PERFORMANCE OF THREE GROUNDNUT (Arachis hypogaea L) VARIETIES AS INFLUENCED BY WEED CONTROL METHODS AND TIME OF PHOSPHOROUS APPLICATION IN NORTHERN GUINEA SAVANNA.

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ABSTRACT

Field trials were conducted in 2018 and 2019 wet seasons at the Teaching and Research farms of Samaru College of Agriculture, Ahmadu Bello University, Zaria Kaduna State. The treatments consisted of three groundnut varieties (SAMNUT-22, SAMNUT-23 and SAMNUT-24), five weed control treatments (weedy check, black polythene mulch, pre-emergence herbicide follow by (fb) Post- emergence herbicide (Pendimenthalin at 1.5 kg a.i ha^{-1} + fluazifop-P- butyl at 1.0 kg a.i 1.5 kg a.i ha^{-1}), manual hoe weeding at 3 and 6 WAS and intra row spacing at 10cm) and two different timing of phosphorous fertilizer application (2 weeks before sowing and at sowing).The treatments were laid in a split plot design with factorial combinations of weed control strategies and time of phosphorous application occupying the main plot while groundnut varieties occupied the sub- plots. The treatments were replicated three time. The results from the study revealed that SAMNUT-24 recorded the least weed dry weight and responded better to weed control efficiency than SAMNUT-22 and SAMNUT-23 respectively. Similarly, SAMNUT-24 recorded higher values for plant height and canopy spread. In terms of weed control methods, groundnut mulched with black polythene recorded highest values for canopy spread and plant height. Time of phosphorous application did not affect plant height. It can be concluded that SAMNUT-24 groundnut variety is superior in terms of vegetative growth and pod yield. Black polythene mulch or hoe weeding at 3 and 6 WAS controls weed effectively. Applying P at different timing had no significant impact on groundnut at Samaru.

Keywords: Varieties, Weed control, Growth and Time of P application.

INTRODUCTION

Groundnut (Arachis hypogaea L.) is a member of the genus Arachis in the family Fabaceae. Although groundnut originated in South America, it is now widely planted in tropical, sub-tropical and warm temperature areas in Asia, Africa, North and South America, and Oceania (Freeman et al.,1999). Groundnut is an important food crop worldwide with an annual production of over 47 million tons on near 28 million hectares in 2017, according to Food and Agriculture Organization (FAOSTAT, 2017). Anon. (2020) In Nigeria groundnut is mainly produced in the Northern State; However, some few southern States also produce small amounts.

In spite of the availability of abundant land and human resources in Nigeria, yield per hectare from groundnut production (in shell) is below world average (44 million metric

tons) (FAOSTAT, 2018). It has been revealed that, there is a shortfall of over 90 percent of groundnut requirement by companies involved in processing (Anon., 2004). The use of improved varieties for a particular ecology is essential in groundnut production. Farmers using improved varieties have derived significant yield gains of 23%, 43% and 31% over local varieties in Mali, Niger and Nigeria respectively (Anon., 2011). Among other agronomic factors low yielding varieties are the major constraints in groundnut production and quality (Asofo-Adeji et al., 1998).

Effective weed control method is essential for profitable groundnut production. Weeds compete for moisture, nutrients and light during the growing season there by lowering the quality and quantity of the crop. Losses caused by weeds vary from one country to another and even within one ecology to the other depending on the predominant weed flora and on the control methods employed (Ibrahim, 2015).

Ayodele and Oso (2014) reported that applied P at the early stage of cowpea growth, was found to stimulate root elongation and proliferation, nodule formation and development of vegetative structures as well as uptake of other plant nutrients; since phosphorus play vital roles in the reactions involving energy transfer, leguminous crop which depends on fixed N for growth would require large amount of phosphorus at the right time.

Based on the foregoing the objective(s) of this study therefore are as follows;

1. To determine the performance of growth of groundnut varieties under Northern Guinea savanna conditions of Nigeria.
2. To determine the most efficient among the weed control method and time of P application for optimum growth of groundnut Northern Guinea savanna ecology of Nigeria.

