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THE GROWTH AND SEED YIELD OF MAIZE VARIETY AS AFFECTED BY TWO LEGUMES INTERCROP

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AUTHOR: **Dr.Adeyeye A.S** **August 2017**

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Adeyeye A.S, Akanbi, W.B, Olalekan, K.K Lamidi, W.A, Othman, H.J, and Ishaku, M.A
Federal University Wukari, Taraba State, Nigeria.
Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria Osun State University, Osogbo, Osun State, Nigeria

CORRESPONDING AUTHOR:
Adeyeye A.S
Email: solorach2002@yahoo.com

CONFLICTS OF INTEREST
There are no conflicts of interest for any of the authors.

ABSTRACT
Intercropping as a simultaneous growing of two or more crops in the same field is a cropping system that has long been used for a long time especially in the tropics to increase productivity and sustainability through maximum utilization of land, labor and growth resources, hence the study was conducted to evaluate growth and yield effect of maize variety intercropped with two legumes on the field at the Teaching and Research Farm of Federal University Wukari,Taraba State, Nigeria. The experimental treatments consisted of two legumes as groundnut and bambara nut intercropped with two varieties of maize (white and yellow). These were laid out on the field using randomized complete block design with three replications .Data were collected on the growth and yield parameters and analyzed using analysis of variance (ANOVA) at 5% level of probability. Results showed that white maize intercropped with groundnut produced significant taller plants and same trend was observed with the number of leaves. Further results revealed that groundnut and white maize intercrop gave the highest Stem girth at 4weeks after planting while the highest 100 seed weight of 25.17g was recorded from white maize and groundnut intercrop. The yield of maize was better when intercropped with legumes. Therefore the combination of white maize and groundnut is recommended as promising option in the maize and legumes intercrop production in the study area.

KEYWORDS: maize legumes, intercrop, growth, yield, variety

INTRODUCTION
Maize (Zea mays L) is the most important cereal in the world. It also an important grain in Nigeria and Africa at large (Olaniyan,2014).Today the crop is one of the most important sources of the world food supply and according to the Food and Agricultural Organization statistics,822.7 million metric tons of maize were produced worldwide in the year 2008 of which

Africa produced 53.2 million metric tons (FAO, 2008).Maize is used as food for human and livestock in various part of the world. Different types of food products are produced from the grains which include palp (Ogi),Monsa, Abari, Agidi etc.(Abdulrahaman and Kolawole,2006). Also livestock feeds are produced from maize as it also served as industrial material in the manufacturing of several commodities such as flour, starch, oil, alcohol and other edible products (Gibson and Benson, 2012).

Intercropping legumes with maize has been a cropping system practiced by farmers which is targeted toward utilizing biologically fixed nitrogen by legumes for the benefit of the maize crop. (Hauggard-Nielsen et

al,2001).Legumes such as groundnut, bambara, soybean are known to improve the nitrogen status of the soil and many authors have reported beneficial effects of legumes on succeeding cereal crops (Nguimgo et al, 1999). Intercropping maize and other cereals with legumes play an important role in the subsistence crop production in the world. It help crop to maintain and improved soil fertility where farmers cannot afford inorganic fertilizers (Daahhmardeh et al 2010).Furthermore it reduces the weeds infestation on the field (Rauber et al, 2001). The yield of maize grain intercropped with legumes are often higher than the sole cropping system because the resources such as water light and nutrients can be utilized more effectively than in sole cropping system (Dahmardeh et al 2010;Li et al ,2006). However recent studies have shown that biologically fixed nitrogen from legumes is not enough to meet all the nitrogen demand of the maize crop therefore supplementary fertilizer is necessary for optimum maize yield (Yusuf et al, 2009). Hence the study was carried out to investigate the effect of legumes (groundnut and bambara nut) on the growth and grain yield of maize variety.

MATERIALS AND METHODS

The study was carried out at the Teaching and Research Farm of Federal University Wukari, Taraba State, Nigeria. Taraba state lie between latitude $6^0$30, 8^0 30N of the equator and between longitude 9^0 and 12^0E of the Greenwich meridian with a land mass of 54.426km^2. It shared boarders with Bauchi and Gombe State in the North, Adamawa State in the East and Cameroon republic in the south west. The state has a tropical wet – dry climate, well drained alluvial soils and has both savannah and Rain forest vegetation. The rainfall ranges between100mm to 250mm per annum in the north with the driest and wettest season lasting from December to February and July to September respectively. Pre soil samples of the site was collected at 15cm depth using an auger and were taken for analysis while the land was ploughed and harrowed for the layout of the experiment.

