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Determination of Relationship between Growth Characteristics and Seed Yield of Sesame (*Sesamum indicum* L.) in Sokoto, Nigeria

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Abstract: *Field trials were conducted at Dry Land Teaching and Research Farm of Usmanu Danfodiyo University Sokoto during the 2015 and 2016 raining seasons to determine the relationship between growth characteristics and seed of sesame (Sesamum indicum L.) in Sokoto, Nigeria. The treatments consisted of four levels of inter-row spacing (40, 50, 60 and 70 cm) and three sesame varieties (Ex-sudan, Gulbarga Local White and Tumkur Local Black). The treatments were arranged in a randomized complete block design (RCBD) replicated three times with factorial combinations of inter-row spacing and varieties. Results of the study indicated that highly significant relationship exist between seed yield and some growth and yield parameters. From the findings of this research, it could be concluded that highly significant positive relationship was observed most frequently between the seed yield and growth components accessed.*

Keywords: Growth, Characteristics, Seed yield and Sesame

Introduction

Sesame crop is cultivated in almost all tropical and subtropical Asian and African countries for its highly nutritious and edible seeds (Iwo *et al*., 2002). Fifty-six percent of the world's production of the crop is in Asia, with Africa having a production analysis of about 44% (FAOSTAT, 2013). The total world production of sesame in 2013 was 4,756,752 tonnes, of which Africa contributed (44.5%) 2,117,585 and Nigeria contributed (3.5%) 165,000 tonnes. The total area cultivated in 2013 for World and Africa were 9,398,770 ha and 4,741,100 ha with Nigeria cultivating about 340,000 ha. The average yields obtained from these hectares were 506.1 kg, 446.6 kg and 485.3 kg respectively (FAOSTAT, 2013). In Nigeria, Sesame is widely grown in the Middle Belt, Northern and Central Nigeria as a minor crop. It became a major cash crop in many Northern States like Benue, Kogi, Gombe, Jigawa, Kano, Nasarawa, Katsina, Plateau, Yobe and Federal Capital Territory (NAERLS, 2010).

Sesame seed is rich in fat, protein, carbohydrates, fibre and some minerals. The oil seed is renowned for its stability because, it actively resists oxidative rancidity even after prolonged exposure to air (Global Agrisystems, 2010). The oil fraction shows a remarkable stability to oxidation, and this could be attributed to endogenous antioxidants namely lignins and tocopherols (Elleuch *et al*., 2007; Lee *et al.,* 2008). The seed is rich in protein and has a good nutritional value similar to soybean (NAERLS, 2010). The composition of sesame shows that the seed is a major source of oil (44-58%), protein (18-25%), carbohydrate (~13.5%) and ash (~5%) (Borchani *et al*., 2010). Sesame seed is approximately 50 percent oil (out of which 35% is monounsaturated fatty acids and 44% polyunsaturated fatty acids) and 45 percent meal (out of which 20% is protein) (Ghandi, 2009). According to Oplinger *et al.* (1990), Sesame oil is used as a fixative in the perfumery industry, in various cosmetics as a carrier for fat-soluble substances, in pharmaceuticals as penicillin, in insecticides, paints and in the manufacture of soaps. Sesame meal left after the oil is pressed from the seed is an excellent high protein (34 to 54%) feed for poultry and livestock. The young leaves of Sesame crop are used as soup vegetable in some areas of Africa, such as West Africa. Fried seeds are consumed in soups and eaten after sweetening with sugar (Kafirirti and Deckers, 2001).

Several researchers reported the relationship between seed yield of sesame crop and various growth and yield characters. Engin *et al*., (2010) found in a study conducted in Australia involving 345 sesame genotypes originated from 29 different sesame producing countries worldwide reported that plant height, number of branches and 1000 seed weight had a significant positive correlation with seed yield. While all characters related to maturity, first flowering and 50% flowering had a negative correlation with seed yield of sesame crop. In another correlation studies conducted in Nigeria by Muhamman *et al*., (2010) revealed that the number of branches, plant height and leaf area had a significant positive correlation with seed yield of sesame crop, while 1000 seed weight and days to 50% flowering showed a non-significant relationship with seed yield. Onginjo *et al*., (2009) in a correlation study involving 30 selected mutant lines and two cultivars reported that seed yield had a strong positive and significant relationship with biomass yield, harvest index and 1000 seed weight but, plant height, oil content, number of capsules per plant as well as number of days to flowering had a weak positive significant correlation with seed yield. Subramanian and Subramanian (1994) reported that seed yield had a significant positive correlation with the number of capsules, number of primary branches, the number of capsules, number of seed per capsule and 1000 seed weight. It has been reported by Adeyemo (1991) that seed yield had a significant correlation with the number of capsules, seed yield per plant, number of seed per capsules, the number of primary branches, length of capsules, 1000 seed weight and stand count of sesame plant.

