International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(Research Article)

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Effect of arbuscular mycorrhizal fungi as fungal biofertilizer on the growth and yield of okra (*Abelmoschus Esculentus l.*) in Kebbi

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International Journal of Science and Research Archive, 2024, 12(02), 2621–2633

Publication history: Received on 03 July 2024; revised on 19 August 2024; accepted on 22 August 2024

Article DOI: https://doi.org/10.30574/ijsra.2024.12.2.1510

Abstract

Studies on effect of arbuscular mycorrhizal fungi of biofertilizer on growth and yield Okra (*Abelmoschus esculentus* L).The study was carried out in the greenhouse, the department of biology ADAMU AUGIE COLLEGE OF EDUCATION ARGUNGU in polythene bags (50g). A total of 420 seeds of Okra were collected from national cereals Research Institute Gwadangaji. A sun dried seeds of the samples was sown in polythene bags and distributed into seven treatments which were used in the study as follows, control (without treatment), biofertilizer only, organic fertilizer only, chemical fertilizer only, organic fertilizer + biofertilizer, 20% chemical fertilizer + biofertilizer, and biofertilizer (two doses). Using complete randomized block design (CRBD). From the result shows that the biofertilizer only in all parameters shows significant differences ($P< 0.05$) compared with the control, which gives an indication that biofertilizer helped plant growth and been able to provide the plants with nutrients as it promoted rapid growth, increased leaf size, leaf length, number of leaves, number of branches, fresh weight and dry weight of the plant, hastened crop maturity, and promote fruit and seed development. It was concluded from the result of the study that a fungal biofertilizer play a role as biofertilizer. Were it is clear that the use of biofertilizer affect the growth of Okra. Biofertilizer (two doses) do not affect the growth of Okra as biofertilizer (one dose).It may be due to competition of fungi. The combination of treatments with biofertilizer were recommended for the optimum growth and the yield of Okra. The experiment may be repeated using another fungi or mixture of different fungi. Potassium solubilizing fungi, phosphate solubilizing fungi or another N-fixing microorganism. Cultivation of the plants in field instead of the polythene bags, to provide an appropriate environment to the fungi.

Keywords: Arbuscular mycorrhizal fungi; Okra; Biofertilizer; Organic fertilizer; Chemical fertilizer

1. Introduction

Plants, like all other living things need food for their growth and development and, they require 16 essential elements carbon, hydrogen and oxygen which are derived from atmosphere and water from the soil. The remaining 13 elements (Nitrogen, Phosphorus, Potassium, Magnesium, Sulfur, Iron, Zinc, Manganese, Copper, Boron, Molybdenum and Chlorine) are supplied either from soil minerals and soil organic matter or inorganic fertilizers (Al-Khial, 2006). They are classified into two categories which are macronutrients and micronutrients depending on the quantity required. NPK (nitrogen, phosphorus and potassium) are primary macronutrients elements which are needed in large amounts while copper, boron and iron are example of micro-nutrients that are needed in only small amounts or micro quantity (Ahmad, 2009). For optimum plants growth, nutrients must be available in sufficient and balanced quantities.

Soil which contains natural reserves are largely unavailable to plants and only a minor portion is released each year through biological processes or chemical processes, this release is too slow to compensate for the removal of nutrients by Agricultural production and to meet crop requirement (Jean – Hsluan, 2006). In the soil, the mineral nutrients are dissolved in water and absorbed through a plant root.

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However, the amounts of nutrients in soil are always unpredictable and not enough for plants growth. As a result, primary nutrients such as NPK which are utilized in the large amounts by crops, are commonly found in blended fertilizers nowadays (Ahmad, 2009). Based on the production process, the fertilizers can be roughly categorized into three types, chemicals, organic and biofertilizers. The use of chemical fertilizer or organic fertilizer has its advantages and disadvantages in the context of nutrients supply, crop growth and environmental quality. The advantages needs to be integrated in order to make optimum use of each type of fertilizers and achieve balanced nutrients management for crop growth (Jen-Hshuan, 2006). Runoff of synthetic fertilizer can enter the water ways, causing water to be polluted and to use oxygen, overtime, chemical fertilizer can degrade the quality of the soil by building up toxins leaching away natural nutrients, making the soil unfit for growing plants. Using too much fertilizers can damage plants by chemical burning, roots and leaves. Organic fertilizer are more difficult to determine how much should be used. Organic fertilizer and are much less potent, so if these are not supplied in the correct amount at the right time, plants may not get the nutrient they need. They are more expensive and must be supplied in large quantities. It is a constant challenge to minimize the use of chemical fertilizers in organic culture and the intensive land use including the artificial, N-fertilizer in agriculture.

So due to the harvest or leaching of cautions,he indirect effect of soil acidity on the presence and availability of toxic, such as aluminum, manganese, or other heavy metals, such are generally more important to crop production than the direct effect of acidity on the plants. Impact of soil acidification decreases the number and activity of useful soil. Organisms, deficiency of magnesium, calcium may occur, phosphorus may become less available, the solubility of several heavy metals may reach toxic level increasing up take of heavy metal by crop plants may cause serious health problem to animals and humans (Levai et al, 2008).