EXPERIMENTAL DESIGN AND TREATMENTS

The treatments consisted of two varieties of maize (White and Yellow) which were intercropped with two legumes (groundnut and bambara nut). The experimental design used was a randomized complete block design replicated three (3) times. The plot size was 4m x 4m with 1.5m border between plot and 2m between replications. The maize was planted using a space of 90cm x 50cm and the legumes were planted in between the maize stand. Sole legumes (bambara and ground nut) were also planted at 40cm x 20cm while sole maize variety at 80cm x 50cm serves as control treatments. The maize were planted at the rate of 3seeds per hole and later thinned to two plants per stand at 2weeks after planting (WAP) while legumes were planted at two seeds per hole. The plots are hand hoed as practiced by farmers starting from 2weeks after planting (WAP) and fortnightly. Maize was also fertilized using NPK fertilizer at two weeks after planting.

Data Collection and Analysis

Data were collected on the growth and yield parameters of maize either sole or intercropped starting from 4, 6,8,10, and 12 weeks after planting and at harvest. The parameters measured were: plant height, Number of leaves, stem girth, dry weight matter, number of fruits weight of fruits number of seeds, 100 seed weight, weight of the cob, and shaft. Data collected were subjected to analysis of variance (ANOVA) using Genstart statistical package and the mean were separated with the use of least significant difference (LSD) and Duncan multiple range test at 5% level of probability.

RESULTS

The effects of legume intercropped with maize variety on the growth parameters are shown in table (2, 3, and 4). Maize variety intercrop with legumes had significant effects on the plant height of maize The highest plant height of 22.30cm was obtained from white maize and Ground nut intercrop at 4, 6, 8 and 10 week after planting followed by sole yellow maize (21.33cm) at 4week after planting and sole white maize at 10 week after planting (Table 2). There was no statistical difference in the number of leaves at 4, 8, and 10 WAP irrespective of the treatments, but at 6WAP white maize and groundnut intercrop gave significantly higher number of leaves (8.35) while white maize and Bambara nut intercrop produced the least number of leaves (6.60) (Table 3).There was a statistical difference in the stem girth measured at 4 and 8 weeks after planting (WAP). At 4 weeks ,white maize and Ground nut intercrop treatment produced the highest stem girth of (3.37) while at 8 weeks, sole yellow maize treatment that gave the highest stem girth which was not different significantly from white maize and groundnut intercrop mean value (Table 4).

The weight of maize fruits produced was influenced by the legumes intercropped in the study for instance sole white maize gave the highest maize fruit weight which was not different statistically from white maize and ground nut and sole yellow maize treatments while white maize and Bambara nut intercrop and yellow maize treatments produced the least fruit weight. The cob weight taken was also significantly influenced by the treatments and sole white and sole yellow maize treatments had the highest cob weight when compared to other

treatments in the study. The number of maize seed per plant in the study was statistically different also, Sole white maize gave the highest number of seed (330) while the least number of seed came from the two treatments namely, white maize and bambara nut and yellow maize and ground nut intercrop respectively. The 100 seed weight of maize weighed was also different statistically in the study, where white maize and ground nut intercrop gave the highest value of (25.17) which was not significantly different from sole white maize, sole yellow maize and yellow maize and bambara nut intercrop treatments but the least value came from yellow maize and ground nut intercrop. The total dry matter weight at harvest was found to be significant and sole yellow maize treatment gave the highest dry matter weight but the mean value was not different significantly from sole white maize treatment while the least dry matter weight came from white maize and ground nut intercrop treatment (Table 5). The white maize and ground nut intercrop treatment and sole white maize treatments produced the highest seed weight per plant while the least came from the order of white maize and bambara nut > yellow maize and bambara nut > yellow maize and ground nut intercrop respectively.

Soil Properties	values
$P^{H(H2o)}$	5.75
Organic carbon (%)	1.36
Organic Matter (%)	2.35
Total N (%)	0.98
Available P (MgL^{-1}	0.52
Exchangeable K (mol/kg)	1.6
Exchangeable Na (mol/kg)	2.1
Exchangeable Ca (mol/kg)	3.8
Exchangeable Mg (mol/kg)	1.8
Exchangeable Acidity (mol/kg)	1.10
TEB	9.3
CEC	10.4
Base Saturation (%)	89.4
Sand (g/kg)	76.80
Clay (g/kg)	15.20
Silt(g/kg)	8.0
Textural Class	Sandy soil

Table 1 : The soil chemical and physical analysis of the Teaching and d Research Farm, Federal University, Wukari

TREATMENTS	4WEEKS	6WEEKS	8WEEKS	10WEEKS
WHITE MAIZE + BAMBARA NUT	16.23ab	36.20b	92.50ab	111.90b
WHITE MAIZE + GROUNG NUT	22.30a	51.20a	121.00a	136.30a
SOLE WHITE MAIZE	16.57ab	46.40ab	86.90b	133.70a
YELLOW MAIZE + BAMBARA NUT	16.17ab	36.60b	87.90b	113.10b
YELLOW MAIZE + GROUND NUT	15.25b	39.50ab	91.00b	118.50ab
SOLE YELLOW MAIZE	21.33a	39.70ab	99.30ab	125.70ab
LSD (5%)	6.71	12.01	27.27	19.10
SE	3.01	5.39	12.24	8.57