Despite the high commercial potentials of sesame in the Nation’s economy and its high nutritional values, research on the crop remains significantly scanty in the study area. However, lack of using appropriate inter-row spacing and high yielding varieties by farmers more often than not lead to low seed yield and productivity of the crop. Seed yield of 69.93 kg/ha and 318.6 kg/ha was obtained in the year 2006 and 2007 respectively with an inter-row spacing of 25 cm (Adam *et al*., 2013). Owing to these reasons, it is, therefore, important to devote time and resources to study the best ways to improve the growth performance of sesame regarding variety and inter-row spacing in Northwestern region of Sokoto, Nigeria.

Materials and Methods

The experiments were conducted during the 2015 and 2016 cropping seasons at the Usmanu Danfodiyo University Teaching and Research Dryland Farm, (Latitude 13⁰ 01˝ N and Longitude 5⁰ 15˝ E) at Sokoto. The annual rainfall of the area ranges between 380 and 889 mm, the temperature ranges between 17 and 40⁰C (SERC, 2006). The climate of the area is dry sub-humid, characterized by a long dry season with cold dry air during harmattan from November to February and hot dry air from March to May followed by short rainy season (Davis, 1983 cited in Sampson 2010). The treatments consist of four different inter-row spacing (40, 50, 60 and 70 cm) and three varieties of sesame (*Sesamum indicum* L.) (Gulbarga Local White, Tumkur Local Black and Ex-Sudan) making up to 12 treatment combinations. The treatments were factorially combined and laid out in a Randomized Complete Block Design (RCBD) with three (3) replications. The treatments were randomly allocated to the plots using randomization technique. All the plots received the same agronomic practices.

The experimental site was ploughed, harrowed, leveled and worked to fine tilt. The prepared land was then marked and sub divided into the required plots and replications in accordance with the layout of the experiment. The gross plot size was 3.0 m x 2.0 m (6 m^2), consisting of rows each measuring 2.0 m in length with 20cm intra-row spacing within each row. The inter-row spacing of 40, 50, 60 and 70 cm were used. Net plot size of 4.4, 4.0, 3.6 and 3.2 m^2 for treatments with 40, 50, 60 and 70 cm inter-row spacing was used with 6, 4, 3 and 2 inner rows for each. However, 2 border rows for each were used for destructive sampling. The seeds were sown on the 4th July 2015 and 27th June 2016 for first and second trial respectively when soil moisture was adequate. A mixture of one part of sesame seed and two parts of river sand was planted manually at a shallow depth of about 1cm, by the dibbling method. The plots were kept free of weed throughout the period of the experiment. Removal of the unwanted plant was carried out with the use of hoe at 3 and 9 WAS and by manually as weed appears. Growth parameters such as number of leaves, leaf length, leaf breath, leaf area, leaf area index per plant and the number of branches were measured at 4, 6, 8 and 10 WAS when the plants are at their growth stage. The data generated were subjected to analysis of variance (ANOVA) using STATISTIX 8.0 Computer Package. Means found to be statistically significant were compared using Dunkan's New Multiple Range Test (DNMRT).