The excessive use of chemical fertilizers has generated several environmental problems including the greenhouse effect thereby causing ozone layer depletion and acidification of water. These problems can be tackled by the use of bio-fertilizers (Sa adatnia and Riahi, 2018). Soil microbes are of great importance in cycling nutrients such as carbon(c), nitrogen (N), Phosphorus (p), Sulphur (s). Not only do they control these elements. The use of living microbes (biofertilizer) accelerate mineralization of organic residues in soil, therefore makes the nutrients more available. At the same time due to effect of living microbes like carbuscular mycorrhizal fungi from biofertilizer, the uptake of heavy metals decreases (Levai et al, 2018).

1.1. Biofertilizier

Biofertilizer can be defined as a substance which contains living microorganisms and is known to help with expansion of the roots system and better seed germination. The micro-organisms containing bio fertilizers can be the tools we could change to replace chemical fertilizers. Bio-fertilizers are products containing living cells of different types of microorganism, which have and ability to convert nutritionally important elements to available form through biological processes. In recent years, bio-fertilizers have emerged as an important component of the integrated nutrient supply system and hold a great promise to improve crop growth and yield through environmental better nutrient supplies (Marianna et al, 2016).

For the last one-decade, bio-fertilizers are used extensively as an eco-friendly approach to minimize the use of chemical fertilizers, improve soil fertility status and for biological activity and any help to rebuild the living soil that can get damage by any earth-work. Most desirable species will have a very difficult time out competing weeds without mycorrhizae, or they slowly released nutrients provided by bio-fertilizers.

Application of beneficial microbes in agricultural practices started 60years ago now there is increasing evidence that those beneficial microbial populations can also enhance plant resistance to adverse environmental conditions e.g. water and nutrient deficiency and heavy metal contamination (Wua et al, 2014).

Bio-fertilizer includes mainly the arbuscular mycorrhizal fungi and phosphorus solubilizing and plant growth promoting micro-organisms and improve phosphorus nutrition and other micro organisms that help nutrients uptake. these biofertiizers can be expected to reduce the use of chemical fertilizers. Among bio-fertilizers, benefiting the crop production are, Azopirillum, blue green algae, Azolla, P-solubilizing micro-organism, mycorrhizal and sinorhizobium (Selvakumar et al, 2017).

1.2. Problem Statement/Justification

In recent years, there are growing concern on measures, against use of chemical fertilizer, the use chemical fertilizer has not been helpful and intensive agriculture because if aggravates soil degradation. The degradation is brought about by loss of organic matter which consequently results in soil acidity nutrients imbalanced and low crop yield. Due to its high solubility up to 70% or inorganic fertilizers can be lost through leaching, denitrification and erosion and reducing their effectiveness (Ayoola and Makinde, 2017, Alimi et al, 2017).

Overpopulation can result in negative effects such as leaching, pollution of water resources, destruction of microorganisms and friendly insects, crop susceptibility to disease attack, acidification or alkalization of the soil or reduction is soil fertility, thus casing irreparable damage to the overall system (Jen-Hshuan, 2016).

Organic fertilizer is hard to get, not sterile low nutrients content. Generally cost significantly more than synthesis fertilizers organic fertilizer requires documentation and regular inspection. Organic fertilizer still releases nutrients into their surroundings these nutrients can find their ways into local streams, rivers and estuaries just as nutrients from synthetic sources do (Thomas et al, 2015). This study aimed to addressed some of these gaps by assessing the effects of arbuscular mycorrhizal fungi as fungal biofertilizer on the growth and yield of Okra (*Abelmoschus Esculentus l.)* in Kebbi.

1.3. Justification of the Study

The Fadama areas and sub-Fadama area of Argungu and Birnin Kebbi are an agricultural land mark with production of different types, of vege tables tubers and cereals. The mass areas of land are occupied mostly by farmers along the river side. They cultivate different types of agricultural products like rice, vegetables which include okra, maize, millet etc. they are densely polluted with many scattered settlements. The farmers use chemical fertilizers to boost or increase productivity to meet their demands but the excessive use of fertilizers leads to contamination of soil and ground water and reduce soil fertility. As the problems of chemical fertilizers are difficult and expensive as a results of the blockade, its known that the excessive use of chemical fertilizer have generated several environmental problems, including the green house effect, ozone layer depletion, acidification of water and pollution of water resources, destruction of micro-organism, acidification on or alkalization of the soil or reduction in soil fertility. So bio-fertilizers can significantly replace partially chemical fertilizer. Hence, there is a need to search for alternative strategies to improve soil health without causing damage to environment as well as soil. Therefore, bio-fertilizers are gaining the importance as they are eco-friendly, non hazardous and non-toxic products (Sharma, wt al, 2018).

Soil microbes are great importance in cycling nutrients such as carbon (C), nitrogen (N), phosphorus (P), and sulphur (S). not only do they control of these elements.

1.4. Statement of the Problem

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Over application can result in negative effects such as leaching, pollution of water resources destruction of micro-organisms and friendly insects, crop susceptibility to disease attack, acidification or alkalization of the soil or reduction in soil fertility, thus causing irreparable damage to the over all system (Jen, Hshuan Chen, 2016).

The use of living microbes (bio-fertilizers) accelerate mineralization of organic residue in soil, therefore make the nutrients more available. At the same time due to the effect of living microbes like Arbuscular mycorrhizal fungi from bio-fertilize, the uptake of heavy metal decreases (Levis et al, 2008).

