg of potassium per hectare (Das ,2011). Among all crop pests, weeds alone are responsible for about one third loss in crop production (Jat *et al.* 2011). Various measures are employed reduced weed population in groundnut and increased its productivity. Manual hoe weeding the

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oldest method of weed control but it has been reported to be uneconomical and usually not efficient (Ojelade *et al*., 2018). It has serious limitation on farm site it does not favour gender sensitivity. The source of labour at a time of higher demand is also of great concern. According to them ((Ojelade *et al*., 2018), manual hoe weeding in groundnut is not desirable as it can lead to the destruction peg and reduce pod and kernel yield. The use of herbicide in weed control is fast gaining momentum especially in groundnut cultivation. This refers to all weed control practices in which toxic chemicals are used to kill, suppress or modify weed growth in such a way as to prevent interference with crop establishment, growth and production of economic yield (Jallow, 2012). Some pre-emergence herbicides labeled for groundnut production include Pendimethalin, Metolachlor, Butachlor, Norflurazone, Diclosulam, Flumioxazin, Dimethenamid etc and postemergence, Imazethapyr, Imazapic, Quzalofop ethyl, Acifluorfen, Bentazoneetc (Arthur,2016). Application of pre-emergence herbicide like pendimethalin followed by manual hoe weeding to keep the crop free of weeds after emergence has shown promising in controlling weeds in groundnut. The use of herbicide alone or in combination with other methods of weed control has been reported to be more economical than using manual hoe weeding alone (Kausar *et al*., 2019). Manual hoe weeding leads to soil disturbance and interfere with pegging. To prevent this, an alternative method of weed control is not only important but necessary. In line with this therefore, this research was initiated to determine the most efficient and economic ways of eliminating weed so as increase the productivity of the groundnut in Southern Guinea Savanna of The Gambia.

2. MATERIALS AND METHODS

The experiment was conducted during the wet season of 2018 at two locations in The Gambia. The first location was at the National Agricultural Research Institute Farm in Banjulinding (Latitude 13^0 22.171 N and Longitude$16^0$38.858W). The second was at Teaching and Research Farm of the University of The Gambia Faraba Banta (Latitude 13^0 14.910 N and Longitude 16^0 32.040W). These locations were characterized by wet (June to October) and dry seasons (November to May). The annual rainfall at Banjulinding was 859 mm while at UTG Faraba Banta was 951mm (courtesy of The Gambia Meteorological Office in Banjul). The soil texture of Banjulinding site was sandy clay while at UTG Faraba Banta it was sandy clay loam. The organic carbon of soils at Banjulinding was 0.94 g kg^{-1}; total N, 0.35 g kg^{-1}; available P of 17.32 mg kg^{-1}; pH,5.7 while that of UTG Faraba Campus has sandy clay loam soil texture; organic carbon of 0.49 g kg^{-1}; total N, 0.28 g kg^{-1}; available P,17.75 $mgkg^{-1}$ and pH of 5.5. The experiments consisted of two factors, groundnut varieties (Senegal 28/206, Fleur 11 and Samnut 24) and ten levels of weed management strategies (Pendimethalin at 1.0kg a.i h^{-1}, Pendimethalin at 1.5kg a.i ha^{-1}, Quizalofop-P-Ethyl at 1.0kg a.i ha^{-1}, Quizalofop-P-Ethylat at 1.5kg a.i ha^{-1}, Pendimethalin at 1.0kg a.i ha^{-1} followed by Quizalofop-P-Ethyl at 1.0kg a.i ha^{-1}, Pendimethalin