Results and Discussion

Correlation Analysis

Results showing the correlation matrix of seed yield and some growth and yield components for the combined data were presented in Table 1 and 2. The correlation coefficient values showed highly significant relationship. In Table 1, seed yield showed positive association with leaf length per plant at 10 weeks after sowing (WAS) ($r = 0.4092$), leaf area at 10 WAS ($r = 0.4207$), leaf diameter at 10 WAS ($r = 0.3839$), number of capsule per plant at 10 WAS ($r = 0.3465$) and capsule length per plant ($r = 0.7045$) whereas, negative association was recorded with number of leaves per plant ($r = -0.6939$), number of days to maturity ($r = -0.6265$) and number of days to 50% flowering ($r = -0.6810$). Similarly, establishment count shows strong positive relationship with number of capsule per plant ($r = 0.3465$) and capsule length per plant (r = 0.7045) this indicates that increase capsule length translate to higher seed yield. While negative relationship (r = -0.2268), (r = -0.6265) and (r = -0.6810) were recorded with leaf area per plant at 10 WAS, number of days to maturity and number of days to 50% flowering respectively. Number of leaves per plant at 10 WAS showed very strong positive correlation with number of branches per plant (r = 0.9640) increase in number of branches also increases seed yield, leaf area index at 10 WAS (r = 0.7870) and number of days to 50% flowering (r = 0.7909) while negative associations were obtained with leaf length (r = -0.5040), leaf area per plant at 10 WAS (r = -0.4907), leaf diameter per plant at 10 WAS (r = -0.4352), number of days to maturity (r = -0.4350) and capsule length per plant (r = 0.6064). Leaf length per plant at 10 WAS exhibited very strong positive relationship with leaf area per plant at 10 WAS (r = 0.9563), increase in leaf area increase photosynthetic ability. Leaf diameter per plant at 10 WAS (r = 0.7870) and capsule length per plant (r = 0.5467) while negative relationship (r = -0.4785, r = -0.2642 and -0.3955) were recorded with number of branches per plant at 10 WAS, number of days to maturity and number of days to 50% flowering respectively. Number of branches per plant at 10 WAS showed strong positive correlation with leaf area index at 10 WAS (r = 0.7429), number of days to maturity (r = 0.7336) and number of days to 50% flowering (r = 0.7806) whereas negative relationship (r = -0.4729, r = -0.4393 and r = -0.5554) were recorded with leaf area per plant at 10 WAS, leaf diameter per plant at 10 WAS, leaf diameter per plant at 10 WAS and capsule length per plant respectively. In addition, leaf area per plant at 10 WAS exhibited positive relationship with leaf diameter per plant (r = 0.9249), number of capsule per plant (r = 0.2668) and capsule length per plant (r = 0.3919) whereas negative relationship (r = -0.2927 and r = -0.4174) were exhibited with number of days to maturity and number of days to 50% flowering parameters. Leaf area index at 10 WAS showed positive association with number of days to maturity (r = 0.5146) and number of days to 50% flowering (r = 0.5242) while negative correlation (r = -0.4643) was produced with capsule length per plant. Leaf diameter recorded negative relationship with number of days to maturity (r = -0.3786) and number of days to 50% flowering (r = -0.4645) whereas no association was observed with number of capsule per plant and capsule length per plant. Strong positive and negative correlation of (r = 0.9052) and (r = -0.4350) exist between number of days to maturity in relation with number of days to 50% flowering and number of days to maturity in relation with capsule length per plant respectively. Number of days to 50% flowering exhibited negative relationship with capsule length per plant (r = -0.5593) whereas number of capsule per plant showed positive relationship with capsule length per plant (r = 0.6492).

In Table 2, seed yield exhibited positive association with harvest index (r = 0.6388), number of seeds per capsule (r = 0.7272) and one thousand seed weight (r = 0.6146) while negative association (r = -0.4162 and r = -0.2952) were recorded with dry matter weight and total yield respectively. Similarly, harvest index recorded positive correlation with number of seeds per capsule (r = 0.4978) and one thousand seed weight (r = 0.3870) while negative correlation (r = -0.7255 and r = -0.6715) were observed with dry matter weight and total yield accordingly. Stover weight exhibited very strong positive relationship (r = 0.9916) only with total yield whereas negative relationship (r = -0.2886 and r = -0.3163) were obtained with number of seeds per capsule and one thousand seed weight respectively. This shows that less stover weight gives more yield. Positive correlation (r = 0.4574) was recorded with number of seeds per capsule in relation with one thousand seed weight whereas negative relationship (r = -0.2450) was recorded with one thousand seed weight in association with total yield. This finding is in line with that of Haruna *et al*., (2012) who equally reported significant and positive correlations between growth characteristics and seed yield in sesame in their respective studies. In conclusion, generally high positive correlation was observed must frequently between growth characteristics and seed yield of sesame in the study area.