Bio fertilizer as a substance which contains living micro organism and it known to help with expansion of the root system and better seed germination. The micro organism containing bio-fertilizer can be the tool we could change to replace chemical fertilizers. Bio fertilizers are products containing cells of different types of micro organisms, which have an ability to convert nutritionally important element to available form through biological processes. In recent year, bio-fertilizer have emerged as an important component of the integrated nutrients, supply system and hold a great promise to improve crops growth and yield through environmental better nutrients supplies (Marinanna et al, 2016).

application of beneficial microbes in agricultural practices started 60 years ago and now there is increasing evidence that these beneficial microbial populations can also enhance plant's resistance to adverse environmental conditions e.g. water and nutrient deficiency and heavy metal contamination (Wua et al, 2014).

Symbiotic association of plant roots with VA-fungi often result in enhanced growth because of increased acquisition of phosphorus (p) and other low mobile mineral nutrients. VA-fungi are known to be effective in increasing nutrients up take, particularly phosphorus and biomass accumulation of many crops in low phosphorus soil (Turk et al, 2016). An hyphal excrete glue, sugar-based compound called Glomalin, which helps to bind particles and makes stable soil aggregate. This gives the soil structure, and improves air and water infiltration, as well as enhancing carbonation nutrients (Contra coasta, 2018).

Objectives of the Study

The objective of the study are:

- To evaluate the effectiveness of Arbuscular mycorrhizal fungi as bio-fertilizer on growth and yield of okra, (*abelmoschus esculentus L*) compared with the control and other fertilizers.
- Isolation, identification and cultivation of local strain of Arbuscular mycorrhizal fungi.

2. Materials and Methods

2.1. Description Study Area

Kebbi state is one of the seven states of the north western geopolitical zone. It was curved out of Sokoto State on August 27, 1991. It capital is Birnin kebbi. The state comprises up to four emirates with 35 district namely (Gwandu, Argungu, Zuru and Yauri). Kebbi derived its name from the 14th century “KEBBI KINGDOM” which was a province of the former Songhai Empire. The state occupies 37, 72797 square kilometers. It boarded Sokoto state in the North eastern part. Also Boarded with Zamfara state on the eastern part and republic of Niger on the western part. The population of the people (predominantly rural), was 3,256,541 according to 2006 official census. The climate of the area a tropical continental type, thus agriculture is the occupation of the people. Sudan Savanah is the predominant vegetation type in the area. The state is blessed with large flowing rivers. The study will cover will be covering only two local government (Argungu and Birnin Kebbi Local Government) respectively.

2.2. Date Analysis

The experimental trials will be conducted in dry seasons from November to October 2024 at Adamu Augie College of Education permanent site at department of Biology of Adamu Augie college of education Argungu (at about 2km from Argungu town) in latitude 13^{o} 01 N’ longitude 5^{o} 15 E. it is 308 meter above sea level and lies with the Sudan savannah belt (reuhen, 1981). The climate of the area is semi-arid with mean annual rainfall of about 600mm (Sokoto, Kebbi and Zamfara, Koval and Kanbe, 2017). The area is characterized by enatic and scanty rainfall with relative humidity ranges 21-47% in the dry season, while temperature ranges from 14-40^{o}c during dry season the area is a low lying level Sokoto-Rima level flood-plain (Fadama). Characterized by a long dry season with cool air between November to February and hot dry air during hot season (March to May (Kovaland Kanbe 1972, Singh, 1995).

2.2.1. Soil Collection and Analysis

The soil samples will be collected from the experimental site and the soil will be through a diameters mesh before the analysis was conducted as approved by (blacket al, 1965).

2.2.2. Soil Texture Analysis

Fifty grams (50th) of sieved soil will be measured an transfer into tone thousand millocylender about six hundred mills (500mm) of distilled water and fifty mills (50mm) of colon solution were added into the cylinder containing the soil samples the solution will be stoned thoroughly. Hydrometer will be differ into each sample and water add up to 1000mil. Then hydrogenous solutions were created the cylinder will be left on a float top and the hydrometer inverted immediately, the time at the first reading of the hydrometer taken to be (F1) for about forty seconds (405) and the data was recorded. The thermometer was inverted to take the first reading as (t1). The samples were kept for about three hours (3hrs) not disturbed after which hydrometer was inverted without shaking the samples and the second hydrometer reading (h2) was recorded the second thermometer reading were (T2). Then, the percentage of sand, clay and soil was calculated by using the formula below:

Percentage of sand =(50-H-2) x 3 (T2-20) – 50) x 1 x 00)

Percentage of clay =(H2 -2) x 3(T2 – 20) – 50 x 1 = 100

Percentage of silt = 100 – (% sand + % clay)

2.2.3. Determination of Soil pH

About 10ml of distilled water was added to 10g of soil a 100ml beaker, the solution was stirred with a glass rod and allow to stand for about 30minutes. The electrode will be calibrated at pH, is then immerse into the suspension and the pH, value was recorded.

2.2.4. Determination of Soil Depth

The top soil was dag-deep down until the ground and wooden meter rule was inserted into the soil depth reading was recorded in centimeter (cm).

2.2.5. Determination of Moisture Content

For the determination of the soil moisture content the procure was adapted by Oyenuga (1978) method. Two (2) grams of the soil sample was weighted in (m) and then heated in an oven 105°c for 24 hours and then allow to cool in desiccators for about 15-20 minutes and then weighted (m2). The crucible was then returned into the oven and weighted after 3 hours for as many times as possible until a constant value or reading was obtained. The percentage of moisture content were calculated as follows.

$$\% \text{ moisture content} = \frac{loss\ of\ mass\ by\ drying}{weight\ of\ soil}\ x\ 100$$

2.2.6. Organims Arbuscular Mycorrhizal Fungi

The fungi use in this experiment will be Arbuscular mucorhizal fungi (AMF)

Okra Seeds

The seeds for the research were purchased from national cereal institute at Gwadangaji town.

