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Response of Groundnut (*Arachis hypogaea* L.) to Critical Period of Crop-Weed Interference in the West Coast Region of The Gambia

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Abstract

Field trials were conducted in the 2021 rainy season at the National Agricultural Research Institute Banjulinding (NARI Site III) and the Teaching and Research Farm of the University of The Gambia (UTG Faraba Banta) to determine the critical period of crop-weed interference on weed attributes, growth and yield of groundnut varieties. The experiment was conducted in a Randomized Complete Block Design with Nine (9) treatments replicated three times. The treatments tested were as follows: Weed-free up to 21 DAS, Weed-free up to 42DAS, Weed-free up to 63DAS, Weed-free check, Weed Infestation up to 21DAS, Weed Infestation up to 42 DAS, Weed Infestation up to 63 DAS, Weedy check. The groundnut variety used as a test crop was Fleur 11. The results revealed that weed-free check (75 DAS) consistently recorded the highest weed control efficiency and lowest weed infestation, weed density, and weed dry weight in both locations. The weedy check had the lowest weed control efficiency in both locations. Similarly, the weed-free check consistently had a positive effect on growth and yield characters. The critical period for crop-weed interference in the groundnut variety tested was observed to be between 21 DAS to 63 DAS. It could be concluded that weed-free check followed by weed-free up to

63DAS and weed-free up to 42 DAS had led to the production of the highest pod and kernel yields of groundnut.

Keywords: Groundnut, weed interference, weed, growth, yield

Introduction

In the Gambia, groundnut (*Arachis hypogaea L)* is the most important crop; occupying 40-50% of the cultivated area followed by early millet (25%), rice (8%), sorghum and maize (7% each) (CILSS, 2008). It is an important and alternative source of protein for many Gambians who cannot afford meat as a source of protein. The haulms are a good source of feed for livestock, especially during the dry season when fresh green grasses are not available. This serves as an additional source of income for farmers in the dry season when the fodder is in high demand. The nuts are eaten fresh, boiled or grilled and prepared for soup. In addition, groundnut kernels are processed into a wide variety of edible products such as edible oil, groundnut butter, salted groundnut, etc. (Romain, 2001).

However, the production of groundnut has not been consistent in the country over the past years mainly due to problems such as climate change and variability, Aflatoxin contamination, poor soil fertility and high weed infestation. Despite the introduction of improved high-yielding varieties and Good Agricultural Practices, the productivity of groundnuts has been low. The total production of groundnut declined from 116,420 MT in 2009 to 94, 371 in 2013. In 2019, the total groundnut area harvested in The Gambia was 115,000ha, average yield was 956.5kgha^{-1} and production was 110,000 tons (FAOSTAT, 2019).

Intensive weed competition is one of the major constraints among the factors limiting groundnut production and productivity in the subregion (Korav *et al*, 2020). The morphological structure and initial slow-growing nature of the groundnut crop make it vulnerable to weed attack and multiplication. This makes weed control very expensive and time consuming since the majority of The Gambian farmers are small-scale and lack farm equipment to effectively manage weeds. Small-scale farmers use simple hand hoes to control weeds in groundnuts. This type of weed control method urges farmers to start weeding very early mostly at the emergence of the crop and in most cases, they weed 3 to 4 times before harvest. Weed removal requires a lot of human and capital resources, and frequent weeding during crop production may not be economical (Korav *et al*, 2020). Therefore, the knowledge of crop-weed interaction will help to determine the exact time/period when weed removal from a crop is critical to maximize production and reduce cost. However, limited research has been carried out in The Gambia to determine the most critical weed removal period in order to reduce crop losses. The critical period of crop-weed competition is an important principle of integrated weed management (Hakeem *et al*.2015). This can certainly help in attaining the level of food security, economic growth and development of poor resource farmers in The Gambia. The removal of weeds throughout the crop season may not be economical. To avoid unnecessary expenses on weed management, the critical period of crop-weed competition during the growing period of groundnut has to be determined (KORAV et al, 2020)The use of appropriate varieties for particular agroecology is also very important in groundnut production.

