EFFECT OF WEEDING REGIME ON THE GROWTH AND YIELD OF TWO VARIETIES OF BAMBARA NUT (*VIGNA SUBTERRANEA* (L.) VERDC) IN ANYIGBA, KOGI STATE

By

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ABSTRACT

The research was conducted in Kogi State University Student Research and Demonstration Farm, during the 2018 rainy session to investigate the effect of weeding regime on the growth and yield of two varieties of Bambara nut (Vigna subterranean). The experiment was a 2x4x3 factorial experiment laid in a Randomized Complete Block Design (RCBD). The treatments consist of two Bambara nut varieties Jatopha and Caro in the main plots while four weeding regime were applied to the sub plot (zero weeding Wo, weed once W1, weed twice W2, and weed free W3) replicated three times. The parameters measured include; number of leaves, plant height, number of branches, number of pods per plot, 100 seed weight, grain yield (kg/ha). The growth and yield attributes of Bambara nut were significantly reduced when the crops were left not weeded. Jatopha variety when kept weed free gave the highest grain yield of 1392.32kg/ha. The study revealed that Jatopha variety gave better growth and yield performance when compared to Caro variety. The mean plant height and mean grain yield of Jatopha variety was 15.90cm and 806.16 kg/ha respectively while that of caro variety was 11.88cm and 332.82 kg/ha respectively.

Key Words: weeding regime, Bambara nut and varieties

INTRODUCTION

Bambara nut (*Vigna subterranea* (L.) Verdc) is a leguminous crop belonging to the family Fabaceae. It ranks third in terms of importance after cowpea and groundnut but often times neglected and underutilized (Effa *et al.,* 2016). The name Bambara nut reveals the crops area of origin believed to be of the Bambara tribe in the Sahelian region of West Africa (Hillocks *et al.,* 2012). The crop is known by several names in different parts of Africa: in Nigeria it is known as 'Gurjiya' or 'Kwaruru' in Hausa, 'Epa-wro' in Yoruba and 'Okpa' in Ibo in South Africa 'Jugo beans', 'Ntoyo Cibemba' in Zambia and 'Nyimo beans' in Zimbabwe (DoubleGist, 2013). Bambara nuts are utilized in various ways. Fresh mature seeds are boiled and eaten like nut while dry seeds can either be roasted or fried and consumed as a snack. Dry seeds may be milled into flour and made into a paste and fried in hot oil as 'akara'. Wheat can be substituted with up to 20 % bambara flour in bread making and can also be used as a composite flour in biscuits and cakes (Addo and Oyeleke 1986; Brough *et al.* 2005; Alozie *et al.* 2009).

The annual production of Bambara nut is estimated to be 0.2 million tonnes from an area of 0.25 million hectares worldwide. Sub-Saharan Africa (West Africa) is the largest producer of Bambara nut with Burkina Faso, Niger, and Cameroon being the leading producers, contributing 74% of global production, while a small quantity is produced in Southeast Asia, the United States of America (USA), and Australia. (FAOSTAT, 2020). In Nigeria Bambara nut is cultivated intensively by women in agriculture or smallholder. The crop is usually intercropped with arable crops like sorghum, millet, maize, yams, and cassava with Benue, Taraba, Plateau, Adamawa, Bauchi, Nassarawa, Kaduna, Niger, Kogi, Ebonyi, Enugu and Cross River State being major producers in the country (Shiyam, 2016). It has high potential for food and nutritional security due to its highly nutritious seeds which contain 55.5 – 69.3 % carbohydrate, 5.3 – 7.8 % fat, metabolizable energy value of 362 –414 kcal/100 g and 17 – 24 % high quality protein (Dansi *et al,* 2012; Hillocks *et al,* 2012; Olanipekun *et al,* 2012), it also contains high amounts of nutritional fiber, Calcium and Iron plus vitamins as thiamin, riboflavin, niacin, and carotene. (Abdulsalami and Sheriff, 2010).

Bambara nut have intrinsic edible attributes and resilience to the biotic and abiotic stresses associated with climate change. They have adapted and co-evolved under the prevailing farming and environmental conditions, weed pressure, insect pest and diseases and low input farming systems in Africa (Majola *et al.,* 2021). Bambara nut farmers benefit from the genetic variation present among landraces varieties such as for food quality, stable and equitable yields, tolerance to weeds, drought, diseases, insect pests and adaptation to the local environment (Adebiyi *et al*., 2019). There is high genetic variation amongst landrace varieties in West Africa useful for genetic improvement and analyses for diverse economic traits of value to the farmer (Puozaa *et al*., 2017).