2.2.7. Collection of the Soil Sample

The soil in this research will be taken at 10-15cm depth supply from random places of Fadama area of Argungu and Birnin Kebbi areas and the soil was air-dried.

2.2.8. Encroachment of AMF

Two (2g) of soil were added to 500ml of flasks containing 18ml of Bark's liquid (Martinex et al, 1985). The sample will be incubated for 4-days at 27-30°c.

Experiment

The present investigation will be carryout during the season (2023-2024) at Biological garden of Department of Biology Adamu Augie College of Education Argungu. The experiment consist of seven (7) treatments of chemical, organic and Biofertilizer, arranged in a complete randomized blocks design (CRBD) with thirty replicates for each treatment and (two) 2 seeds were transplanted in each polythene bag (50g) (after germination one of two seed disposed) which mean that each treatment are as shown below.

- A – Control (no inoculation)
- B – Biofertilizer only (AMF one dose)
- C – Organic fertilizer only
- D – Chemical fertilizer only
- E – Organic + biofertilizer (AMF)
- F – Bio-fertilizer + 20% chemical fertilizer
- G – Bio-fertilizer (two doses of AMF).

The total number of seeds were 420 seeds to be sown in 210 polythene bags (depth = 20cm, H = 30cm). These polythene bags will be distributed in complete randomized block design (CRBD). There will be five arrows, each will have 7 treatments (A,B,C,D,E,F,G), distributed randomly where each treatment have 6 polythene bags in each arrows, so 240 seeds were inoculated with Arbuscular Mycorrhizal fungi (60) seeds with organic and (60) seeds with chemical fertilizer.

2.2.9. Soil Preparation

The soil the basic properties of the soil use for the experiment was sand = silt = clay pH).

2.2.10. Inoculation of the Seeds

The seeds are to be inoculated before sowing 240 of Okro seeds Biofertilizer, organic **+** Biofertilizer, Biofertilizer **+** 20% chemical fertilizer and Biofertilizer (two doses were in place in fungal suspension one hour before sowing under sterilized soil where 180 seeds (control, compost chemical) were placed in Burk's media (without serosa).

2.3. The growth Parameter

The yield parameters plants height (cm) number of branches, stem fresh weights (g), root fresh worst (g), stem dry weight (g) root dry weight (g) will be measured. The measurement was taken after every 3 weeks by using thread and wooden meter tulle.

2.3.1. Statistical Analysis

The data will be analyzed statistically using statistical package for window called latex for least significance difference that is in testing for means that are significantly different or not.

3. Results

3.1. Soil analysis

The results of soil analysis from the site of the experiment shows that the site had pH of 6.7, slightly acidic, the organic carbon percentage of the soil was found to be low 0.25%, the percentage of nitrogen was found to be 0.041%. The soil composition of phosphorus was found to be 0.91% low C moll kg while the potassium composition was found to be low 0.21%. The composition of sodium and calcium was found to be 0.14% C moll kg and 037% C moll kg low respectively. The magnesium content was found to be 0.22% low C moll kg the cation capacity of the soil was found to be 5.46% C moll kg. The percentage of the soil was found to be (95.0%) while that of silt is (8.7%), clay percentage was found to be (0.8%) and moisture content of the soil was 2.7%.

The first sets of experiment were to determine the impact of arbuscular mycorrhizal fungi on the growth and yield of okra as bio fertilizer in Argungu area. The growth and yield parameters considered were length of the okra, length shoot of okra, length root of okra, biomass of dry shoot of okra, dry root of okra, dry biomass of the whole plant, wet root and wet shoot biomass, wet biomass of whole plant, number of branches, length of leaves and number of leaves.

3.2. Different parameters

Different parameters of growth of okra through the 2 months of culture, at the first three weeks the branches are equal in all treatments, then branches were increased at B, F, E, C than A at the end of two months the higher measurement of branches were at B, D and E, respectively.

3.3. Effects of sources plant nutrients

Table 1: the effect of sources plants nutrients on shoot and root length of okra is presented in table 1. The result indicated that, the effect of sources of nutrients on shoot length is not significance at 3 WAP; however, at 6 and 9 WAP, sources of plant nutrient significantly affected shoot length, chemical fertilizer and 20% chemical + biofertilizer did not differ significantly with higher shoot length and the lowest shoot length was control. At 9 WAP the sources of fertilizer did not differ significantly. But the lower shoot length was from control the higher shoot length recorded at chemical and 20% chemical + biofertilizer could be due to fast release of plant nutrients from chemical fertilizer. The result is similar to the finding of the effect of sources of plants nutrients on root length is significant, the sources of plants nutrients did not differ significantly, but the low length root is from control, the lower root length recorded could as a result of low fertility status of the soil.