Materials and Methods

The study was conducted during the wet growing season of 2021 at two different locations in The Gambia. The first location was at the National Agricultural Research Institute farm in Banjulinding (NARI Site III), which lies between latitude 13^{o}N and longitude 14^{o}S. The second location was at the University of The Gambia (UTG) Research Farm at Faraba Banta (latitude 13^o 14.910 N and longitude 16^o 32.040W), Kombo East. The annual rainfall at Banjulinding was 1000 mm while at UTG Faraba Banta was 900mm (courtesy of The Gambia Meteorological Office in Banjul). The result indicated that the soil was sandy clay at NARI Site III while at UTG Faraba Banta it was sandy clay loam. The pH was moderately acidic in both locations. The organic carbon content was slightly low in both locations, however the total N and available P were high in both locations. The exchangeable bases and CEC were low in both locations. The experiment was laid in a Randomized Complete Block Design with 9 treatments replicated three times. The treatments tested were: Weed-free up to 21 DAS, Weed-free up to 42DAS, Weed-free up to 63DAS, Weed-free check (75DAS), Weed Infestation up to 21DAS, Weed Infestation up to 42 DAS, Weed Infestation up to 63 DAS, Weedy check. The groundnut variety used was Fleur 11. Gross and net plot sizes were 6 m^2 and 3 m^2, respectively. Fertilizer was broadcasted one week after sowing at the rate of 20 $kgha^{-1}$ of nitrogen, 40 $kgha^{-1}$of phosphorous and 20$kgha^{-1}$ of potassium and single super phosphate 18%. Data were collected on weed dry matter at the physiological maturity of groundnut, weed density, Weed Control Efficiency according to Mani *et. al*., (1976) and Percentage of weed infestation according to Sharma, (2008). Also, observations were made on a number of branches, canopy height, Pod and Kernel Yield (kg ha^{-1}). All the data generated from the experiment were subjected to Analysis of Variance (ANOVA) using GentStat software**.** Where the F-test is significant, the difference between the means was compared using Students-Neumans Keuls Test (SNK). Simple linear regression was used to test the relationship between pod yield of groundnut and weed density.

Results and Discussion

Effect of Critical Period of Crop-Weed Interference and Groundnut Varieties on Weed Density (ha^{-1}) and Weed Dry Weight ($kgha^{-1}$)

The effects of a critical period of crop-weed interference and groundnut varieties on weed density and weed dry weight at harvest are presented in Table 4. The results indicated that the critical period of crop-weed interference had a significant effect on weed density and weed dry weight at both locations. The weed density and weed dry weight were significantly higher in the weedy check at both locations followed by weed infestation up to 63 Days after Sowing (DAS). The lowest weed density and weed dry weight were recorded in the weed-free check. The results showed significant differences amongst the weed-free treatments from 21-63DAS and weed-infested treatments 21-63 DAS for both weed density and weed dry weight. Similarly, the weed-free check (75 DAS) and weed-free up 63 DAS were significantly different from the 21 and 42 days weed free after sowing. There was no significant difference between weed free check and weed-free up to 63DAS. Also, no significant difference was observed between 21 and 42 days weed-free after sowing. The weed density and dry weight were significantly higher at the level of un-weeded control (weedy check) than all the other treatments under the two varieties at both locations. The weed free check recorded the lowest weed density and dry weight at both locations as shown in Table 4. The varieties had a significant effect on weed dry weight at both locations. Fleur 11 recorded higher weed dry weight than the other variety.