Materials and Methods

The experiment was conducted in 2018 and 2019 wet seasons at the Teaching and Research Farm of Samaru College of Agriculture, Ahmadu Bello University Zaria (11° $11^{'}$ N, 07° $38^{'}$ E, and 686m above sea level) located in the northern Guinea Savanna agro ecological zone of Nigeria. The land was harrowed twice to a fine tilt and ridged 75cm between rows and then marked out into 90 plots with 1.5 m spacing between blocks and 0.5m spacing between plots. The gross and net plot size were 18.0 m^2 (4.5m x 4m) and 6.0 m^2 (1.5m x 4m) respectively. The groundnut seeds were sown at 20cm spacing with 2 seeds per hole. The treatments consisted of three groundnut varieties (SAMNUT-22, SAMNUT-23 and SAMNUT-24), five weed control treatments (weedy check, black polythene mulch, pre-emergence herbicide follow by (fb) Post- emergence herbicide (Pendimenthalin at 1.5 kg a.i ha^{-1} + fluazifop-P- butyl at 1.0 kg a.i 1.5 kg a.i ha^{-1}), manual hoe weeding at 3 and 6 WAS and intra row spacing at 10cm) and two different timing of phosphorous fertilizer application (2 weeks before sowing and at sowing).The treatments were laid in a split plot design with factorial combinations of weed control strategies and

time of phosphorous application occupying the main plot while groundnut varieties occupied the sub- plots. The treatments were replicated three time. Data on the following parameter were collected:

Weed dry weight samples were taken from $1m^2$ quadrat at 12 WAS. The samples was cleared free of soil and oven dried at 70^o C to constant weight for dry matter determination using E2000 electronic mettler balance.

Weed control efficiency (W.C.E.) (%) at harvest

This was calculated using the formula:

$$W.C.E. = \frac{\text{Weed dry weight in weedy check} - \text{Weeds dry weight per treatment}}{\text{Weed dry weight in weedy check}} \times 100$$ (Das, 2008).

Plants height was measured at 12WAS using metre rule from the ground level to tip of the last fully expanded leaf of each of the 5 tagged plants per net plot. The average was computed and recorded for each treatment and expressed in centimeter.

Canopy spread was measured from the five tagged plant by taking the diameter of the open canopy using a meter rule and the mean obtained were recorded on per plot basis and expressed in centimeter. This was done at 12 WAS.

Pod weight kg plot^{-1} was determined by measuring the weight of the total harvested pods in each net plot using E2000 electronic mettler balance and the values were recorded on plot^{-1} basis.

The data collected was subjected to Analysis of Variance (ANOVA) using general linear model GLM of the Statistical Analysis System package (SAS, 2003) and the means was separated using the Duncan's Multiple Range Test (5% probability level) (Duncan, 1955).

RESULTS

Weed dry weight and Weed control efficiency

Table 1 shows the effect of groundnut varieties on weed control methods and time of phosphorous application on weed dry weight at 12 WAS and weed control efficiency at Samaru during 2018 and 2019 wet season. At both years SAMNUT-23 recorded the highest values for weed dry weight while SAMNUT-24 recorded the least values for weed dry weight. Also SAMNUT-24 and SAMNUT-22 recorded the highest values for weed control efficiency in 2018 and 2019 respectively while SAMNUT-22 and SAMNUT-23 in 2018 and SAMNUT-24 in 2019 recorded the least value for weed dry weight. However, at both years weedy check recorded the highest values for weed dry weight while black polythene mulch and hoe weeding at 3 and 6 WAS in both years and pendimenthalin at 1.5 kg a.i ha^{-1} fb fluazifop- P-butyl at 1.0 kg a.i ha^{-1}in 2019 only recorded the least value for weed dry weight of groundnut at Samaru. Also weed control weed control efficiency was significantly higher with the application of black polythene mulch and hoe weeding at 3 and 6 WAS in 2018 and 2019 while the weedy check of both years recorded the least values for weed control efficiency of groundnut at Samaru. Likewise, application of phosphorous at 2 Weeks before sowing significantly recorded highest value for weed dry weight and weed control efficiency in 2019 than at sowing. The interaction between varieties and weed in 2018 and varieties and

phosphorous in 2018 with respect to weed control efficiency was significant.