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at 1.0kg a.i ha^{-1} followed by supplementary hoe weeding at 6 weeks after sowing, Manual hoe weeding at 3 and 6 weeks after sowing, Pendimethalin at 1.5kg a.i ha^{-1}followed by supplementary hoe weeding at 6 weeks after sowing, Pendimethalin at 1.5kg a.i ha^{-1} followed by Quizalofop-P-Ethyl at 1.5kg a.i ha^{-1} and Weedy check). The treatments were factorial combined and laid out in a Split plot design replicated three times. Level of weed management strategies were assigned to the main plots while the groundnut varieties allocated to the sub plots. The land was cleared plough , harrowed and ridged. The land was demarcated into plots of 3m x 4.5m. Gross and net plots sizes were $13.5m^2$ and $4.5m^2$ respectively.Sowing was done when the rainy season was fully established and the crops were spaced at 75cm inter rows and 25cm intra rows with two seeds planted per stand. The pre-emergence herbicide (Pendimethalin) was applied immediately after sowing according to the treatments while the post-emergence herbicide (Quizalofop-P-Ethyl) was applied at 6 weeks after sowing using knapsack sprayers. Fertilizer was applied at rate of 20 $kgha^{-1}$ of nitrogen, 40$kgha^{-1}$ of phosphorous (P_2O5) and 20$kgha^{-1}$ of potassium using NPK 15:15:15 and single super phosphate 18%. Data were collected on morphological composition of weeds (narrow, broadleaved and sedges), weed density, weed control efficiency (%) and pod yield. Data generatedand recorded were subjected to analysis of variance (ANOVA) using GenStat software**,** 17th Edition and the difference between the means were compared using Students-Neuman Keuls' Test (SNK). Gross profit for each treatment combinations were calculated by subtracting the total cost of cultivation from the return. Benefit –cost ratio for each treatment combinations were calculated by dividing gross profit by total cost of cultivation.

3. RESULTS

Effect of weed management strategies and Groundnut Varieties on Morphological composition of weed

The effect of weed management strategies on morphological composition of weed was significant in both locations (Table 1). Weedy check recorded the highest number of broad leaves, grasses and sedges than other weed management strategies in both locations. Manual hoe weeding at 3 and 6 weeks after sowing recorded the lowest number of broad leaves at Banjulinding while at UTG Faraba Banta pre-emergence application of Pendimethalin at 1.5 kg a.i h^{-1} recorded the lowest number of broad leaves. In both locations weedy check control plots had higher number of broad and narrow leaved species as well as sedges except at UTG Fara Banta were lowest number of sedges were observed. All herbicide treated plot alone or in combination with others had similar number of broadleaved, narrow leaved and sedges.The groundnut varieties significantly affected morphological compositions of weed at UTG Faraba

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Banta while non-significant effect was observed at Banjulinding. Fleur 11 recorded the highest number of broad leaves and sedges than the other varieties (Table 1).

Table 1: Effect of Weed Management Strategies and Groundnut Varieties on Morphological attributes of weed at Banjulinding and UTG Faraba Banta during 2018 Rainy Season

Treatments	Location					
	Banjulinding			UTGFaraba Banta		
	Broad Leaves	Grasses	Sedges	Broad Leaves	Grasses	Sedges
Weed Management Strategies						
Pendimethalin at 1.0kg a.i h^{-1}	26.8ab	71.2b	36.0b	10.1b	10.70b	51.4ab
Pendimethalin at 1.5kg a.i ha^{-1}	23.3ab	52.8b	24.8b	8.6b	4.90b	52.0a
Quizalofop-P-Ethyl at 1.0kg a.i ha^{-1}	53.1ab	7.1cd	31.0b	16.2b	4.10b	75.8a
Quizalofop-P-Ethyl at 1.5 kg a.i ha^{-1}	46.3ab	1.4cd	41.9b	12.2b	2.30b	79.4a
Pendimethalin at 1.0kg a.i h^{-1} fb Quizalofop-P-Ethyl at 1.0kg a.i ha^{-1}	26.6ab	3.0d	26.4b	13.9b	2.70b	80.0a
Pendimethalin at 1.0kg a.i h^{-1} fb SHW at 6 WAS	12.7ab	39.1bc	26.4b	9.7b	4.30b	61.4a
Manual hoe weeding at 3 and 6 WAS	7.4ab	16.1cd	20.0b	10.0b	7.40b	42.6b
Pendimethalin at 1.5 kg a.i h^{-1} fb SHW at 6 WAS	19.1ab	42.6bc	23.7b	13.0b	2.80	66.8a
Pendimethalin at 1.5kg a.i h^{-1} fb Quizalofop-P-Ethyl at 1.5 kg a.i ha^{-1}	16.1ab	2.3cd	30.6b	9.0b	2.60b	49.7ab
Weedy check	65.2a	125.2a	55.3a	41.0a	49.00a	41.2b
Level of Significance	0.031	0.001	0.010	0.022	0.001	0.042
SE±	11.35	9.00	5.51	5.56	2.665	9.24
Vareity (V)						
Senegal 28/206	29.6	35.2	31.9	12.8b	8.70	56.2b
Fleur 11	31.3	33.1	30.3	16.0a	10.13	69.0a
Samnut 24	28.1	39.9	32.6	14.0ab	8.40	54.9a
Level of Significance	0.585	0.294	0.62	0.029	0.468	0.043
SE±	3.91	3.08	1.68	0.90	1.053	4.22
Interaction						
WM*V	0.473	0.555	0.557	0.116	0.033	0.335

