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EFFECT OF SOME SAHELIAN TREE SPECIES ON THE GROWTH AND YIELD OF SOME SELECTED CROPS IN MAIDUGURI.

MATHIAS NZITIRI BWALA[1], IBRAHIM KAUMI[1], NAFISAT ABDULKADIR[2], KANADI BITRUS TARFA[3] AND PAUL MADA KAMBAYASA[4]

[1]National Environmental Standards and Regulations Enforcement Agency (NESREA). [2]Biological Science Department, Bayero University, Kano (BUK). [3]Biological Science Department, Gombe State University (GSU)

ABSTRACT

Agroforestry helps to increases crop yields through facilitation as there will be no competition and improved availability of resources for the growing crop. The integration of trees and crops further helps to improves income of the local farms while also conserving soil and water for environmental protection. Trees generally have the capacity for reducing wind velocity and

Introduction

The Sahel gotten from an Arabic word "*Sahil*" means coast or shore believed to relate to another Arabic word "*sahl*" which means "plain" refers to the semi-arid region of Africa between the Sahara to the north and the savannas to the south, stretching across the southern edge of the Sahara Desert, (Bayala *et al.*, 2006; Allen, Diakite & Gana, 2009). The Sahel has witnessed several incidents of drought over the years which has seriously affected the agricultural system of the region, causing food crisis evident in the high level of malnutrition and hunger leading to starvation and death of hundreds of people and animals (Bayala *et al.*, 2006: 2011)

The Sahel region cuts across 10 different nations, which are reported to be among the poorest countries of the world, and also a home to more than 50 million people, about 85% of which are subsistence agricultural farmers (Bonkoungou *et*

trapping dust and also contribute to food security and poverty alleviation by providing fruits, wood (fuel and construction) and fodder. The study was aimed at studying the effect of some Sahelian tree species on the growth and yield of some selected crops in Maiduguri. 8 active farmlands were randomly selected, tree species (Faiherbia albida, Balanies aegyptica and an exotic species Azadirachta indica) from the farmlands were identified and randomly selected for the study. The crops grown on the farmlands (Groundnut (Arachis hypogaea), Cowpea, Vigna unguiculutu, Okra (Abelmoschus esculentus) were measured for the growth (plant height, plant width and number of leaves) and yield (Number of pods and pods yield) parameters under the 3 divided zones (under canopy, neighboring canopy and control) in each sampling station. The result of this study showed that A. indica has yield adverse effect on the growth and yield of groundnut but has no effect on okra crop. F. albida on the other hand shows no effects on the growth and yield of both groundnut and okra. The study further revealed that B. aegyptica shows adverse effects on the growth and yield of groundnut but has no effect on the growth and yield of cowpea.

Key words: *Faiherbia albida, Balanies aegyptica, Azadirachta indica, Arachis hypogaea, Vigna unguiculutu, Abelmoschus esculentus*

al, 1998; Bayala *et al*., 2006: 2011). Th e Sahel is characterized by a 9-month dry season and frequent droughts during the short rainy season. The traditional parkland systems which involve the integrated crop – tree – livestock systems, serves as the main providers of food, nutrition, income and other environmental service. Over years these services are deteriorating mainly due to over exploitation and climate change been the chief factor (Boffa *et al*, 2000; Harris, 2012).

The integration of trees and crops increases crop yields through facilitation as there will be no competition and improved availability of resources for the growing crop (Mariama *et al*, 2019). This integration helps improves income of the local farms while also conserving soil and water for environmental protection (Bayala *et al*.,

2012). Trees generally were reported to show capacity for reducing wind velocity and trapping dust and also contribute to food security and poverty alleviation by providing fruits, wood (fuel and construction) and fodder (Haglund *et al*., 2011).

Groundnut (*Arachis hypogaea*), Cowpea, (*Vigna unguiculutu*), Okra (*Abelmoschus esculentus*) are economically important widely cultivated crop in the study area and the tropic as a whole.

MATERIALS AND METHOS

Study Area

The study was carried out at Federal Government College, Maiduguri (FGCM) which was established in February, 1973 by the Federal Government as one of the "Unity Schools" aimed at fostering national unity by bringing together students from various backgrounds, cultures, languages and ethnic groups to study under the same roof, making the college as a classical example of a multicultural school having a multicultural classroom setting (FGCM, 2003).

Staffs were allocated land to cultivate during the rainy season and were not allowed to cut down any tree, which has helped to conserve the indigenous Sahelian tree species like *Faiherbia albida*, *Balanies aegyptica* and an exotic species *Azadirachta indica*.