Plant height and Canopy spread

The effect of groundnut varieties, weed control methods and time of phosphorous application on plant height and canopy spread 12 WAS at Samaru during 2018 and 2019 wet seasons is presented in Table 2. Plots sown to SAMNUT-24 significantly produced the tallest and widest crop in both years. While plant height in 2019 and canopy spread in 2018 recorded the least value for groundnut plant. Application of black polythene mulch significantly recorded the highest value for plant height in 2019 and canopy spread in both years. While the control recorded the least value for both growth parameters, also the use of intra row spacing at 10 cm in both years and pendimenthalin at 1.5 kg a.i ha^{-1} fb fluazifop- P-butyl at 1.0 kg a.i ha^{-1} in 2018 recorded the least value for canopy spread of groundnut plant. However, none of the time of P application was significant for both growth characters. No interaction.

Pod yield

SAMNUT-24 significantly produced the highest pod yield of groundnut in both years while SAMNUT-22 recorded the least values for pod yield of groundnut in 2019 (Table 3). Application of black polythene mulch and hoe weeding at 3 and 6 WAS significantly produced the highest value for pod yield of groundnut than the rest of the weed control methods used. None of the time of P application was significant for pod yield of groundnut at both years at Samaru. No interaction.

DISCUSSIONS

Effect of variety on growth of groundnut

The superiority of SAMNUT-24 (early maturing variety) over SAMNUT-22 (late maturing variety) and SAMNUT-23 (medium maturing variety) in terms plant height and canopy spread. Also it could probably be as a result of the ability of the early maturing variety to withstand both weed pressure and different weed control strategies employed that includes tolerance to herbicide used. Thus given the early maturing SAMNUT-24 variety an upper hand over SAMNUT-22 and SAMNUT-23 in terms of growth parameters such as plant height, canopy spread and crop growth rates among others. This is in accordance with the finding of Ibrahim et al.(2014) who reported that crop differ in their ability to assimilate photosynthates and partitioning of these assimilates to growth and yield.

Effect of weed control on growth of groundnut

Based on the results obtained from the trials, it was observed that better groundnut crop growth was observed in treatments with black polythene mulch and hoe weeding at 3 and 6 WAS because of the ability of these two weed control strategies in having a more efficient weed control when compared with others. This result is in conformity with that of Mubarak (2004) reported that efficient weed control facilitates plant to have more resources for growth.

Effect of Time of Phosphorous Application

The inconsistencies recorded due to time of phosphorous application at 2 WAS before sowing or at sowing had a great impact on weed dry weight and weed control efficiency. The reason for the superiority recorded by time of phosphorous application at 2 WAS before sowing with respect to weed characters mentioned could be due to the fact that phosphorous is an immobile element. Therefore, weeds being an opportunistic pest that seizes the opportunity of the availability of P and other growth factors in the soil and mined it out, which eventually resulted to accelerated growth and development of the weed floral before fully establishment of the groundnut plant of which the P was meant for. Thereby, reducing the quantity of the recommended dose of P that was allocated for the groundnut plant. According to Jones and Jacobsen (2009) reported that timing fertilization with peak nutrient uptake demands is essential for optimizing both yield and quality. In general, nutrient uptake rate are highest from early to mid-growing season, which is why fertilization near the time of seeding is generally very effective. P should be applied immediately before or at planting due to its immobility in soil.

CONCLUSIONS

Based on the findings of this research work, it can be concluded that SAMNUT-24 groundnut variety is superior in terms of vegetative growth and pod yield when compared with the two other varieties. While, the use of black polythene mulch or hoe weeding at 3 and 6 WAS controls weed more effectively and resulted to better growth of groundnut when compare to other weed management strategies. Applying P at different timing did not have any significant impact on groundnut at Samaru.

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Table 1: Effect of Groundnut Varieties, Weed Management and Time of Phosphorus Application on Weed Dry Weight at 12 WAS and Weed Control Efficiency at Samaru during 2018 and 2019 wet seasons.