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Means followed by the same letter(s) in a column are not significantly different at 5% level of probability using Students-Neuman Keuls (SNK) Test. SHW= Supplementary Hand Weeding, WAS=week after sowing, fb= followed by

The interaction between groundnut varieties and weed management strategies was significant on Sedges at UTG Fara Banta (Table 2). Unweed control of all the three varieties had higher number of sedges than when the varieties were weeded. Fluer 11 significantly recorded higher number of sedges than unweeded Senegal 28/206 and Samnut 24. All the three varieties recorded low number of sedges when weeds were control with either herbicide alone or in combinations with other manual hoe weeding.

Table 2: Interaction between Weed Management Strategies and Groundnut varieties on Number of Grasses at UTG Faraba Banta during 2018 Rainy Season

Weed Management Strategies	Varieties		
	Senegal 28/206	Fleur 11	Samnut 24
Pendimethalin at 1.0kg a.i ha^{-1}	12.0c	7.3c	12.7c
Pendimethalin at 1.5kg a.i ha^{-1}	6.7c	6.3c	1.7c
Quizalofop-P-Ethyl at 1.0kg a.i ha^{-1}	2.3c	3.3c	6.7c
Quizalofop-P-Ethyl at at1.5kg a.i ha^{-1}	3.3c	2.3c	1.3c
Pendimethalin at1.0kg a.i. ha^{-1}fb Quizalofop-P-Ethyl at1.0kg a.i ha^{-1}	4.3c	1.3c	2.3c
Pendimethalin at 1.0kg a.i ha^{-1}fb SHW at 6WAS	5.3c	3.3c	4.3c
Manual hoe weeding at 3 and 6WAS	6.0c	8.0c	8.3c
Pendimethalin at 1.5 kg a.i ha^{-1}fb SHW at 6WAS	3.7c	3.7c	1.0c
Pendimethalin at1.5 kg a.i. ha^{-1} fb Quizalofop-P-Ethyl at1.5kg a.i ha^{-1}	3.3c	1.3c	3.0c
Weedy check	40.0b	64.3a	42.7b
SE+	5.40		

Means followed by the same letter(s) in a column are not significantly different at 5% level of probability using Students-Neuman Keuls (SNK) Test. SHW= Supplementary Hand Weeding, WAS=week after sowing, fb= followed by

Effect of Weed Management Strategies and Groundnut Varieties on Weed Density and Control Efficiency

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The effect of weed management strategies and groundnut varieties on weed density and weed control efficiency at harvest was presented in Table 3. Weedy check significantly recorded the highest weed density and the lowest weed control efficiency in both locations. Manual hoe weeding at 3 and 6WAS significantly recorded the lowest weed density and the highest weed control efficiency at both locations. All herbicides treatments alone or in combinations with other options had similar number of weeds with manual hoe weeding in both locations. However, application of Quizolofop-p-ethyl at 1.5 kg a.i. ha^{-1} had lower weed control efficiency than the other herbicide treated plots at Banjulinding. Weedy check control plots had higher weed density and the lowest weed control efficiency in both locations. The groundnut varieties significantly affected weed density at UTG Faraba Banta. Fleur 11 recorded the highest number of weeds while Samnut 24 and Senegal 28/206 recorded the lowest. The varietal effect on weed control efficiency was however observed to be non-significant in both locations. The interaction between weed management strategies and groundnut variety on weed density and control efficiency was also not significant in both locations.