The critical period of crop-weed interference and groundnut varieties interacted significantly for weed dry weight at UTG Faraba Banta. Unweeded control (weedy check) of all the two varieties significantly recorded the highest weed density and weed dry weight than the other critical period of the crop-weed interferences in both locations as shown in Tables 2 and 3 respectively. The weed-free check recorded the lowest weed density and dry weight at both locations as shown in Tables 2 and 3 respectively. In general, weed dry matter accumulation increased with increasing the duration of the weed competition period in both locations. The highest weed dry weight, a number of broad leaves, grasses and sedges, weed density, low weed control efficiency and higher weed infestation was recorded in weedy check than other critical periods of crop-weed interference treatments. This is in line with the findings of (Korav et al., 2020). This is because the experimental sites were species-rich weed communities that were able to emerge freely because no weed management measures were applied. This is in line with Pabitra *et al.* (2016) who reported that maximum weed density and dry matter were recorded in the weedy check treatment. Less weed competition resulted in a higher weed control efficacy index and lower weed dry matter by weed-free check than other critical periods of crop-weed interference treatment. This is because manual hoe weeding resulted in the cutting of the weed seedlings and the burial of weed seeds in the soil at greater depth than another management strategy. Weed dry matter accumulation increases with increasing the duration of the weed competition period in both locations. This is in conformity with the findings of Korav *et al.*, (2020). The weed-free check and weed-free up to 63 DAS were effective in reducing weed density and decreasing weed dry matter compared to the weedy check. The highest weed density and lowest weed control efficiency were recorded by the weedy check. This is because of the available dormant weed seeds in the soil seed bank which germinate as they are not controlled. This result agreed with Pabitra *et al.* (2016) who reported that maximum weed density was noticed in the weedy check on groundnut field.

Table 1. Effect of Critical Period of Crop - Weed Interference and Groundnut Varieties on Weed Density (ha^{-1}) and Weed Dry Weight ($kgha^{-1}$) at NARI Site and UTG Faraba Banta during 2021 Rainy Season

Treatments		Location			
		NARI Site III		UTG Faraba	
		Weed density at Harvest (ha^{-1})	Weed dry weight at harvest ($kgha^{-1}$)	Weed density at harvest (ha^{-1})	Weed dry weight at harvest ($kgha^{-1}$)
Crop - Weed Interference					
Weed Free up to 21DAS		141667bc	135.8bc	147778bc	116.4bc
Weed Free up to 42DAS		108889bcd	104.4bc	122778bc	83.4cd
Weed Free up to 63DAS		78889cd	88.7bc	90556c	52.2cd
Weed Free check		38333d	49.4c	47222c	16.8d
Weed Infestation up to 21DAS		109444bcd	113.7bc	118333bc	104.5bc
Weed Infestation up to 42 DAS		137222bc	141.7.4bc	142222bc	119.4bc
Weed Infestation up to 63DAS		187222b	162.6b	211667b	183.3b
Weedy check		988333a	953.6a	1136667a	943.4a
Level of significance		**	**	**	**
LSD		87694.4	82.5	102288.4	73.9
SE±		42811.0	40.27	49935.6	36.1
Fleur 11		219306	236.9a	252153	220.4a
Philippine Pink		228194	200.6b	254028	184.45b
Level of significance		NS	**	NS	*
LSD		110326.3	12.24	53272.8	33.3
SE±		25641.5	2.84	12381.4	7.7
Interaction	V*CWI	NS	**	NS	**

Means followed by the same letter(s) in a column are not significantly different at a 5% level of probability using the Students-Neuman Keuls (SNK) Test, DAS=Days after sowing, V= Variety, CWI= Crop- Weed Interference, NS= Not Significant, LSD= Least significant different

Table 2. Interaction between Critical Period of Crop - Weed Interference and Groundnut varieties on Weed Dry Weight at NARI Site III during 2021 Rainy Season

Crop - Weed Interference	Varieties	
	Fleur 11	Philippine Pink
Weed free up to 21 DAS	134.8cde	137.0cd
Weed Free up to 42DAS	104.4cdef	104.4cdef
Weed Free up to 63DAS	90.8cdef	86.7cdef
Weed free check	77.8cdef	21.1df
Weed Infestation up to 21DAS	111.9cdef	115.6cdef
Weed Infestation up to 42 DAS	138.9c	144.4c
Weed Infestation up to 63 DAS	146.2c	178.9c
Weedy check	1090.8a	816.3b
LSD	109.3	
SE±	53.6	

Means followed by the same letter(s) in a column are not significantly different at a 5% level of probability using Students-Neuman Keuls (SNK) Test, LSD= Least significant difference, DAS=Days after sowing