	Weed dry weight		Weed control efficiency	
Treatments	2018	2019	2018	2019
Varieties (V)				
SAMNUT22	208.3b	383.60b	59.88b	68.81a
SAMNUT 23	321.2a	551.85a	57.53b	62.07b
SAMNUT 24	158.1c	302.28c	69.99a	55.19c
S.E+	12.739	23.215	1.164	2.264
Weed control methods (W)				
Weedy check	550.0a	1141.8a	0.00d	0.00d
Black polythene mulch	40.9d	110.29c	98.20a	89.78a
Pendimenthalin at 1.5 kg a.i. ha^{-1}fb fluazifop-P-butyl at 1.0 kg a.i. ha^{-1}	303.8b	219.27c	51.57c	75.26b
Hoe weeding at 3 and 6 WAS	44.8d	172.45c	98.80a	80.09b
Intra row spacing at 10 cm	207.0c	419.20b	63.76b	65.00c
S.E.+	15.057	36.322	2.230	2.376
Time of phosphorus application (P)				
2Weeks Before sowing	218.4	448.62a	61.58	65.99a
At sowing	240.0	376.60b	63.36	58.06b
S.E+	9.523	22.972	1.410	1.781
Interactions				
V x W	NS	NS	*	NS
V x P	NS	NS	NS	*
W x P	NS	NS	NS	NS
V x W x P	NS	NS	NS	NS

Means followed by the same letter within the same treatment group /column are statistically similar using DMRT at 5% level of significance. NS = Not Significant. WAS = Weeks After Sowing . * = Significant at 5 %.

Table 2: Effect of Groundnut Varieties, Weed Management and Time of Phosphorus Application on Plant height at 12 WAS and Canopy spread at 12 WAS at Samaru during 2018 and 2019 wet seasons.

	Plant height		Canopy spread	
Treatments	2018	2019	2018	2019
Varieties (V)				
SAMNUT22	45.3b	58.2b	3757.0b	3651.0b
SAMNUT 23	43.8b	51.0c	3107.3c	2968.5b
SAMNUT 24	54.5a	64.6a	4588.0a	6855.7a
S.E+	1.13	1.47	170.91	446.46
Weed control methods (W)				
Weedy check	47.8	40.1c	3212.9c	1604b
Black polythene mulch	51.7	72.2a	5283.2a	7632a
Pendimenthalin at 1.5 kg a.i. ha^{-1}fb fluazifop-P-butyl at 1.0 kg a.i. ha^{-1}	46.5	55.8b	3425.6c	5378ab
Hoe weeding at 3 and 6 WAS	45.9	63.1b	4296.9b	5532ab
Intra row spacing at 10 cm	47.6	58.6b	2868.5c	2313b
S.E.+	1.98	2.47	193.84	1314.25
Time of phosphorus application (P)				
2Weeks Before sowing	47.9	57.7	3670.2	4794
At sowing	47.8	58.3	3964.7	4189
S.E+	1.25	1.56	122.59	831.21
Interactions				
V x W	NS	NS	NS	NS
V x P	NS	NS	NS	NS
W x P	NS	NS	NS	NS
V x W x P	NS	NS	NS	NS

Means followed by the same letter within the same treatment group /column are statistically similar using DMRT at 5% level of significance. NS = Not Significant. WAS = Weeks After Sowing .

Table 3: Effect of Groundnut Varieties, Weed Management and Time of Phosphorus Application on Pod yield kg plot^{-1} at Samaru during 2018 and 2019 wet seasons.

	Pod yield kg plot^{-1}	
Treatments	2018	2019
Varieties (V)		
SAMNUT-22	1.76b	2.84c
SAMNUT -23	1.71b	3.30b
SAMNUT- 24	2.39a	3.97a
S.E+	0.143	0.144
Weed control methods (W)		
Weedy check	1.64ab	2.37b
Black polythene mulch	2.23a	4.65a
Pendimenthalin at 1.5 kg a.i. ha^{-1}fb fluazifop-P-butyl at 1.0 kg a.i. ha^{-1}	2.07ab	2.80b
Hoe weeding at 3 and 6 WAS	2.20a	3.96a
Intra row spacing at 10 cm	1.61b	3.08b
S.E.+	0.186	0.251
Time of phosphorus application (P)		
2Weeks Before sowing	1.91	3.33
At sowing	1.99	3.41
S.E+	0.117	0.159
Interactions		
V x W	NS	NS
V x P	NS	NS
W x P	NS	NS
V x W x P	NS	NS

Means followed by the same letter within the same treatment group /column are statistically similar using DMRT at 5% level of significance.

NS = Not Significant.