Weeds are known to be one of the outstanding pests that cause significant reduction in plant yield, increase the cost of production and in some cases render the land unusable for farmers (Oudhia, 2004; Garko *et al.,* 2018). Abdulraheem and Charles (2018) defined weeds as any plant or vegetation except fungi that interferes with man's objectives. Their detrimental characteristics overshadow their benefits according to the farmer's perspective since no plant is truly a weed in itself (Dwight, 2007; Oyewole *et al*.,2013). Hence, weeds are man-made problem, originating from man disturbing the natural balance of the ecosystem leading to the emergence of undesired plants. weed compete with crop for limited climatic and edaphic resource, harbor diseases, disease causing organisms and crop pest.

Some weeds secret harmful substances that impede the growth of crops. Bambara nut initial slow growth coupled with some morphological traits does not allow it to grow above the weeds hence making it susceptible to weed interference. Weeds meddling with Bambara nut is a major problem, requiring considerable investment of human labour to minimize its negative impact (Shiyam, 2016).

Oyewol *et al.,* (2013), mentioned that weed pest in crop production are a major challenge in attaining food security in Nigeria and in Africa as a whole as it constitutes a major drawback in plant productivity. The use of agro chemicals in weed control or management have been discouraged by several authors due to the residual effect of such chemicals hence the need to develop a weeding program that will be both climate smart and cost effective. It is in this context that this research was designed to investigate the effect of weeding regime on the growth and yield of two varieties of Bambara nut.

MATERIALS AND METHODS

Experimental site

The experiment was conducted at Kogi State University Student Research and Demonstration Farm (Lat 7^0 29^1 N and Long 7^0 11^1E) in the Guinea savanna agro ecological zone during the rainy season of 2018. Kogi state has a bimodal rainfall with the peak pattern occurring in July and September.

Treatment and Experimental Design

The treatments consist of two varieties of Bambara nut (Jatopha and Caro) and four weeding regime (zero weeding, weed once, weed twice and weed free) replicated three times. The experiment is a 2x4x3 factorial experiment laid in a Randomized Complete Block Design (RCBD).

Soil Analysis

Soil samples were taken from the upper layer (0-15cm) shortly before ploughing and analyzed for the physical and chemical properties. Results are summarized in Table 1.

Cultural Practices

The field was cleared of vegetation manually and then ploughed, harrowed and ridged. The seeds were obtained from Institute of Agricultural Research (IAR), and were sown on the 14th of September 2018 using the drilling method of planting for the two varieties. Weeding was carried out manually (hoe weeding) to ensure that the treatments were followed appropriately

Harvesting

Harvesting was done when the leaves began to wilt and turn yellow where about 80% of the pods had matured.

Data collected on growth and yield parameters

Number of leaves per plant: this was obtained by counting the number of leave from 4 tagged plants per net plot and the average taken.

Plant height: this was obtained by measuring the height of four tagged plants per net plot from the ground to the tip at 30 DAP and 45DAP after planting and the average taken.

Number of branches The number of branches of four tagged plants per net plot were counted and the average taken

Number of Pods per Plot This was determined by counting the pods harvested per sampled population. The results obtained were recorded as means of the sampled population.

Weight of 100 seeds per plot:100 seeds were randomly selected from harvested plants in each block and weighed with an electric weighing balance.

Grain Yield per Hectare: This was determined by extrapolating the grain yield per net plot

$$\text{Seed yield per hectare} = \frac{\text{Grain yield per plot}}{\text{Land Area}} \times 10000$$

Data analysis: The growth and yield parameters measured were collated and subjected to Analysis of Variance (ANOVA). Significantly different means were separated using Least Significant Difference (LSD).

Results

Soil Analysis: Table 1 show that the land used was sandy loam textured. It was also observed that the soil of the experimental site was relatively acidic with a pH of 5.80.