Table 3. Interaction between Critical Period of Crop - Weed Interference and Groundnut varieties on Weed Dry Weight at UTG Faraba Banta during 2021 Rainy Season

Crop - Weed Interference	Varieties	
	Fleur 11	Philippine Pink
Weed free up to 21 DAS	119.1cdef	113.7cdefghi
Weed Free up to 42DAS	85.7defghi	81.1defghi
Weed Free up to 63DAS	54.3efghi	50.0efghi
Weed free check	16.9fhi	16.7gi
Weed Infestation up to 21DAS	91.1defghi	`71.7c
Weed Infestation up to 42DAS	116.7cdefgh	122.2cde
Weed Infestation up to 63DAS	200.0c	166.7cde
Weedy check	1079.4a	807.3b
LSD	98.8	
SE±	34.18	

Means followed by the same letter(s) in a column are not significantly different at a 5% level of probability using Students-Neuman Keuls (SNK) Test, DAS=Days after sowing

Effect of Critical Period of Crop-Weed Interference and Groundnut Varieties on Weed Control Efficiency (%) and Weed Infestation (%)

The effect of a critical period of crop-weed interference and groundnut varieties on weed control efficiency and weed infestation at harvest is presented in Table 4. The critical period of crop-weed interference significantly affected weed control efficiency and weed infestation in both locations. The weedy-free check was found to be more efficient in controlling weeds followed by weed-free at 63 days after sowing at both locations. The least was recorded by the weedy check control (Table 4). The groundnut varieties showed no significant effect on weed control efficiency and weed infestation at both locations. There was no significant interaction between the critical period of crop-weed interference and groundnut varieties on weed control efficiency at both locations. Less weed competition resulted in higher weed control efficiency by weed free-check than other critical periods of crop-weed interference treatment. This is because manual hoe weeding resulted in the cutting of the weed seedlings and burial of weed seeds into the soil at greater depth than other management strategies. This is in conformity with the findings of Korav *et al*., (2020)**.**

Table 4. Effect of Critical Period of Crop - Weed Interference and Groundnut Varieties on Weed Control Efficiency (%) and Weed Infestation (%) at NARI Site and UTG Faraba Banta during 2021 Rainy Season

Treatments		Location			
		NARI Site III		UTG Faraba	
		Weed Control Efficiency (%)	Weed Infestation (%)	Weed Control Efficiency (%)	Weed Infestation (%)
Crop - Weed Interference					
Weed free up to 21DAS		63.67d	54.74e	68.00e	66.83d
Weed Free up to 42DAS		72.33c	44f.02f	78.5c	54.74e
Weed Free up to 63DAS		83.53b	33.77g	87.68b	45.98f
Weed free check		98.28a	21.08h	98.11a	22.45g
Weed Infestation up to 21DAS		73.39c	64.5d	76.00d	65.50d
Weed Infestation up to 42DAS		65.00d	75.83c	65.00f	76.67c
Weed Infestation up to 63DAS		53.00e	87.33b	52.83g	85.50b
Weedy check		0f	95.17a	0.00h	96.31a
Level of significance		**	**	**	**
LSD		2.3	2.36	1.44	2.37
SE±		0.81	0.82	0.62	0.88
Variety					
Fleur 11		63.87	59.70	66.16	63.98
Philippine Pink		63.43	59.41	65.37	64.51
Level of significance		NS	NS	NS	NS
LSD		1.8	5.84	2.96	5.13
SE±		0.30	0.84	0.42	0.22
Interaction	V*CWI	NS	NS	NS	NS

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, DAS=days after sowing, V= Variety, CWI= Crop- Weed Interference, NS= Not Significant, LSD= Least significant different

Effect of Critical Period of Crop-Weed Interference and Groundnut Varieties on Crop Growth Rate and Plant Dry Matter (gplot^{-1})

The effect of a critical period of crop-weed interference and groundnut varieties on crop growth rate and plant dry matter is presented in Table 5. The critical period of crop-weed interference had a significant effect on crop growth rate and plant dry matter in both locations. The weed-free plot recorded the highest crop growth rate and plant dry matter in both locations. The weedy check recorded the lowest crop growth rate and plant dry matter at both locations. The crop growth rates were found to be significantly higher at both weed-free check and weed-free treatment up to

63 Days after sowing than the rest of the treatments. Similarly, the weed-free at 42 days after sowing was significantly different from weed-free at 21 DAS, weed-infested at 21 DAS, weed-infested at 42 DAS and weed-infested at 63 DAS ($p<0.05$) at both locations.