Table 1 The effect of sources plant nutrients on shoot and root length of okra for each Treatment

Treatment	**Shoot length (cm)**			**Root length (cm)**		
Sources of plant nutrients	**3 Weeks**	**6 Weeks**	**9 Weeks**	**3 Weeks**	**6 Weeks**	**9 Weeks**
Biofertizer	15:00	20:20 [a]	23.70 [a]	17.00 [a]	22.40 [a]	27.8 [a]
Biofertilizer two doses	10.50	13.70 [b]	17.70 [a]	16.60 [a]	21.80 [a]	26.90 [a]
Chemical	16.00	21.30 [a]	26.10 [a]	10.00 [a]	16.80 [a]	21.30 [a]
20%Chemical+Biofertilizer	15.60	20.10 [a]	24.50 [a]	12.60 [a]	20.50 [a]	25.10 [a]
Organic	11.20	15.80 [b]	18.20 [a]	12.80 [a]	18.70 [a]	20.20 [a]
Organic+Biofertilizer	12.50	16.30 [b]	18.16 [a]	12.80 [a]	16.50 [a]	21.10 [a]
Control	10.10	10.30 [c]	12.60 [b]	18.50 [b]	10.20 [b]	14.30 [b]
LSD	2.01	0.766	0.66	0.70	0.666	0.37

Means not following by the same letter (s) are significantly different using ; LSD = Significant – NIS = not significant

Table 2 Effect of sources of plant nutrients on number of branches and leave length of okra.

The effect of sources of plant nutrients on number of branches for plant and lead length are presented in table 2, the result medicated of 3 and 6 WAP did not differ significantly ($p<0.05$) while Bio fertilizer and chemical fertilizer have the highest numbers of branches and lowest number of branches was found to be from the control at 9 WAP sources of plant nutrients did not affect number of branches. The lower number of branches recorded at control could be as a result low fertility status of the soil. The effect sources of plant nutrients on lead at 3n WAP. The sources of plant nutrients did not altered lead length. Biofertilizer (two doses) and chemical fertilizer recorded the highest leaves length while control recorded the lowest leaves length. While the lowest lead length was from the control. This could be as a result of lower nutrients status of the soil response to sources of plants nutrients. In Kebbi, Sudan savanna Nigeria.

Table 2 Effects sources of plant nutrients on number of branches and leave length of okora each treatment

Treatment	**Number Branches**			**Leaves Length (CM)**		
Sources of plant nutrients	**3 Weeks**	**6 Weeks**	**9 Weeks**	**3 Weeks**	**6 Weeks**	**9 Weeks**
Biofertizer (one doses)	17:00	10:00 [a]	12.00	15.60	18.500 [a]	23.300 [a]
Biofertilizer two doses	6.00 [a]	9.00 [a]	9.00	18.70 [a]	23.80 [a]	26.70 [a]
Chemical	9.00 [a]	12.00 [a]	14.00	20.00	23.20 [a]	26.30 [a]
20%Chemical+Biofertilizer	5.00 [a]	8.00 [a]	11.00	12.80 [a]	15.60 [a]	18.60 [a]
Organic	6.00 [a]	9.00 [a]	11.00	17.50	20.20 [a]	23.80 [a]
Organic+Biofertilizer	70.00 [a]	10.00 [a]	14.00	10.60	14.80 [a]	18.20 [a]
Control	2.00 [b]	5.00 [b]	8.00	9.20	12.60 [b]	15.20 [a]
LSD	0.74	0.5	0.88	2.96	1.63	0.37

Means not following by the same letter (s) are significantly different using LSD = Significant – NIS = not significant

Table3: Effect of sources of plant nutrients on wet weight of shoot and wet weight of whole plant. The effect of plants nutrient on wet weight of shoot and wet weight of whole plants are represented in Table 3.The result indicating that at the 3 and 6 weeks did not differ significantly {$p < 0.05$} while the lower wet weight was from the control experiment. But at 9 weeks the sources of plant nutrient did not affect wet weight of 20% chemical + Biofertilizer and chemical, there was correlation which have the highest wet weight /out the lowest wet weight was observed or recorded to control. And this could be as a result of poor nutrients status of the soil. The effect of plant nutrients sources of wet weight of whole plant of 3 weeks there was no much differences in nutrients to take up but at 6 and 9 weeks sources of plant nutrients significantly affect wet weight of the whole plants. But organic and organic + Biofertilizer recorded the highest wet weight of the whole plants, while can't recorded the lowest wet weight of the whole plant. At 6 and 9 weeks

after planting sources of plant nutrients significantly affect wet weight of the whole plants organic and organic + Biofertilizer did not differ significantly {$p < 0.05$} with higher wet weight and lowest wet weight was from the control. The higher wet weght of organic and organic + Biofertilizer could be due of fast release of nutrients from the organic and organic + Biofertilizer, and the lowest recorded for control could be due to poor nutrients status of the soil.

Table 3 Effect of sources of plant nutrients on wet weight of shoot and wet weight of whole plant for each treatment

Treatment	**Wet weight of shoot**			**Wet weight of whole plant**		
Sources of plant nutrients	**3 Weeks**	**6 Weeks**	**9 Weeks**	**3 Weeks**	**6 Weeks**	**9 Weeks**
Bio Fertilizer	26.57[b]	39.30[b]	41.60[b]	100.74[c]	111.39[b]	125.56[c]
Bio fertilizer (two Doses)	26.37[b]	34.26[b]	26.30[a]	158.68[b]	165.68[a]	175.90[b]
Chemical	64.39[a]	72.56[a]	70.74[a]	153.92[b]	143.60[b]	177.36[b]
20% Chemical + Bio Fertilizer	67.70[a]	69.82[a]	72.94[a]	131.32[b]	143.60[a]	156.47[b]
Organic	49.60[a]	52.30[a]	54.10[a]	222.32[b]	235.49[a]	246.50[a]
Organic + Bio Fertilizer	59.60[a]	62.30[a]	65.10[a]	190.31[a]	201.30[a]	212.48[a]
Control	27.58[b]	29.56	32.39[b]	49.20[d]	56.60[c]	105.60[c]
LSD	3.70	4.66	4.20	3.33	3.70	4.67

Means not following by the same letter are significantly difference using LSD; = significant - NS = not significant.