Table 1: Simple Correlation Matrix (Coefficient values and their level of significant) showing the relationship between seed yield and some growth parameters

Parameter	SYLD (kg/ha)	EC	NL 10	LL 10 (cm)	NB 10	LA 10 (cm^2)	LAI 10	LD 10 (cm)	NDM	NFL	NCPP	CL (cm)
SYLD(kg/ha)	1.000											
EC	-0.0527	1.0000										
NL 10	-0.6939**	-0.0204	1.0000									
LL 10 (cm)	0.4092**	-0.2168	-0.5040**	1.0000								
NB 10	-0.6518**	-0.0298	0.9640**	-0.4785**	1.0000							
LA 10 (cm^2)	0.4207**	-0.2268*	-0.4907**	0.9563**	-0.4729**	1.0000						
LAI 10	-0.5276**	0.1728	0.7870**	-0.0523	0.7429**	-0.0083	1.0000					
LD 10(cm)	0.3839**	-0.1776	-0.4352**	0.7868**	-0.4393**	0.9249**	0.0443	1.0000				
NDM	-0.6265**	-0.6265**	-0.4350**	-0.2642**	0.7336**	-0.2927*	0.5146**	-0.3786**	1.0000			
NFL	-0.6810**	-0.6810**	0.7909**	-0.3955**	0.7806**	-0.4174**	0.5242**	-0.4645**	0.9052**	1.0000		
NCPP	0.3465**	0.3465**	-0.1699**	0.0333	-0.0951	0.2668*	-0.1939	0.1161	0.1570	0.0333	1.0000	
CL (cm)	0.7045**	0.7045**	-0.6064**	0.5467**	-0.5554**	0.3919**	-0.4643**	0.3105	-0.4350**	-0.5593**	0.6492**	1.0000

Means within a column followed by the same letters are statistically not significant at 5% level of probability using Duncan's multiple range test (DMRT) ** = Significant at 1%, * = Significant only at 5% and Ns = Not significant at 5%, SYLD = Seed Yield, EC = Establishment count, NL 10 = Number of Leaves at ten weeks after sowing, LL 10 = Leaf length at ten weeks after sowing, NB 10 = Number of Branches at ten weeks after sowing, LA 10 = Leaf Area at ten weeks after sowing, LAI 10 = Leaf Area Index at ten weeks after sowing, LD 10 = Leaf Diameter at ten weeks after sowing, NDM=Number of days to maturity, NFL= Number of days to 50% flowering, NCPP= Number of capsule per plant and CL=Capsule length per plant.

Table 2: Simple Correlation Matrix (Coefficient values and their level of significant) showing the relationship between seed yield and harvest parameters

Parameter	SYLD (kg/ha)	HIX	DMW (kg/ha)	NSPC	TSW (g)	TYLD (kg/ha)
SYLD (kg/ha)	1.0000					
HIX	0.6388**	1.0000				
DMW (kg/ha)	-0.4162**	-0.7255**	1.0000			
NSPC	0.7272**	0.4978**	-0.2886*	1.0000		
TSW (g)	0.6146**	0.3870**	-0.3163**	0.4574**	1.0000	
TYLD (kg/ha)	-0.2952*	-0.6715**	0.9916**	-0.1999	-0.2450*	1.0000

Means within a column followed by the same letters are statistically not significant at 5% level of probability using Duncan's multiple range test (DMRT) ** = Significant at 1%, * = Significant only at 5% and Ns = Not significant at 5%, SYLD = Seed yield, HIX = Harvest index, DMW = Dry matter weight, NSPC = Number of seed per capsule, TSW = Thousand seed weight and TYLD= Total yield.

Reference

Adam, L. N., Ibrahim Y.D. and Haliru Y. (2013). Effects of Inter-row Spacing and Plant Density on Performance of Sesame (*Sesamum Indicum* L.) in a Nigerian Sudan Savanna. *Science International. (Lahore)*, 25(3), 513-519.