There were no significant differences among weed-infested at 21 DAS, weed-infested at 42 DAS and weed-infested at 63 DAS ($p<0.05$) at both locations (Table 5). The groundnut varieties showed no significant effect on crop growth rate and plant dry matter at both locations. There was no significant interaction between the critical period of crop-weed interference and groundnut varieties on crop growth rate and plant dry matter at both locations. The lack of weed control throughout the growth period caused a significant reduction in plant dry matter in both locations. This is because weeds compete with crops for growth resources hence reducing plant dry matter. This finding is corroborated by the findings of Jat *et al.* (2011) reported that crop plants and weeds share the same ecological niche and they compete for nutrients, sunlight, moisture, and space and therefore, reduce the supply of these inputs to the crop plant and that can drastically reduce plant dry matter.

Table 5. Effect of Critical Period of Crop-Weed Interference and Groundnut Varieties on Crop Growth Rate and Plant Dry Matter (gplot^{-1}) at NARI Site and UTG Faraba Banta during 2021 Rainy Season

Treatments		Location			
		NARI Site III		UTG Faraba	
		Crop growth rate at 6 WAS	Plant Dry matter (gplot^{-1})	Crop growth rate at 6 WAS	Plant Dry matter (gplot-1)
Crop -Weed Interference					
Weed Free up to 21 DAS		12.21e	68.9cd	6.24e	56.9
Weed Free up to 42 DAS		18.98d	72.9cd	11.48d	58.5c
Weed Free up to 63DAS		31.07c	83.7c	16.72c	67bc
Weed Free check		65a	133.9a	32.13a	102a
Weed Infestation up to 21DAS		11.11e	55.2d	5.96e	43.7c
Weed Infestation up to 42DAS		9.96e	54.4d	5.24e	45c
Weed Infestation up to 63 DAS		8.09e	63.4cd	3.85e	56.6bc
Weedy check		4.63e	22.2e	2.53e	19.5d
Level of significance		**	**	**	**
LSD		6.16	15.70	3.81	9.12
SE±		2.148	5.47	1.327	6.45
Variety					
Fleur 11		22.56	68.1	11.23	57.9
Philippine Pink		22.2	71	11.7	58.4
Level of significance		NS	NS	NS	NS
LSD		2.97	6.8	1.08	4.44
SE±		0.489	1.12	1.327	3.14
Interaction	V*CWI	NS	NS	NS	NS

Means followed by the same letter(s) in a column are not significantly different at 5% level of probability using the Students-Neuman Keuls (SNK) Test, DAS=day after sowing, V= Variety, CWI= Crop- Weed Interference, NS= Not Significant, LSD= Least significant different

Effect of Critical Period of Crop-Weed Interference and Groundnut Varieties on Pod and Kernel Yield (kg ha^{-1})

Pod and kernel yield (kgha^{-1}) as influenced by the critical period of crop-weed interference and groundnut varieties is shown in Table 6. The pod and kernel yields/ha ranged from 370kgha^{-1} – 1350.7kgha^{-1} and 138.0kgha^{-1} – 1336.1kgha^{-1} in Site III. A similar scenario was recorded at the Faraba trial site. The highest pod and kernel yieldha^{-1} was obtained in the weed-free check followed by weed free at 63 DAS, while the lowest pod and kernel yieldsha^{-1} were found in the weed-infested check in all the sites. The critical period of crop-weed interference had a significant effect on pod and kernel yield in both locations. The weed-free check was significantly higher than all the tested treatments. Also, there were significant differences among weed-free at 42 DAS and 63 DAS and weed-free at 21 DAS, weed infested at 21 DAS, 42 DAS and 63 DAS in all the locations ($p<0.05$). There was no significant difference between the weed-free at 42 DAS and 63 DAS**.**