Table 4: Effect sources of plant nutrients on Dry weight of shoot and Dry weight of Root of Okra.

The effect of sources of plant nutrients on dry weight of shoot and Root of okra is presented in Table 4; the result indicated that at 3 and 6 weeks after planting, the sources of plants nutrients did not differ significantly {$p < 0.05$}, while the lower number was recorded at control and this could be due to poor fertility status of the soil. The effect of dry weight of root the sources of plant nutrients at 3 after planting

did not altered the dry weight of the plant, but at 6 and 9 weeks after planting the sources of plant nutrients did not differ significantly {$p < 0.05$} organic with higher dry weight. While the lowest dry weight was from the control. This could be due to poor nutrients in the soil. Although chemical and 20% chemical + Biofertilizer has the highest dry weight {g}, while the least dry weight was recorded at control and this could be due to poor fertility of the soil. But at 9 weeks after planting still chemical and 20% chemical + Biofertilizer recorded the highest dry weight of the shoot {g}, while control recorded the lowest dry weight {g}. But 3 weeks after planting, there was slight weight differences between organic fertilizer and Bio fertilizer {one dose} have the highest dry root weight {g}.But at 6 and 9 weeks after planting did not differ significant {$p < 0.05$}, organic with higher dry weight and followed by Bio fertilizer {one dose}, while the lowest dry weight was from the control. This could be due to poor nutrients status of the soil.

Table 4 Effect sources of plant nutrients on dry weight of shoot and dry weight of root of okra of each treatment

Treatment	**Dry weight of shoot (g)**			**Dry weight of plant (g)**		
Sources of plant nutrients	**3 Weeks**	**6 Weeks**	**9 Weeks**	**3 Weeks**	**6 Weeks**	**9 Weeks**
BioFertilizer (one Dose)	8.80	11.10[a]	16.23[a]	4.45[a]	5.10[a]	6.25[a]
Biofertilizer (Two Doses)	11.66[a]	12.10[a]	16.23[a]	6.40[a]	7.10[a]	8.17[a]
Chemical	18.71[a]	20.24[a]	22.80[a]	4.40[a]	5.60[a]	6.22[a]
20% Chemical + BioFertilizer	15.56[a]	16.64[a]	17.90[a]	4.66[a]	6.98[a]	7.20[a]
Organic	10.75[a]	11.78[a]	16.61[a]	8.84[a]	10.37[a]	12.16[a]
Organic + BioFertilizer	12.61[a]	12.61[a]	14.90[a]	5.80[a]	6.40[a]	7.60[a]
Control	2.96[b]	3.10[b]	4.27[b]	22.11[b]	3.80[b]	1.46[b]

Means not following by the some letter (3) are significantly different using LSD. = significant – NS = not significant

Table 5: Effected Dry weight of whole plant of Okra.The effect source of plant nutrients on dry weight of whole plants. The results are presented on Table 5.This indicated that the presence of nutrients may affect the dry weight of a whole plant. At 3 weeks there is much differences in dry weight, but at 6 and 9 weeks after planting. There is much differences in weights, but 20% chemical + Bio fertilizer and organic + Bio fertilizer has the highest dry weights recorded. This could be due to the availability of the nutrients in the soil status. Bio fertilizer {two doses} and control has the lowest number and this could be due to poor nutrients status of the soil.

Table 5 Effect dry weight of whole plants

Treatment	**Dry weight of whole plant (g)**		
Sources of plant nutrients	**3 weeks**	**6 weeks**	**9 weeks**
Bio Fertilizer	90.83	21.30[b]	22.60[b]
Bio fertilizer (Two Doses)	39.69[a]	41.70[a]	42.20[a]
Chemical	59.67 [a]	61.80 [a]	43.20 [a]
20% Chemical + Bio Fertilizer	48.70 [a]	49.70 [a]	51.40 [a]
Organic	47.13 [a]	47.20 [a]	50.90 [a]
Organic + Bio Fertilizer	48.50 [a]	50.30 [a]	52.40 [a]
Control	11.18[b]	12.30[c]	14.60[c]
LSD	4.33	3.37	2.74

Means not following by the same letter are significantly difference using LSD = significant = NS not significant