Table 3: Effect of Weed Management Strategies and Groundnut Varieties on Weed Density (ha^{-1}) and Control Efficiency (%) at Banjulinding and UTG FarabaBanta during 2018 Rainy Season

Treatments	Location			
	Banjulinding		UTG Faraba Banta	
	Weed density	Weed Control Efficiency	Weed density	Weed Control Efficiency
Weed managements strategies				
Pendimethalin at 1.0kg a.i ha^{-1}	310371b	49.5c	174926b	52.7ab
Pendimethalin at 1.5kg a.i ha^{-1}	226420bc	62.3b	170370b	50.1b
Quizalofop-P-Ethyl at 1.0kg a.i ha^{-1}	201728bc	65.3b	212346b	62.2ab
Quizalofop-P-Ethylat at 1.5kg a.i ha^{-1}	192592bc	46.2c	228148b	61.0ab
Pendimethalin at 1.0kg a.iha^{-1} fb Quizalofop-P-Ethylat at 1.0kg a.i ha^{-1}	134074c	67.6b	223210b	74.3ab
Pendimethalin at 1.0kg a.iha^{-1}fb SHW at 6 WAS	165432bc	69.5b	208395b	78.0ab
Manual hoe weeding at 3 and 6 WAS	94580c	88.4a	141729b	82.6a
Pendimethalin at 1.5kg a.iha^{-1}fb SHW at 6 WAS	173827bc	71.3b	208395b	78.0ab
Pendimethalin at 1.5kg a.iha^{-1} fb Quizalofop-P-Ethylat at 1.5kg a.i ha^{-1}	102716c	70.7b	147160b	81.2a

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Weedy check	561481a	11.1d	334568a	17.5c
Level of significance	0.001	0.001	0.001	0.001
SE±	32581.4	3.94	20506.5	4.74
Variety				
Senegal 28/206	218000	60.5	188815b	66
Fleur11	205926	58.9	226256a	61
Samnut 24	224741	61.2	188815b	63
Level of significance	0.483	0.787	0.003	0.268
SE±	11078.1	2.38	8341.1	2.6
Interaction				
WM*V	0.800	0.818	0.608	0.146

Means followed by the same letter(s) in a column are not significantly different at 5% level of probability using Students-Neuman Keuls (SNK) Test. SHW= Supplementary Hand Weeding, WAS=week after sowing, fb= followed by

Effect of Weed Management Strategies and Groundnut Varieties on Weed Dry Weight and Pod Yield

Weed management strategies had significant effect on weed dry weight and pod yield in both locations (Table 4). Weedy check control plots had consistently recorded the highest weed dry weight and the lowest pod yield in both locations. Pre-emergence applications of pendimethalin at 1.5 kg a i.ha^{-1} had higher pod yield in both locations. All herbicide treated plots had higher and statistically similar pod yield with manual hoe weeding at 3 and 6 WAS. Groundnut variety had no effect on weed dry weight and pod yield in both locations except on pod yield at Fara Banta where Samnut 24 significantly recorded higher pod yield than Fleur 11 and Senegal 28/206. The interaction of variety and weed control strategies on weed dry weight and pod yield was not significant in both locations.

Table 4: Effect of Weed Management Strategies and Groundnut Varieties on Weed Dry Matter (ha^{-1}) and Gnut yield at Banjulinding and UTG FarabaBanta during 2018 Rainy Season

Treatments	Location			
	Banjulinding		UTG Faraba Banta	
	Weed Dry Matter kg ha^{-1}	Pod yield kg ha^{-1}	Weed Dry Matter kg ha^{-1}	Pod yield kg ha^{-1}