The varieties showed no significant effect on pod and kernel yield ha^{-1} in both locations. The interaction between the critical period of crop-weed interference and groundnut varieties on pod and kernel yield ha^{-1} was not significant in both locations. In both locations, Weedy check (unweeded) and weed infestation up to 63 DAS treatments had the lowest yield component and yield. This could be related to a reduction of dry matter production due to competition between crops and weeds for limited environmental resources. This agreed with Priya *et al*., (2013) who reported that groundnut yield decreased with increasing time of weed interference with all types of weed species. These findings also corroborated the findings of maintaining (Osunleti *et al*., (2022) who reported that a weed-free environment resulted in maximum yields of groundnuts. Similarly, Jallow *et al*., (2019) reported weedy-check control plots resulted in increased weed germination and growth which translates into higher weed density, weed dry and lower weed control index in various locations. The consequence of all these is serious competition between the weed and groundnut which also explains the reasons for low pod yield on the control plots (Jallow et *al*., 2019).

Table 6. Effect of Critical Period of Crop - Weed Interference and Groundnut Varieties on Pod and Kernel Yield (kg ha^{-1}) at NARI Site and UTG Faraba Banta during 2021 Rainy Season

Treatments		Location			
		NARI Site III		UTG Faraba	
		Pods Yield (kg ha^{-1})	Kernel Yield (kg ha^{-1})	Pod Yield (kg ha^{-1})	Kernel Yield (kg ha^{-1})
Crop - Weed Interference					
Weed free up to 21DAS		785.3bcd	683.2bcd	753.7d	668.9d
Weed Free up to 42DAS		864.3bc	787.6bc	872.3c	778.0c
Weed Free up to 63DAS		984.8b	915.6ab	950.4b	835.7b
Weed free check (75DAS)		1350.7a	1092.6a	1336.1a	1235.7a
Weed Infestation up to 21DAS		693.5cde	608.3cd	711.1d	634.1d
Weed Infestation up to 42 DAS		622.2de	545.0cd	640.2d	552.4d
Weed Infestation up to 63DAS		516.2ef	483.8d	522.8f	447.4f
Weedy check		370f	412.7d	138g	93.3g
Level of significance		**	**	**	**
LSD		195.8	271.3	46.1	42.5
SE±		97.56	93.6	15.9	14.6
Variety					
Fleur 11		749.4	629.5	740.55	653.4
Philippine Pink		797.6	752.7	740.7	657.9
Level of significance		NS	NS	NS	Ns
LSD		237.4	234.9	28.8	39,2
SE±		39.0	35.8	4.73	6.4
Interaction	V*CWI	NS	NS	NS	NS

Means followed by the same letter(s) in a column are not significantly different at 5% level of probability using the Students-Neuman Keuls (SNK) Test, DAS=day after sowing, V= Variety, CWI= Crop- Weed Interference, NS= Not Significant, LSD= Least significant different

Effects of Weed density on Pod yield of Groundnut under different Weeding Regimes at Site III and UTG Faraba

Figures 1 and 2 show the effects of weed density on pod yield of groundnut under different weeding regimes in Site III and UTG Faraba, respectively. The results in both locations showed a similar trend in terms of the effects of weed densities on the yield of groundnut. The pod yield of groundnut at both locations began to increase at weed densities of 108,889/ha in Site III and 122,778 in UTG Faraba at weed-free up to 42 Days after Seeding. This shows that the most critical period of crop-weed interactions starts from weed-free up to 21 Days after seeding to weed-free up to 42 Days after seeding. According to Korav et al (2020), the critical period for weed competition in groundnut was estimated from 22 days after emergence to 62 days after emergence. Similarly, the pod yield of groundnut declined as weeding was delayed up to 21 Days after seeding and 42 Days after seeding, respectively. The highest pod yield was obtained at the lowest weed density in the Weed-free plot (75 DAS) while the lowest pod yield was observed at the highest weed density in the weedy check (no weeding).