Sampling

A total of 8 different farmlands and 3 tree species were randomly selected for the study as shown in **Table 1.**

Table 1 Sampling Stations

S/N	FARM	GPS COORDINATE	TREE SPECIES		CROP
			LOCAL NAME	**BOTANICAL NAME**	GROWN/REMARK
1	**A**	N11^0 49′ 2.53″ E013^0 11′ 9.09″	Neem	*Azadirachta indica*	Groundnut **(A1)** Okra **(A2)**
2	**B**	N11^0 49′ 11.91″ E013^0 10′ 31.78″	Neem	*Azadirachta indica*	Groundnut **(B1)** Okra **(B2)**
3	**C**	N11^0 49′ 18.28″ E013^0 10′ 49.84″	Neem	*Azadirachta indica*	Groundnut (**C)**

4	**D**	N11^0 49′ 20.06″ E013^0 11′ 21.31″	Gawu	*Faiherbia albida*	Groundnut **(D1)** Okra **(D2)**
5	**E**	N11^0 49′ 2.53″ E013^0 11′ 9.09″	Gawu	*Faiherbia albida*	Groundnut **(E)**
6	**F**	N11^0 49′ 11.91″ E013^0 10′ 31.78″	Gawu	*Faiherbia albida*	Groundnut **(F1)** Okra **(F2)**
7	**I**	N11^0 48′ 27.16″ E013^0 11′ 23.31″	Aduwa	*Balanies aegyptica*	Groundnut **(I)** Cowpea **(I2)**
8	**J**	N11^0 48′ 44.44″ E013^0 10′ 56.76″	Aduwa	*Balanies aegyptica*	Groundnut (**J1**) Cowpea **(J2)**

Experimental Design

8 active farmlands were randomly selected, tree species from the farmlands were identified and randomly selected for the study. A total of 3 Sahelian tree species (*F. albida*, *B. aegyptica* and an exotic species *A. indica)* were identified and randomly selected from the farmlands.

The area around each tree was subdivided into 2 zones according to the tree's crown size. Crop sampling positions were selected according to distance to the tree crown with three categories: directly under crown (UC), in the crown neighborhood (NC – about 2m from crown limit) and in a treeless position was used as control as explained by Mariama *et al.*, (2019)

Crop Sampling

In each sampling site, the crops grown were zoned as UC, NC and Control and 3 samples were randomly selected from each zone. Measurements are taken according to methods explained by Mvumi *et al.*, (2018) as follows:

I. **Plant height (cm):** The height of randomly selected 3 crops from each in each zone were measured from ground level to the tip of the last fully opened leaf after every 14 days from 30 days post planting and recorded.

II. **Stem width (cm)**: Stem width was measured from the randomly selected 3 crops in each zone using measuring tape at 42 days after planting.

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III. **Number of leaves:** Fully opened leavers were counted from the randomly selected crops in each zone at 42days after planting.

IV. **Number of pods:** Number of pods per each zone were counted and recorded.

V. **Pod yield (g):** After harvesting, the total weight of the sampled pods from each zone was recorded.

Statistical Analysis

Statistical analysis of the data of the growth and yields of the crop was done using ANOVA

RESULTS AND DISCUSSION

Groundnut (*Arachis hypogaea*) and *Azadirachta indica*

Canopy	Plant Height (cm)	Stem width (cm)	Number of leaves	Number of pods	Pod yield (g)
C	26.8667 ^{A}	4.03333 ^{A}	38.3333 ^{A}	37.6667 ^{A}	167.333 ^{A}
NC	25.9333 ^{A}	3.96667 ^{A}	35.6667 ^{A}	33.6667 ^{A}	162.667 ^{A}
UC	7.4000 ^{B}	2.03333 ^{A}	19.0000 ^{B}	10.0000 ^{B}	38.667 ^{B}

Means that do not share a letter are significantly different; grouping using the turkey method and 95% confidence

Presence of *A. indica* canopy affected the growth of the groundnut height, number of pods and pod yield thereby causing a significant decline, whereas; stem width, number of leaves were not affected.

Okra (*Abelmoschus esculentus*) and *Azadirachta indica*

Canopy	Plant Height (cm)	Stem width (cm)	Number of leaves	Number of pods	Pod yield (g)
C	136.0 ^{A}	33.0 ^{A}	60.5 ^{A}	78.5 ^{A}	259.0 ^{A}
NC	119.5 ^{A}	30.5 ^{A}	55.0 ^{A}	73.0 ^{A}	237.5 ^{A}
UC	106.5 ^{A}	26.0 ^{A}	41.5 ^{A}	56.0 ^{A}	192.5 ^{A}

Means that do not share a letter are significantly different; grouping using the turkey method and 95% confidence

Even though there was no significant difference in Okra height, the data on Okra height was the highest under canopy (136.0 cm), followed by neighboring canopy (119.5 cm) and the control had the least value (106.5 cm).