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Weedmanagement strategies				
Pendimethalin at 1.0kg a.i ha^{-1}	268.9b	1084a	165.9b	963a
Pendimethalin at 1.5kg a.i ha^{-1}	195.1bc	1097a	159.6b	1024a
Quizalofop-P-Ethyl at 1.0kg a.i ha^{-1}	185.3bc	969a	136.4b	924a
Quizalofop-P-Ethylat at 1.5kg a.i ha^{-1}	276.5b	1020a	143.2b	910a
Pendimethalin at 1.0kg a.iha^{-1} fb Quizalofop-P-Ethylat at 1.0kg a.i ha^{-1}	167.4bc	954a	85.6b	1025a
Pendimethalin at 1.0kg a.iha^{-1}fb SHW at 6 WAS	150.0bc	1072a	77.7b	978a
Manual hoe weeding at 3 and 6 WAS	56.6c	1075a	71.3b	964a
Pendimethalin at 1.5kg a.iha^{-1}fb SHW at 6 WAS	152.2bc	1142a	102.6b	1030a
Pendimethalin at 1.5kg a.iha^{-1} fb Quizalofop-P-Ethylat at 1.5kg a.i ha^{-1}	154.4bc	1149a	68.2b	976a
Weedy check	465.6a	213b	311.7b	174b
Level of significance	0.001	0.001	0.001	0.001
SE±	34.02	76.1	28.35	59.6
Variety				
Senegal 28/206	201.9	959	123.4	843b
Fleur11	215.6	981	137.5	864b
Samnut 24	203.4	992	135.8	983a
Level of significance	0.667	0.696	0.472	0.004
SE±	11.03	27.7	8.82	30.0
Interaction				
WM*V	0.871	0.523	0.105	0.927

Means followed by the same letter(s) in a column are not significantly different at 5% level of probability using Students-Neuman Keuls (SNK) Test. SHW= Supplementary Hand Weeding, WAS=week after sowing, fb= followed by

Effect of Weed Management Strategies and Groundnut Varieties Net Revenue and Cost Benefit

The influenced of groundnut varieties on gross revenue, net revenue and cost benefit of weed management strategies is presented in Tables 5 (Banjulinding) and 6 (UTG Fara Banta). The results indicated that the cost benefit ration of all the unweeded three varieties were lower (< 1) than the weeded varieties in both locations. All the weeded varieties had higher cost benefit ration of greater than one in both locations. Pre-emergence application of pendimethalin at 1.5kg a i. ha^{-1} to Senegal 28/206 had higher cost benefit than the other treatments combinations at

Banjulinding. However at UTG Fara Banta, pre-emergence application of pendimethalin at 1.5 kg a.i. ha^{-1} followed by supplementary hoe weeding at 6WAS recorded higher financial benefit than the other treatments combinations. Among the weed controlled plots, pre-emergence applications of pendimethalin at 1.0 kg a.i. ha^{-1} followed by post-emergence application of quizalofop-P-Ethyl at 1.00 kg a.i. ha^{-1} to Fleur 11 had the lowest financial benefit than all other combinations except unweeded varieties at Banjulinding. However, at UTG Fara Banta, manual hoe weeded Fleur 11 at 3 and 6 WAS had the lowest benefit.

Table 5: Effect of Weed management Strategies and Groundnut Varieties on Cost Benefit and Return Analysis at Banjulinding during 2018 Rainy Season

Treatmens		Total Yield (kg ha^{-1})	Total Variable Cost (USD)	Average Price/kg (USD)	Gross Revenue (USD)	Net Revenue (USD)	Benefit Cost Ratio
WM	VAR						
1	1	1012	264.58	0.417	422.00	157.42	1.59
2	1	1207	270.83	0.417	503.32	232.49	1.86
3	1	900	266.04	0.417	375.30	109.26	1.41
4	1	947	272.81	0.417	394.90	122.09	1.45
5	1	953	282.71	0.417	397.40	114.69	1.41
6	1	1135	305.92	0.417	473.30	167.38	1.55
7	1	1012	344.36	0.417	422.00	77.64	1.23
8	1	1108	312.17	0.417	462.04	149.87	1.48
9	1	1135	295.73	0.417	473.29	177.56	1.60
10	1	185	247.92	0.417	77.15	-170.77	0.31
1	2	1177	271.88	0.417	490.81	218.94	1.81
2	2	935	278.13	0.417	389.90	111.78	1.40
3	2	1024	273.33	0.417	427.00	153.67	1.56
4	2	1062	280.10	0.417	442.85	162.75	1.58
5	2	844	290.00	0.417	351.95	61.95	1.21
6	2	1119	313.21	0.417	466.62	153.41	1.49
7	2	1039	351.65	0.417	433.26	81.61	1.23
8	2	1151	319.46	0.417	479.97	160.51	1.50
9	2	1189	303.02	0.417	495.81	192.79	1.64
10	2	267	255.21	0.417	111.34	-143.87	0.44
1	3	1064	268.96	0.417	443.69	174.73	1.65