Table 1. **Soil Analysis**

Parameters Measured	Values Obtained
Particle size distribution (%)	
Clay	14.64
Silt	1.00
Sand	84.36
Textural class	sandy loam
pH (H_2O)	5.8
Organic Carbon (%)	0.31
Total Nitrogen (%)	0.016
Available Phosphorus (mg/kg)	5.19
Exchangeable cation (Cmol/kg)	
Calcium (Ca)	3.68
Magnesium (mg)	1.62
Potassium (K)	1.28
Sodium (Na)	0.58
Effective Cation Exchange Capacity	9.07

Effect of weeding regime on growth parameters:

Table 2. Effect of Weeding Regime on the Number of Leaves, Number of Branches and Plant Height

	Treatment	**Number of leaves**		**Number of branches**		**Plant height(cm)**	
		30DAP	45DAP	30DAP	45DAP	30DAP	45DAP
Jatopha	W0	57.30	111.70	19.10	32.80	13.90	14.70
	W1	62.30	172.00	19.70	47.55	13.10	16.60
	W2	53.70	188.30	21.20	49.35	13.00	16.50
	W3	54.00	171.30	18.00	47.60	13.10	15.80
	Mean	**56.83**	**160.85**	**19.5**	**44.33**	**13.28**	**15.90**
Caro	W0	38.00	99.00	12.70	21.85	9.80	11.20
	W1	48.70	136.30	16.20	29.95	10.40	12.50
	W2	44.00	139.00	14.70	35.00	9.97	12.30
	W3	41.00	136.70	13.70	35.50	10.03	11.50
	Mean	**42.93**	**127.75**	**14.33**	**30.58**	**10.05**	**11.88**
	LSD $_{0.05}$	**3.66**	**3.43**	**3.71**	**2.89**	**3.00**	**4.27**

(zero weeding W0, weed once W1, weed twice W2, and weed free W3) DAP- Days After Planting

Results from Table 2 show that weeding regime had significant ($P \leq 0.05$) effect on number of leaves, number of branches and plant height at 30DAP and 45DAP respectively. At 30DAP Caro variety had the least number of leaves at W0 (zero weeding) with 38 leave while Jatopha variety had the highest number of leaves at W1 (weed once) with 62 leaves. At 45DAP Jatopha variety at W2 (weed twice) had the highest number of leaves with 188 leaves whereas caro variety at W0 (zero weeding) had the least number of leaves with 99 leaves.

The results also show that at 30 DAP Caro variety had the least number of branches at W0 (zero weeding) with 12.70 branches which was not significantly different from W2 (weed twice) and W3 (weed free) having 14.70 and 13.70 branches respectively while Jatopha variety had the highest number of branches at W_2 (weed twice) with 21.20 branches but not significantly different from W0 (zero weeding) and W1 (weed once) having 19.10 and 19.70 respectively. At 45 DAP Jatopha variety at W2 (weed twice) had the highest number of branches with 49.35 branches which was not significantly different from W1 (weed once) and W3 (weed free) with 47.55 and 47.60 respectively. Caro variety at W0 (zero weeding) had the least number of branches with 21.85 branches.

Furthermore, at 30 DAP Caro variety had the least plant height at W_0 (zero weeding) with 9.80 cm which was not significantly different from W1 (weed once), W2 (weed twice) and W3 (weed free) having 10.40cm, 9.97cm and 10.03cm respectively while Jatopha variety had the highest plant height at W0 (zero weeding) with 13.90cm but not significantly different from W_1 (weed once), W2 (weed twice) and W3 (weed free) having 13.10cm, 13.00cm and 13.10cm respectively. At 45 DAP Jatopha variety at W1 (weed once) had the highest plant height of 16.60cm which was not significantly different from W0 (zero weeding), W2 (weed twice) and W3 (weed free) having 14.70cm, 16.50cm and 15.80cm respectively. Caro variety at W0 (zero weeding) had the least plant height with 11.20cm.