4. Discussion

The problem of chemical fertilizers is a global problem, and researchers are working all over the world to find a lasting solution to this problem as it is in the last century, when chemical fertilizer were first introduced into the Agricultural field, most of the problems faced by famers to increased yield of the plantation have been solved. However chemical fertilizers started to show there sides effect on human and environment [Bin Zakaria A.A. 2018].The increased use of fertilizers and chemicals have a negative impact on soil quality overtime ,leading to accumulation of certain compounds and salts in the soil or transfer such chemicals and salts into the groundwater, which increases the salinity. Argungu and Birnin –kebbi is an Agricultural lands, have high population density with small space, and lack of farm lands. Farmers use chemical fertilizers in agriculture which caused negative impact on some plants and the environment contributed to the deterioration of Bio diversity. In addition, because of fluctuation of rainfall in our country, the effect of chemical fertilizer caused the chemicals to accumulate in the soil, lead to low productivity because of the high salinity of the soil to add chemical fertilizer, where high rainfall caused the decent of chemicals into the ground water. So due to the fluctuation and irregular rainfall, the use of chemical fertilizers may have risks. This is because of the acidic nature or acidic tolerant of the soil it should be noted that chemical fertilizers are difficult to obtained due to the siege as they costly and have side effects and multiple damages. More over the price of chemical fertilizer is expensive and sometimes not available to farmers {Al-Khiat 2017}. Partial or total replacement 0f chemical fertilizer will be useful in Argungu and Birnin Kebbi Agricultural land, to overcome the harmful effect of chemical fertilizers and to maintain soil fertility and groundwater. Bio fertilizer will be the best solution to replace chemical fertilizers. Biofertilizer are carrier-based preparation containing mainly effective strains of micro organisms in sufficient number, which are useful for nitrogen fixation. Amongst the nutrients nitrogen is the nutrient, which play major role in synthesis of chlorophyll, amino acids and protein building blocks {Mahato et al, 2016}. Biofertilizer have several advantages over chemical fertilizers, they are non pollutants, in-expensive, utilize renewable resources. In addition to there ability of using free available solar energy, atmospheric nitrogen and water. Beside supplying nitrogen to crops, they also supply other nutrients such as vitamins and growth promoting substances {contra costar, 2017}. Amongst Bio fertilizers, Arbuscular Mycorrhizal fungi strains play a key role in harnessing the atmospheric nitrogen through its fixation in the roots. They have been also reported to improve fertility condition of the soil{Mahato et al, 2016}. Nitrogen fixer micro organisms such as Arbuscular Mycorrhizal fungi. A fungal Bio fertilizer can supply nitrogen by fixing the nitrogen from atmosphere and convert it into ammonium ion for plant uptake. The Okra, is important and desirable to the consumer, the option is available throughout the year due to cultivation in green-houses, where the growing season needs to be warm relatively short. Nitrogen is considered as one of the major nutrients required by plants for growth, development and yield. The specific objective of this study was use of fungal Biofertilizer which is isolated locally from soil as a Biofertilizer. This study show the role of nitrogen fixing Arbuscular Mycorrhizal fungi encouraging plant growth, where using fungal Biofertilizers, a Biofertilizer stimulate the growth of Okra, where the use of Biofertilizer gave the second best results after chemical fertilizer, and even better than compost, 20% chemical + Biofertilizer and compost + Biofertilizer, explains that the was move effective in nutrients uptake as a result of mineralizing organic soil, nitrogen and producing phytohormones. There was an excellent growth in plants that were moculated with but it is important to indicate that these plants get only the nitrogen while it did not get the other nutrients such as potassium and phosphorus , although that growth was clear and in most cases better than the other treatments except plants that took chemical fertilizer where these plants got all the nutrients needed for proper growth. This indicates that moculation of Fungal Bio fertilizer had beneficiary response on growth of Okra. The application of microbial inoculants as so called Biofertilizer is a promising method to promote plant growth by increasing the availability of nutrients to plants, mainly nitrogen and phosphorus {Eicler et al, 2014}, {shaharoona et al,2016, Richard Chardoson et al, 2018}. Main sources of Bio fertilizer are plant growth promoting Rhiobacteria {PGPR}, beneficial fungi Cyanobacteria {blue-green algae}. In addition to the improvement of nutrients uptake microbal inoculants can promote the growth of crops by protecting plants soil-borne pathogens {Thrance et al, 2010} and productin of Phytohormones {Kannan and Sureendar 2015}. As shown from the result that the Biofertilizer mall parameter is higher than control, which gave an indication that Biofertilizer helped plant growth and been able to provide plant with nitrogen, which is one of the most important nutrient for plant growth, as it promoted rapid growth, increased leaf size and quality hastened crop maturity and promote fruits and seed development. Nitrogen is an integral part of chlorophyll manufacture through photosynthesis {Mikkelson and hartz 2016}. But lack of other nutrients such as potassium and phosphorus make growth less than the growth of plants with a chemical fertilizer, where potassium is needed for the plants cells metabolic and in influencing the action of enzymes, as well as in adding the synthesis and trans location of carbohydrates. And roof developments, the stalk and stem strength, flower and seed formation, crop maturity and production, nitrogen fixation in legumes, crop quality are the attributes associated with phosphorus nutrition {Ahmad et al, 2018, William 2018}. The research took place at Biological Garden Adamu Augie Collage of Education Argungu and Birnin-Kebbi in polythen bags and use nutrients poor soil which may reduce the work of Fungi, as well as the lack of any food for the plant only through nitrogen-fixing. A fungal Biofertilizer uses carbon for its metabolism for simple, or compound substances carbanaceous materials in soil. Besides carbon, A fungal Biofertilizer also requires calcium for nitrogen fixation. The addition of chemical fertilizers or organic adversely affect the performance of fungi and thus the effect of fungi alone is stranger than the effect of when mixed with chemical fertilizers and organic {Benson 20011}.Compost + Biofertilizer are less than or equal to Biofertilizer. Adding compost to the soil causes the fungi to move to the analyses of these compost, therefore, the fungi consume the nitrogen chain to itself to grow and multiply, and after the end of this stage fungi begins in the analyses of compost and nitrogen production, at this time the plant may be beyond the stage of formation of negative growth. Thus the addition of organic fertilizers with fungi does not give a significant result compared to the Biofertilizer, where the decomposition of compost takes a long time to start supplying the plants nutrients. The presence of fungi, with chemical fertilizers leads to the irresence of two inhibition factors to fungi, the first is the high amounts nitrates and secondly, the acidic environment due to the presence of chemical fertilizer. Through the result we find that the use of A Fungal Biofertilizer alone had a positive effect on the growth parameters of Okra. The fungi inoculants caused effective increased in growth parameters such as number and weight of yield, root and shoot length, wet dry weight of root and shoot. Nitrogen percentage of Okra. The outcomes of this research showed that A fungi Bio fertilizer play role as Bio fertilizer where it is cleard that the use of A fungi Biofertilizer affect the growth of Okra. Bio fertilizer {two doses} don't affect the growth of Okra as Bio fertilizer {one dose} it may be due to the composition of fungi.