The stem width recorded 33.0 cm under canopy which was the highest. This is followed by the neighboring canopy with 30.5cm and the control recorded the least value of 26 cm. the difference between treatments is not significant.

Okra planted under the canopy of *A. indica* shows the highest number of leaves with 61, neighboring canopy with 55 and 42 for the control. This also shows no significant difference.

Okra planted under the canopy of *A. indica* shows the highest number of pods with 78.5, neighboring canopy with 73 and 56 for the control. This also shows no significant difference.

Okra planted under the canopy of *A. indica* shows the highest number of pod yield with 259, neighboring canopy with 237.5 and 192.5 for the control. This also shows no significant difference.

Groundnut (*Arachis hypogaea*) and *Faidherbia albida*

Canopy	Plant Height (cm)	Stem width (cm)	Number of leaves	Number of pods	Pod yield (g)
C	23.2667 ^{A}	3.8667 ^{A}	37.0000 ^{A}	28.6667 ^{A}	102.667 ^{A}
NC	23.0667 ^{A}	3.8333 ^{A}	36.6667 ^{A}	28.0000 ^{A}	98.667 ^{A}
UC	22.7667 ^{A}	3.8000 ^{A}	36.3333 ^{A}	20.0000 ^{A}	68.667 ^{A}

Means that do not share a letter are significantly different; grouping using the turkey method and 95% confidence

Present of *F. albida* canopy affected the growth of the groundnut height (23.3 cm), followed by control with (23.0 cm) and neighboring canopy with (22.7 cm) respectively. Present of *F. albida* canopy affected the stem width (3.86 cm), followed by neighboring canopy with (3.83 cm), and the control with the least value (3.80 cm) though causing no significance difference.

Groundnut planted in the neighboring canopy shows the highest number of leaves (37.0), followed by control (36.6) and groundnut planted under

F. albida canopy shows the least number of leaves (36.3) though causing no significant difference.

Groundnut planted under no canopy (control) shows the highest number pods and pod yield, followed by groundnut planted under canopy and the neighboring canopy with 28.6 & 102.6, 28.0 & 98.6 and 20.0 & 68.6 respectively, this also shows no significant difference.

Okra (*Abelmoschus esculentus*) and *Faiherbia albida*

Canopy	Plant Height (cm)	Stem width (cm)	Number of leaves	Number of pods	Pod yield (g)
C	124.0 ^{A}	16.5 ^{A}	31.5 ^{A}	27.0 ^{A}	93.5 ^{A}
NC	109.5 ^{A}	16.0 ^{A}	30.0 ^{A}	22.5 ^{A}	69.5 ^{A}
UC	73.6 ^{A}	13.0 ^{A}	26.0 ^{A}	19.5 ^{A}	62.4 ^{A}

Means that do not share a letter are significantly different; grouping using the turkey method and 95% confidence

Present of *F. albida* canopy affected the growth component of Okra in terms of height, stem width, number of leaves, number of pods and number of pod yield with 124.0 cm, 16.5 cm, 31.5, 27.0, 93.5 respectively, though causing no significant difference in each of the growth component when compared with neighboring canopy (109.5, 16.0, 30.0, 19.5 and 69.5 cm respectively) and the control (73.6, 13.0, 26.0, 22.5 and 62.4 cm respectively).

Groundnut (*Arachis hypogaea*) and *Balanites aegyptica*

Canopy	Plant Height (cm)	Stem width (cm)	Number of leaves	Number of pods	Pod yield (g)
C	24.5 ^{A}	3.75 ^{A}	30.0 ^{A}	37.0 ^{A}	92.5 ^{A}
NC	23.0 ^{A}	3.70 ^{A}	28.5 ^{A}	36.5 ^{A}	89.0 ^{A}
UC	15.0 ^{A}	3.40 ^{A}	18.0 ^{B}	10.0 ^{B}	18.5 ^{B}

Means that do not share a letter are significantly different; grouping using the turkey method and 95% confidence

Groundnut planted under neighboring canopy of *B. aegyptica* shows the longest height (24.5 cm), followed by control (23.0 cm) and then groundnut planted under the canopy of *B. aegyptica* (15.0) but still shows no significant difference.

Groundnut planted under no canopy (control) grow the thickest stem (stem width), followed by neighboring and under the canopy of *B. aegyptica* with 3.75, 3.70 and 3.40 cm respectively causing no significant difference.

Groundnut planted under neighboring canopy of *B. aegyptica* grow the highest number of leaves (30.0), followed by control and the groundnut planted under the canopy of *B. aegyptica* with 28.5 and 18.0 respectively but this shows a significant difference between the groundnut planted under the canopy of *B. aegyptica* ant the other two treatments.