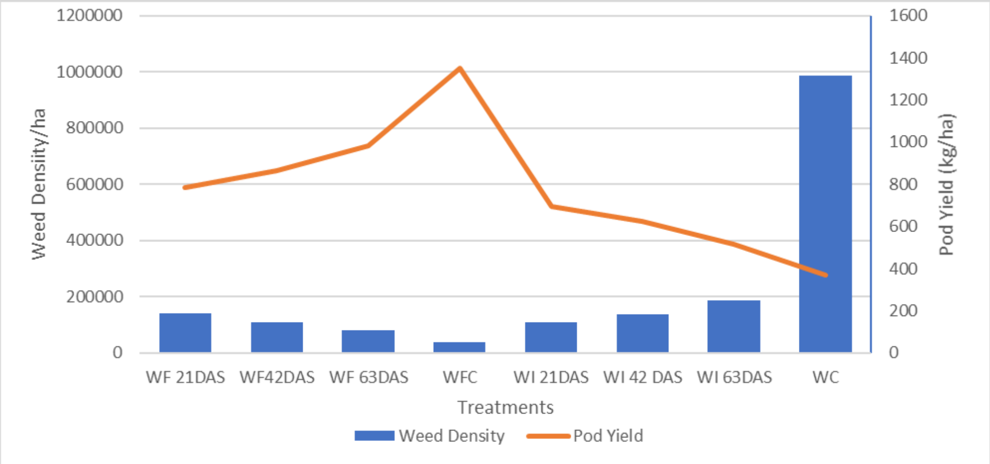

Figure 1. Shows the Effects of Weed Density on Pod Yield of Ground under Different Weeding Treatments in Site III

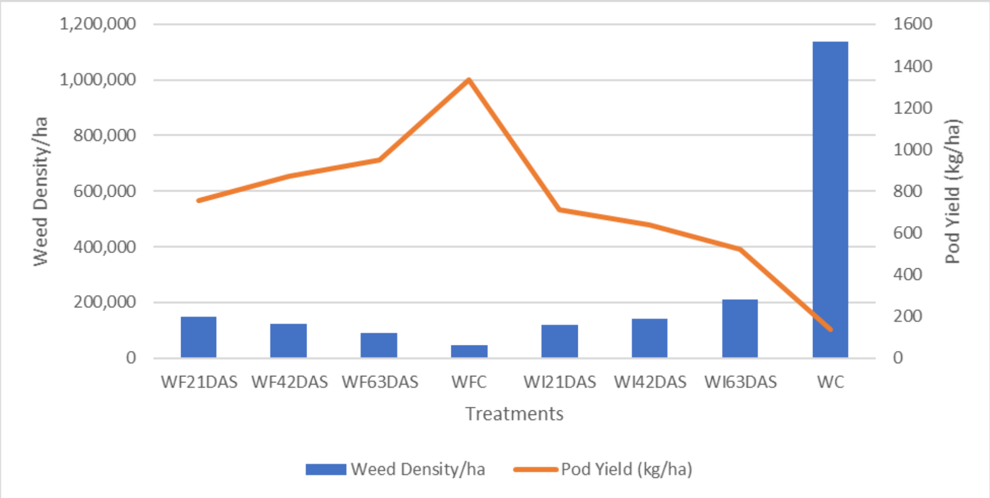

Figure 2. Shows the Effects of Weed Density on Pod Yield of Ground under Different Weeding Treatments at UTG Faraba

Effect of Weed Density on Pod Yield at NARI Site III

A simple linear regression analysis between weed density and pod yield was significant at NARI Site III (Table 7). The weed density had a negative relationship with the pod yield per hectare. The adjusted coefficient of determination was R^2 0.578 which revealed that the variation in pod yield per hectare could be explained by variation in weed density in a ratio of about 58% represented by the nearest dots to the linear line (Figure 3) indicating that an increase in one weed of weed density could lead to a decrease in pod yield per hectare. This result is in agreement with Tasmiya *et al.*, (2017) who reported that weed density could reduce groundnut yield as high as 24 to 70%.