Effect of weeding regime on yield parameters:

Table 3 **Effect of Weeding Regime on the Number of pods/plot, 100 Seed weight and Grain yield**

	Treatment	Number of pods/plot	100 seed weight(g)	Grain yield kg/ha
Jatopha	W0	23.67	118.90	380.00
	W1	33.70	193.70	566.16
	W2	68.54	221.60	886.17
	W3	71.00	232.70	1392.32
	Mean	**49.23**	**191.73**	**806.16**
Caro	W0	31.30	119.00	126.3
	W1	22.70	149.40	246.96
	W2	54.30	135.70	556.82
	W3	33.30	128.30	401.20
	Mean	**35.4**	**133.1**	**332.82**
	LSD $_{0.05}$	**2.23**	**1.69**	**33.82**

(zero weeding W0, weed once W1, weed twice W2, and weed free W3) DAP- Days After Planting

Results from Table 3, show that weeding regime had significant ($P \leq 0.05$) effect on Number of pods/plot, 100 Seed weight and Grain yield. Jatopha variety had the highest number of pods at W3 (weed free) with 71 pods while Caro variety had the least number of pods at W1 (weed once) with 22.7 pods. Jatopha variety had the least and highest 100 seed weight at W3 (weed free) and W0 (zero weeding) with 232.70g and 118.90g respectively. Caro variety had the least grain yield of 126kg/ha at W0 (zero weeding) while jatopha variety had the highest grain yield at W3 (weed free) with 1392.32kg/ha.

Discussion

The relatively lower growth parameters measured on the plots were there was zero weeding for the two varieties used show that weeds must have competed with the crop for essential nutrient and sunlight therefore leading to the lower performance in terms of number of leaves, number of branches and plant height, whereas when the plots were kept weed free or weeding conducted twice, higher performance was observed. This is in line with the findings of El Naim *et al.*, (2010), Oyewole and Obaweda (2020).

It was also observed that the Jatopha variety performed better than the caro variety. This may be due to the inherent characteristics of varieties to adapt to a given environment and better utilization of growth resources (Konlan *et al.*, 2013).

The plots that were kept weed free gave the highest performance in terms of yield characteristics (100 seed weight and grain yield) this is similar to the findings of Garko *et al.*, (2018). Weeding once will not give the required weed management needed throughout the growing season hence giving room for the growth of fresh weeds which later compete with crops for the limited and available resources. Results from (table 3) show that Jatopha variety outperformed the Caro variety in all the yield parameters measured hence indicating that different varieties have varying tolerance level to weed infestation. This is in accordance with the findings of (Oyewole *et al*., 2016).

Conclusion

Weeds adversely affect crops by competing for both climatic and edaphic factors necessary for optimum productivity. They also affect farmers by increasing the cost of production either in the acquisition of herbicides or increasing labour cost and expending time. Weed management has become essential in bambara nut crop production process and a good knowledge of the most effective weeding frequency to maximize productivity and profit for the farmer is of utmost importance. Hence the study was conducted to evaluate the effect of weeding regime on the growth and yield of Bambara nut (*Vigna subterranea* (L.) Verdc). Results from the research show that Jatopha variety gave the heights growth and yield values in the study area when compared to Caro variety. It was also observed that Jatopha variety when kept weed free gave the heighest number of pods, 100 seed weight and grain yield with values 71, 232.70 g and 1392.92 kg/ha respectively.

REFERENCES

Abdulraheem M. I, and Charles E. F. (2018) Characteristics Effects of Weed on Growth Performance and Yield of Maize (Zea Mays). *Biomedical Journal of Scientific & Technical Research*, *7*(3), 7–10. https://doi.org/10.26717/bjstr.2018.07.001495

Abdulsalami, M.S and Sheriff, H.B (2010) Effect of Processing on the Proximate Composition and Mineral Content of Bambaranut (*Vondezeia subterrenean*). *Bayero Journal of Pure and Applied Science* 3(1):188-190

Addo, A.A. and Oyeleke, O.A. (1986). Nutritional evaluation and organoleptic properties of biscuits supplemented with bambara nut flour. A seminar paper, 1 – 10

Adebiyi, J.A.; Njobeh, P.B. and Kayitesi, E. (2019) Assessment of nutritional and phytochemical quality of Dawadawa (an African fermented condiment) produced from Bambara groundnut (*Vigna subterranea*). *Microchem. J*., 149, 104034.