Groundnut planted under no canopy (control) grow the highest number of pods (37.0), followed by the groundnut planted under the neighboring canopy of *B. aegyptica* and then the groundnut planted under the canopy of *B. aegyptica* with 36.5 and 10.0 respectively causing a significant difference between the two other treatments and the groundnut planted under the canopy of *B. aegyptica.*

Groundnut planted under neighboring canopy of *B. aegyptica* grow the highest number of pod yield (92.5), followed by control the groundnut planted under the canopy of *B. aegyptica* with 89.0 and 18.5 respectively but this shows a significant difference between the groundnut planted under the canopy of *B. aegyptica* and the other two treatments.

Cowpea (*Vigna unguiculutu*) and *Balanites aegyptica*

Canopy	Plant Height (cm)	Stem width (cm)	Number of leaves	Number of pods	Pod yield (g)
C	28.50 ^{A}	59.0 ^{A}	34.0 ^{A}	71.0 ^{A}	96.5 ^{A}
NC	27.55 ^{A}	51.5 ^{A}	33.5 ^{A}	63.5 ^{A}	92.5 ^{A}
UC	26.95 ^{A}	46.5 ^{A}	32.5 ^{A}	42.5 ^{A}	65.0 ^{A}

Means that do not share a letter are significantly different; grouping using the turkey method and 95% confidence

TIJARBT
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Cowpea planted under *B. aegyptica* neighboring canopy has the longest height (28.5) followed by beans planted under *B. aegyptica* canopy (27.5) and then control (26.9). This shows no significant difference.

Cowpea planted under *B. aegyptica* canopy has the thickest stem, followed by control and then beans planted under neighboring canopy with 59.0, 51.5 and 46.5 respectively but still shows no significant difference among the treatments.

While cowpea planted under no canopy (control) grow the highest number of leaves, number of leaves and pod yield with 34.0, 71.0 & 96.5 respectively. Cowpea planted under canopy of *B. aegyptica* followed those planted under no canopy in response to the number of leaves grown with 33.5 then Cowpea planted under neighboring canopy of *B. aegyptica* with 32.5 but in respect to the number of pods grown and the pods yield, beans planted under the neighboring canopy of *B. aegyptica* grow a higher number of pods and pod yield (63.5 & 92.5) than the beans grown under the canopy of *B. aegyptica* (42.5 & 65.0). This still shows no significant difference among the treatments.

DISCUSSION

The result of this study showed that *A. indica* had significantly affect the growth of groundnut height, number of pods and pod yield, whereas; stem width, number of leaves were not affected. this indicated that *Azadirachta* provides slow and steady nourishment and improves yield and quality of groundnut. Additionally, *A. indica* had no effect on the yield and yield components. This could be as a result of no nutrient derived under *A. indica* by okra. The increase in the soil nutrient under Azadirachta might not be high enough to improve the growth and yield of okra. However, other reports indicated to have increase in the growth and yield of okra when seed cake of Azadirachta is added in the soil (Eifediyi et al., 2015).

According to Kumar and Khanna, 2006, they reported to have a significant increase in the plant height, number of leaves and number of branches with increase in the rates of neem seed cake (NSC) application. There was a significant response of okra to the different levels of NSC application in the vegetative and yield parameters. This could be attributed to the contribution of the NSC, which is a form of organic

amendment to supplying the plants with macro and micro nutrients which are essential for growth, development and yield of okra. Olaniyi et al., (2005) reported significant increase in plant height, number of leaves, number of fruits and fruits yield of okra when organo-mineral fertilizer (OMF), a type of organic manure was applied on Ogbomoso in south west Nigeria and optimum result was recorded at 4t/ha.

Moreover, *F. albida* caonopy had shown no effect on the yield and yield components of groundnut and okra because the soil could be nutrient-limited. However, the enhancement of soil fertility by trees is conspicuous in studies which also compare productivity of crops grown on soils formed under tree canopies and control in open sites. For instance, total biomass of millet plants grown on soils sampled under of *F. albida* in Niger was 63 percent higher than of those grown on soil sampled away from trees (Moussa, 1997 cited in http://www.fao.org retrieved on 21st April, 2021).

However, groundnut and beans planted under the canopy of *B. aegyptica* shows no significant decline in the growth and growth component of the two crops which may be due to nutrient limitation in the soil and no literature explain the increase in the yield of any crop planted under *B. aegyptica* canopy.

CONCLUSION

The result of this study showed that *A. indica* has yield adverse effect on the growth and yield of groundnut but has no much effect upon association with okra plant.

F. albida on the other hand shows no effects on the growth and yield of both groundnut and okra

The study further revealed that *B. aegyptica* shows adverse effects on the growth and yield of groundnut but has no effect on the growth and yield of cowpea.

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