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2	3	1147	275.21	0.417	478.30	203.09	1.74
3	3	983	270.42	0.417	409.91	139.49	1.52
4	3	1050	277.19	0.417	437.85	160.66	1.58
5	3	1066	287.08	0.417	444.52	157.44	1.55
6	3	962	310.29	0.417	401.15	90.86	1.29
7	3	1174	348.73	0.417	489.56	140.83	1.40
8	3	1167	316.54	0.417	486.64	170.10	1.54
9	3	1122	300.10	0.417	467.87	167.77	1.56
10	3	187	252.29	0.417	105.20	-147.09	0.42

Calculation of total revenue is based on 0.417USD per kg groundnut the prevailing market price in The Gambia, D= Gambia Dalasi, WM= Weed Management: 1=Pendimethalin at 1.0kg a.i h^{-1}, 2=Pendimethalin at 1.5kg a.i ha^{-1},3= Quizalofop-P-Ethyl at 1.0kg a.i ha^{-1}, 4=Quizalofop-P-Ethylat at 1.5kg a.i ha^{-1},5= Pendimethalin at 1.0kg a.i ha^{-1} followed by Quizalofop-P-Ethyl at 1.0kg a.i ha^{-1}, 6=Pendimethalin at 1.0kg a.i ha^{-1} followed by supplementary hoe weeding at 6 weeks after sowing, 7=Manual hoe weeding at 3 and 6 weeks after sowing,8= Pendimethalin at 1.5kg a.i ha^{-1}followed by supplementary hoe weeding at 6 weeks after sowing, 9=Pendimethalin at 1.5kg a.i ha^{-1} followed by Quizalofop-P-Ethyl at 1.5kg a.i ha^{-1} ,10=Weedy check

VAR=Variety: 1= Senegal 28/206, 2= Fleur11,3 = Samnut 24

Table 6: Effect of Weed management Strategies and Groundnut Varieties on Cost Benefit and Return Analysis at UTG Faraba Banta during 2018 Rainy Season

Treatments		Total Yield (kg ha^{-1})	Total Variable Cost (USD)	Average Price/kg (USD)	Gross Revenue (USD)	Net Revenue (USD)	Benefit Cost Ratio
WM	VAR						
1	1	930	264.58	0.417	387.81	123.23	1.46
2	1	1058	270.83	0.417	441.19	170.36	1.62
3	1	949	266.67	0.417	395.73	129.06	1.48
4	1	811	273.43	0.417	338.19	64.76	1.24
5	1	953	283.33	0.417	397.4	114.07	1.4
6	1	893	292.25	0.417	372.38	80.13	1.27
7	1	851	325.08	0.417	354.87	29.79	1.09
8	1	911	298.39	0.417	379.89	81.50	1.27
9	1	880	296.35	0.417	366.96	70.61	1.24
10	1	193	247.92	0.417	80.48	-167.44	0.32

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1	2	921	271.88	0.417	384.06	112.18	1.41
2	2	885	278.13	0.417	369.05	90.92	1.32
3	2	882	273.96	0.417	367.79	93.83	1.34
4	2	927	280.73	0.417	386.56	105.83	1.38
5	2	1004	290.63	0.417	418.67	128.05	1.44
6	2	1015	299.43	0.417	423.26	123.83	1.41
7	2	907	332.37	0.417	378.22	45.85	1.13
8	2	964	305.68	0.417	401.99	96.31	1.31
9	2	975	303.65	0.417	406.58	102.93	1.34
10	2	161	255.21	0.417	67.14	-188.07	0.26
1	3	1038	268.96	0.417	432.85	163.89	1.61
2	3	1130	275.21	0.417	471.21	196.00	1.71
3	3	941	271.04	0.417	392.4	121.36	1.45
4	3	993	277.81	0.417	414.08	136.27	1.49
5	3	1118	287.71	0.417	466.21	178.50	1.61
6	3	1026	296.52	0.417	427.84	131.32	1.44
7	3	1133	329.45	0.417	472.46	143.01	1.43
8	3	1414	302.77	0.417	589.64	286.87	1.95
9	3	1073	300.73	0.417	447.44	146.71	1.49
10	3	170	252.29	0.417	70.89	-181.40	0.28