Alozie, Y.E., Iyam, M.A., Lawal, O., Udofia, U. and Ani, I.F. (2009). Utilization og bambara groundnut flour blends in bread making. *Journal of Food Technology*, 7 (4) : 111 – 114

Brough, S.H., Azam-Ali, S.N and Taylor, A.J. (1993). The potential of bambara groundnut (*Vigna subterranea* (L.) Verdc.) in vegetable milk production and basic protein functionality systems. *Food Chem*. 47 : 277 – 283

Dansi, A., Vodiouhe, R. and Azokpota, P. (2012). Diversityof the neglected and underutilized crop species of importance in Benin. *The Scientific World Journal*, 932 – 947

DoubleGist (2013). Bambara Nut – Effect of Packaging Material and Oil Type on Sensory Properties and Microbial Stability. (http://www.doublegist.com/bambaranut-effect-packaging-material-sensory-properties)

Dwight D.L.Penn State's College of Agricultural Sciences. The Pennsylvania State University, 2007

Effa, E., Nwagu, F., Osai, E., & Shiyan, J. (2016). Growth and yield response of Bambara groundnut (Vigna subterranea (L .) Verdc) to varying densities and Phosphate fertilizer rates in Calabar , South Eastern Nigeria. *Journal of Biology, Agriculture and Healthcare*, *6*(16), 14–20.

El Naim A. M., Eldoma M. A. and Abdalla A. E., (2010) Effect of weeding frequencies and plant density on vegetative growth characteristic of groundnut (Arachis hypogaea L.) in North Kordofan of Sudan. *International Journal of Applied Biology and Pharmaceutical Technology*, 1(3):1188-1193

FAOSTAT (2020). Food and Agriculture Organization of the United Nations. Statistical Databases; FAOSTAT: Rome, Italy, 2020

Garko M. S., Yawale, M. A., Sa'ad A. M. and Abba U. U. (2018). Growth and development of bambara groundnut (Vigna *subterranea* L.) As affected by phosphorus levels and weed control method in as affected by phosphorus levels and weed control method in Sudan Savanna, Nigeria. *FUDMA Journal of Agriculture and Agricultural Technology* 2504-9496 Vol. 4 No. 1, pp 24-31

Hillocks, R.J., Bennett, C. and Mponda, O.M. (2012). Bambara nut: A review of utilization, market potential and crop improvement. *African Crop Science Journal* 20 (1): 1 – 16

Konlan S., Sarkodie-Addo J. A.E. and Kombiok M.J., (2013) Groundnut (Arachis hypogaea L.) varietal response to spacing in the Guinea savanna agro-ecological zone of Ghana: Nodulation and nitrogen fixation, *Agric. Biol. J. North America*, 4(3):324-335.

Majola, N.G., Gerrano, A.S. and Shimelis, H. (2021). Bambara Groundnut (*Vigna subterranea* L. Verdc.) Production, Utilisation and Genetic Improvement in Sub-Saharan Africa. Agronomy 2021, 11, 1345. https:// doi.org/10.3390/agronomy11071345

Olanipekun, B.F., Otunola, E.T., Adejuyitan, J.A. and Adeyanju, J.A. (2012). Proximate and fatty composition of bambara nut (Voandzeia subterranean (L.) Thouars) as influenced by fermentation with a combination of *Rhizopus oligosporus* and R. *nigricans*. Transnational *Journal of Science and Technology, 2 (9): 77 – 87*

Oudhia, P. (2004). Pyto-sociolocal studies of rainy Waster lands weed with special reference to Parthenium hysterophorus L.) in Raipur District.//www.iprng.org/IPRNG-parthenium A and W 15. Htm

Oyewole CI and Obaweda OD. (2020). Effect of weeding regime on pest infestation, growth and yield of okra (Abelmoschus esculentus L, moench) in Anyigba, Kogi State, Nigeria. GSC Biological and Pharmaceutical Sciences, 11(1), 106-112

Oyewole CI, Shuaib H and Musa UT. (2016). Sustainable crop production: growth and yield response of three varieties of groundnut (Arachis hypogeal L.) sown to three weeding regimes and two plant spacing in Anyigba, Kogi State, Nigeria, *Journal of International Scientific Publications: Agriculture and Food,* 4, 373 – 385.

Oyewole, C. I Oyewole, A. N. and Obaje E.M. (2013) Effect of nutrient source and rates on weed population, weed dry matter, growth and yield of eggplant (*Solanum melongena* L) in Anyigba Kogi State, Nigeria. *Journal of Environmental Science, Computer Science and Engineering & Technology* Vol.2. No.3, 511-521

Puozaa, D.K., Jaiswal, S.K. and Dakora, F.D. (2017). African origin of Bradyrhizobium populations nodulating Bambara groundnut *(Vigna subterranea* L. Verdc) in Ghanaian and South African soils. *PLoS ONE*, v (12). e0184943.