Table 7: Regression Analysis between Weed Density and Pod yield ($kgha^{-1}$) at NARI Site III

Source	d.f.	Sum of squares	Mean Squares	R^{-2}	Adjusted R^{-2}	F	Significant Level
Regression	1	2983376.39	2983376.395	0.5785	0.5694	63.13	0.0001
Residual	46	2173516.381	47250.356				
Total	47	5156892.776					

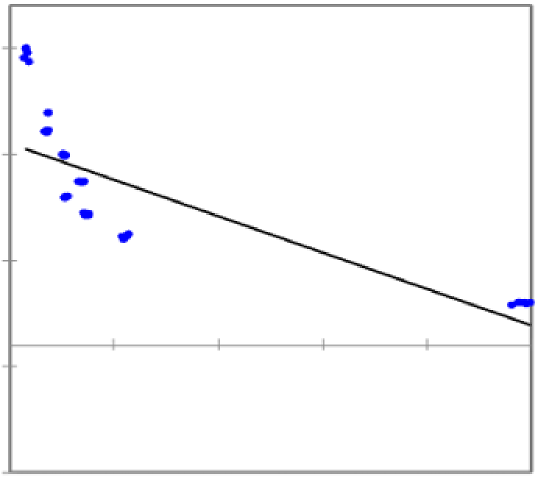

Figure 3: Effect of weed density on pod yield ($kgha^{-1}$) at NARI Site III

Effect of Weed Density on Pod Yield at UTG Faraba

A simple linear regression analysis between the pod yield per hectare and the weed density was significant at UTG Faraba Banta (Table 8). The pod yield per hectare had a negative relationship with the weed density, the adjusted coefficient of determinant was R^2=0.582 which indicated that the reduction in pod yield per hectare was caused by the increase in weed density in a ratio of about 58% and this rate is represented by the nearest dots to the linear line (Figure 4). The linear regression equation was formed as follows:

$$Y= -0.00086+951.94\ WD$$

where Y= pod yield per hectare and WD= weed density -0.00086 constant, and 951.94 regression coefficient (b), indicating that an increase in one weed could lead to a decrease in pod yield per hectare in rate of 951.94. This result is in conformity with the finding of Tasmiya*et al.*, (2017) who reported that weed density could reduce groundnut yield as high as 24 to 70%.

Table 8. Regression Analysis between Weed Density and Pod yield ($kgha^{-1}$) at UTG Faraba Banta

Source	d.f.	Sum of squares	Mean Squares	R^{-2}	Adjusted R^{-2}	F	Significant Level
Regression	1	2958298.709	2958298.709	0.582	0.573	64.06	0.0001
Residual	46	2124244.084	46179.219				
Total	47	5082542.799					

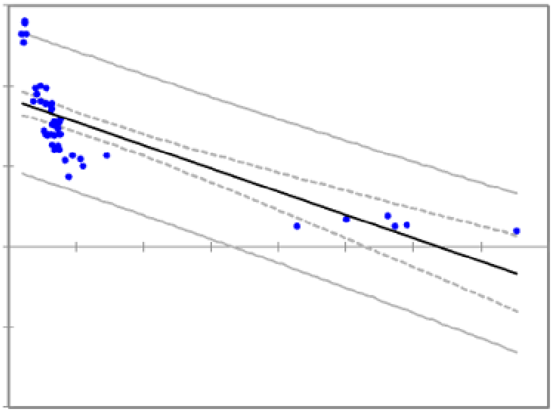

Figure 4. Effect of weed density on pod yield ($kgha^{-1}$) at UTG Faraba Banta

Conclusion

From the outcome of the results, it could be concluded that weed-free check followed by weed-free up to 63 DAS had led to the production of the highest pod and kernel yields of groundnut. Philippine Pink recorded the highest pod yield and kernel yield than the other groundnut varieties.

Recommendation

The current results could help groundnut producers in The Gambia to improve the efficacy of their weed management strategies. The main practical implication of this study is that weeds must be controlled up to maturity. The findings are valuable for groundnut growers in optimizing the timing of weed control as well as in developing an integrated weed control strategy.

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