Calculation of total revenue is based on 0.417 USD per kg groundnut the prevailing market price in The Gambia. D= Gambian Dalasi

WM= Weed Management: 1=Pendimethalin at 1.0kg a.i h^{-1}, 2=Pendimethalin at 1.5kg a.i ha^{-1},3= Quizalofop-P-Ethyl at 1.0kg a.i ha^{-1}, 4=Quizalofop-P-Ethylat at 1.5kg a.i ha^{-1},5= Pendimethalin at 1.0kg a.i ha^{-1} followed by Quizalofop-P-Ethyl at 1.0kg a.i ha^{-1}, 6=Pendimethalin at 1.0kg a.i ha^{-1} followed by supplementary hoe weeding at 6 weeks after sowing, 7=Manual hoe weeding at 3 and 6 weeks after sowing,8= Pendimethalin at 1.5kg a.i ha^{-1}followed by supplementary hoe weeding at 6 weeks after sowing, 9=Pendimethalin at 1.5kg a.i ha^{-1} followed by Quizalofop-P-Ethyl at 1.5kg a.i ha^{-1}, 10=Weedy check

VAR=Variety: 1= Senegal 28/206, 2= Fleur11,3 = Samnut24

4. DISCUSSION

The results showed that all the weed control treatments significantly reduced number of broadleaved, narrowed leaved and sedges in both location. Lower number of broadleaved observed in plots treated with 1.5 kg a.i ha^{-1} of pendimethalin implies that this herbicide is effective in reducing the entire weed population at this rate as indicated by lower weed density. The activities of this herbicide may be due its activity in preventing cell division which lead to ultimate death as reported by Das (2011). Higher number of broad, narrow leaved and sedges as well as lower weed control index and higher weed dry weight reported on weedy check control

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plots may be due to proliferation of weed growth which continued to germinate and grow at the expense of crop. This corroborated with earlier findings of Garko *et al.* (2016), Bolaji *et al*., (2015), Ojelade *et al.* (2018) and Kausar *et al.* (2019) in which they separately reported that weedy check control plots resulted in increased weed germination and growth which translate into higher weed density, weed dry and lower weed control index in various locations. The consequences of all these is serious competition between the weed and groundnut which also explained the reasons low pod yield on the control plots. This obvious because of the fact that groundnut is weak competitor with weed as reported by Das (2011).

The groundnut varieties responded differently to weed attributes and pod yield. Higher number of weed observed on Fleur 11 indicted that it competes poorly with weeds. This could be attribute to its short stature and spreading growth habit which provide enough sunlight which stimulate weed growth. The finding is in consistence with findings of Garko et al. (2016) who noted that groundnut varieties responded different to weed management strategies. Similarly, because of the fact that Samnut 24 is taller with more branches and leaves, it support fewer number of weed species and higher pod yield. This variety can therefore be used in weed management in the study area. This is in agreement with Garko *et al.* (2016) who reported that Samnut is an improve variety of groundnut with superior growth and yield character that can assist in weed management.