Table 2 : Effect of legumes intercrop on the plant height of maize variety at various stages of Plant growth

values with different letters along column are significantly different using DMRT at 5% probability level

Table 3 : Effect of legumes intercrop on the number of leaves of maize variety at various stages of plant growth

TREATMENTS	4WEEKS	6WEEKS	8WEEKS	10WEEKS
WHITE MAIZE + BAMBARA NUT	5.87a	6.60b	9.93a	0.93a
WHITE MAIZE + GROUNG NUT	5.60a	8.53a	11.13a	1.03a
SOLE WHITE MAIZE	6.27a	6.87b	10.67a	1.33a
YELLOW MAIZE + BAMBARA NUT	5.83a	7.20ab	11.27a	0.93a
YELLOW MAIZE + GROUND NUT	5.93a	7.60ab	11.10a	1.00a
SOLE YELLOW MAIZE	6.00a	7.13ab	11.67a	1.00a
LSD (5%)	0.70	1.32	1.86	0.46
SE	0.32	0.59	0.84	0.21

values with different letters along column are significantly different using DMRT at 5% probability level

Table 4 : Effect of legumes intercrop on the stem girth of maize variety at various stages of plant Growth

GROUNG NUT				
SOLE WHITE MAIZE	2.47b	4.37a	5.33ab	6.17a
YELLOW MAIZE +BAMBARNUT	2.73ab	4.30a	4.80ab	5.67a
YELLOW MAIZE + GROUND NUT	2.63b	4.47a	4.77b	6.03a
SOLE YELLOW MAIZE	3.13ab	4.30a	6.93a	7.50a
LSD (5%)	0.68	1.25	0.84	1.22
SE	0.30	0.56	0.38	0.55

values with different letters along column are significantly different using DMRT at 5% probability level

TREATMENTS	Maize fruit weight(g)	Shaft weight(g)	Maize cob weight(g)	Number of seeds	100 seed weight(g)	Total plant dry weight at harvest	Seed weight(g)
WHITE MAIZE + BAMBARA NUT	49.90b	8.27b	10.93b	165.00b	19.97ab	61.10a	33.80b
WHITE MAIZE + GROUNG NUT	117.00a	10.93ab	22.87ab	303.00ab	25.17a	40.70b	83.70a
SOLE WHITE MAIZE	118.50a	14.67ab	25.10a	330.00a	24.00a	85.70a	75.20a
YELLOW MAIZE + BAM-BARA NUT	63.30ab	10.27ab	12.63b	175.00b	22.60a	57.30ab	40.50b
YELLOW MAIZE + GROUND NUT	35.40b	7.53b	13.03b	166.00b	15.93b	51.10ab	30.0b
SOLE YELLOW MAIZE	111.10a	17.00a	26.77a	240.00ab	24.37a	88.00a	53.60ab
LSD (5%)	34.38	5.80	7.48	127.70	5.94	18.07	32.70
SE	15.43	2.60	3.36	57.30	2.7	8.11	14.67

Table 5 : Effect of legumes intercrop on the yield parameters of maize variety at various stages of plant Growth

values with different letters along column are significantly different using DMRT at 5% probability level

DISCUSSION

The growth and development of maize variety was influenced by the legumes intercrop. The height of maize, stem girth and number of leaves were all affected positively by the intercrop of legumes especially when white maize was intercrop with ground nut. This result may be due to the availability of nutrients especially nitrogen from the root noodles of legumes which is the major nutrient required by maize for optimum growth and development which is in line with the works of Nnadi et al, (1998), Horst and Hardter, (1994) and N'Goran and N' Guessan, (1999) who reported an improvement in the growth parameters of maize due to the legumes maize intercrop. The yield parameters of maize variety were also significantly influenced by the legumes intercrop where white maize and groundnut intercrop performed better when compared to other treatments .This may be due to the ability of the legume to fix atmospheric nitrogen in the soil through symbiotic N fixation. (Adeleke and Haruna, 2012) Hence the legumes improved the nitrogen status of the soil and made it available to the maize crop. This is in line with the work of Giller and Cadisch (1995) who reported an improvement in the soil status such as microbial biomass, C and N, soil enzyme activities and contributions from fixed N in the roots and N released from plant roots to be responsible for the yield parameters in maize following legume than continuous maize cropping. The number of seeds and the weight of cobs was not significantly affected by the intercropping in comparison with sole cropping although the differences being very small which support the work of Gabatshele et al (2012) on maize and cowpea plant. But he stressed further that intercropping are more beneficial and better than sole cropping.

CONCLUSION

The study showed the yield of maize to be enhanced by intercrop with legumes especially groundnut crop therefore the study recommends the use of Maize and groundnut intercropping pattern for the farmers in the study area for more efficient resources use and higher quality maize production.

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Contact Us:

SIFT DESK
Deerpark Dr, #75, Fullerton,CA,92831,United States.
E-mail:
helpdesk@siftdesk.org
Visit us on the web at:
www.siftdesk.org