4.1. Length of Okra on Application AMF

Inoculation with A Fungal Biofertilizer promoted shoot length when compared to control. The inoculated plants both root and shoot length more than control as shown. When root elongation is associated with the production of IAA in early stages. The IAA content was increased in inoculated plants as compared to control and so increased root length due to Fungal phytohormones. Also the lack of essential nutrients causes the elongation of roots to obtain nutrients {Hamid et al, 2016 and Hassan, 2017}. These results are in accordance with most similar previous studies {Dhamanga Onkar et al, 2018, Mahato et al, 2018}. Dry weight of Okra on Application of AMF. The growth of roots and shoot were increased in the presence of A Fungal Biofertilizer as Bio fertilizer. The addition of AMF to the soil affects the increase in negative propagation as the fungi are fixing nitrogen, which is an important factor in the stages of plants growth, especially the early stages where the stem, roots and leaves grow in these stages. The fungi provided the right amount of nitrogen, the plant grew very well during the initial stages and continued to grow, but of the other nutrients, which are very important for plant cause growth weaker than chemical. But this growth in the presence of nitrogen, only is an excellent and clear. The plant growth has declined in the final stages, especially the growth of the stem where there is a weakness in the stem as aresult of lack of other nutrients, but dry weight of the system was higher than control, where stalk and strength, crop maturity and production, are the attributes associated with phosphorus nutrition. This results are accordance with most similar previous studies (Bugyaraj et al, 1978, Abd El Gaward et al, 2012, Shama et al 2014, Rawia et al, 2018, Selva kumar et al, 2018). The number and weight of the last three collections +on Applications AMF. Only the last three collection were weight and this was not enough to compare the treatments and efficiency of fungi or chemical fertilizer or organic fertilizer to increase the production of plant. It was observed that the production of plant that inoculated with fungi produce Okra better than control. Ofcourse the presence of nitrogen that was fixed with fungi increased the negative growth more than increased production. This results are in accordance with most similar previous studies (Abd -El Gaward et al, 2012, Milani et al, 2014, Rawia, 2018, Mirzakhanis 2018). Application of Bio fertilizers is an acceptable approach for higher yield with good quality and safe for human consumption. In general it appears that, as expected, application of Bio fertilizers improved yield. And other plant criteria, this has also been reported else where (Tabrizi et al, 2016). From the research results of the experiment it is clear that Bio fertilizer shows better results as compare to that of control. The advantage of Bio fertilizer is that it does not pollute the soil and also does not show any effect on human health and environment. Chemicals fertilizers were better than the Biofertilizer and that due to the absence of other nutrients in plants inoculated with fungi. Finally obtaining less amount of healthy products with less environmental disturbances is preferred over obtaining higher amount of non-healthy products with more environmental disturbances.

5. Conclusion

In conlusion the present research investigated the influence of fungal association with uptake of nitrogen and phosphorus. A fungal Biofertilizer, isolated from the soil on the growth and yield of Okra. Results from the search indicated that yield and growth of Okra, have been affected by the moculation with A Fungal Biofertilizer, because these Bio fertilizer can combine with N-P proper uptake in nutrients to plant in soil. Increased yield and growth for about 5-30%. In most parameters, the Bio fertilizer were higher than control and hearly equal or sometimes higher than compost, 20% chemical + Bio fertilizer and organic +Biofertilizer. A high yield of Okra was obtained in the presence of A fungal Biofertilizer alone when compare to control yield. Higher dry and wet root and were obtained in the presence of A fungal Biofertilizer alone when compared to control yield. The length was higher in shoot and root of plant moculated with A fungal Biofertilizer when compared to control yield. The chemically fertilized plant show the best growth in all cases.

Recommendation

- The research may be repeated by using another fungi or using a mixture of different fungi such as N-fixing fungi, potassium solubilizing fungi, phosphate solubilizing fungi or another N-fixing micro organism.
- Using a wide range of plants which are important and consume large amounts of chemical fertilizers.
- Inoculation of fungi by different preparations such as immobilization.
- The research may be repeated without mixing chemical fertilizer and compost to fungi but by adding some nutrients to the soil.
- Using a chemical fertilizer of nitrogen only to compare its effect with fungi impact.

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