The total cost of production were generally higher in weed managed plots compared to weedy check suggesting that the cost of weed control is generally higher. Net revenue and benefit cost ratio were highest when pre-emergence application of pendimethalin at 1.5kg a.i h^{-1} was used irrespective of groundnut varieties while the least was the control in both locations. The profitable performance of herbicide treated plot could be to due to low cost herbicide compared to manual weeding. This also explain the reason of having cost benefit of less than on weedy check plots and greater than one on plots where weed are properly managed. Similar observations were made by Sareta *et al*. (2016) on wheat. Higher cost incur on manual hoe weeding suggested that this method of weed management is no longer economical as reported by Osipitan *et al.* (2018). The higher cost of labour incurred by manual hoe weeding could be attributed to an increase in required labour, which were usually expensive (Osipitan *et al.*, 2018). The availability of manual labour at peak period is also a major source of concern. Supplementing herbicide weed control with hoe weeding resulted in additional cost without corresponding increase in profit. Lower performance of herbicide treated plots (benefit) at Faraba Banta could be attributed to heavy rain after few hours of herbicide application. Moisture availability have been reported to affect herbicide efficacy and weed control (Das, 2011).

In conclusion, all the weed control strategies significantly reduced the number of narrow and broadleaved weeds as well as sedges. Pre-emergence application of pendimethalin at 1.5 kg a.i ha^{-1} alone or followed post-emergence application of quizalofop-p-ethyl at 1.5 kg a.i. ha^{-1} had higher pod yield because of efficient weed management without causing mechanical injury to pegs. These treatments prove to be profitable in groundnut production and could therefore be recommended along with any of the varieties studied.

REFERENCES

Arthur, S. (2016). Evaluation of Herbicides and Fungicides on Groundnut (*Arachis hypogaea l.*) Quality and Productivity. University of Education, Winneba, Ghana.

Ayomide, (2010). Effect of Row Spacing and Weed Control on the Growth and Yield of Groundnut, University of Agriculture, Abeokuta Nigeria.

Bolaji, U and Eemmanuel, O. E. (2015). Growth analysis and yield of two varieties of groundnut (*Arachis hypogea* L.) as influenced by different weed control methods *Indian Journal of Plant Physiology* 20(2):130-136

Das, T. K. (2011). Weed Science Basic Application. Publication Jain brothers. New Delhi, pp795-900

Garko, M.S, Mohammed, I.B, Yakuba, A.I, Muhammad, Z.Y (2016). Performance of Groundnut Varieties (*Arachis hypogaea L.*) As Influenced by Weed Control Treatments in Kano State of Nigeria. International Journal Scientific and Technology Research, Vol. 5, Issued 03, March 2016

Jallow, S. (2012). Effects of Different Weed Management Practices on the Yield and Yield components of Groundnut (Unpublished Bachelor's project). University of The Gambia, The Gambia.

Jat, R.S, Meena, H.N., Singh, A.L, Java, N., Surya, and Misra, J.B. (2011). Weed Management in Groundnut in India: A review. *Agricultural Research Communication Centre. Agri. Reviews, 32(3):155-171*

Kausar, S., Zia ul Hassan, M, Arif Khan M. (2019). Comparison of different weed control methods in groundnut (*Arachis hypogaea* L.) under rainfed conditions. *Journal of Aridland Agriculture*. 5:6-8

Ojelade, O.B., Lagoke, A.T., Adigun, J. A., Babalola, O.A., Daramola, O.S. and Osipitan, O.A. (2018). Intra-row spacing and weed control influence growth and yield of groundnut (*Arachis hypogea* L.). *Advances in Agricultural Science* 4:1-11

Osipitan O. A., I. Yahaya and J. Adigun (2018). Economic of weed management methods as influenced by row spacing in crops. Journal of Agricultural Science 10(2):98 -103

Permanent Interstates Committee for Drought Control in the Sahel (CILSS)., (2008). Gambia Profile Food Security, Final Report, (2): 3-21

Romain, R.H., (2001). Crop Production in Tropical Africa, Brussels, Belgium. Pp 500-610.

Sareta, H., Worku, W. and Begna, B. (2016).Economics of herbicide weed management in wheat in Ethiopa. *African Crop Science Journal* 24:109-116

Sathya, R., Priya, C., Chinnusamy, P., Manickasudaram and Babu, C(2013). A Review on Weed Management in Groundnut (*Arachis hypogea*l.), *Inernational Journal of Agricultural Science and Research (IJASR),(3):163-172*

Vara Prasad, P.V., Vijaya, G. K and Hari, D. U, (2017). Soils, Plant Growth and Crop Production – vol.ii- *Growth and Production of Groundnuts*