Adeyemo, M.O., and Ojo, A.A. (1991). Genetic variability and associations of agronomic traits and seed of sesame (*sesamum indicum* L). *Nigerian Journal of Genetics* VIII: 39-40.

Borchani, C., Besbes S., Blecker C. H. and Attia H. (2010). Chemical Characteristics and Oxidative Stability of Sesame Seed, Sesame Paste, and Olive Oils. *Journal of Agriculture, Science and. Technology*. 12: 585-596.

Davis, G. (1983). Crops of the Drier Region of the Tropics. Longman Pub. Ltd Pp 134

Elleuch, M., Besbes, S., Roiseux, O., Blecker, C. and Attia, H. (2007). Quality characteristics of sesame seeds and by-products. Food Chemistry 103 (2): 641 – 650

Engin, Y., Emre, K., Seynus, F. and Bulent, U. (2010). Assessment of selected criteria in sesame by using correlation coefficient, path and factor analysis. *Australian journal of crop science*. 4(8) 598-602.

FAOSTAT (2013). FAOSTAT Database Results.http://www.faostat.org.

Ghandi, A.P. (2009), Simplified Process for the Production of Sesame seed (*Sesamum indicum* L.) butter and its Nutritional Profile. *Asian Journal of food and Agro-industry*: 2(01), 24-27.

Global AgriSystems. (2010). Dehulled and roasted sesame seed oil processing unit. http://mpstateagro.nic.in/Project%20Reports%20pdf/Dehulled%20and%20Roasted%20 Sesame%20Seed%20Oil%20Processing%20Unit.pdf.

Haruna, I. M., Aliyu, L., Olufajo, O.O. and Odion, E. C. (2012). Contributions of some growth characters to seed yield of sesame (*Sesamum indicum* L.). ISABB *Journal of Food and Agriculture Science* 2, 9 –14.

Iwo G.A., Idowo, A.A., and Ochigbo. A. A. (2002). "Evaluation of Sesame Genotypes for Yield Stability and Selection in Nigeria". *Nigerian Agric. J*. 33: 76–82.

Kafiriti, E. M. and Decker, J. (2001) Crop Production in Tropical Africa C.I.P Royal Library Albert I. Brussels Belgium. 725-881.

Lee, J.Y., Lee, Y.S., & Choe, E.O. (2008) Effects of Sesamol, Sesamin and Sesamolin Extracted from Roasted Sesame Oil on the Thermal Oxidation of Methyllinoleate. Food Science and Technology 42: 1871-1875.

Muhammad, M.A., Mohammed, S.G., Lado, A. and Belel, M.D. (2010). Interrelationship and path coefficient analysis of some growth and yield characteristics in sesame (*Sesamum indicum* L.). *Journal of Agricultural Science* 2, 100 – 105.

NAERLS (2010). Beniseed production and utilisation in Nigeria. Extension Bulletin No 154, HorticultureSeriesNo.5. www.naerls.gov.ng/extmat/bulletins/Beniseed.pdf.

National Cereals Research Institute (2005). Oilseeds Research Programme, N.C.R.I. Badegi.

Onginjo, E.O. and Ayiecho, P.O. (2009). Genotypic variability in sesame mutant lines in Kenya. *African crop science journal* vol.17 no.2 2009. Pp 101-107

Oplinger, E.S, Putnam., D.H. Kaminski, A.R.., Hanson, C.V., Delke, E.A., Schulter, E.E. and Doll, J.D. (1990). Sesame: Alternative Field Crops Manual. http://www.mgo umn.edu/crop/sesame.htm.

Sampson, H. U. (2010). Effect of Herbicides and Manual Weed Control on Growth and Yield of Sesame at Sokoto. A Dissertation submitted to the Postgraduate school of Usmanu Danfodiyo University Sokoto, Nigeria.

SERC. (2016). Sokoto Energy Research Centre, Usmanu Danfodiyo University Sokoto, Nigeria.

Subramanian, S., and Subramanian, M. (1994). Correlation studies and path coefficient analysis in sesame (*Sesamum indicum* L.). *Journal of agronomy and crop science*. Vol. 173 issue 3-4. Pg. 241-248. October 1994.