An investigation of some fungi species found in organically and inorganically fertilized soils in Afaka area of Kaduna State, Nigeria.

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Abstracts

Microorganisms are found in large numbers in soil usually between one to ten million microorganisms are present per grain of soil with dominant number of bacteria and fungi. Soil organisms contribute to important soil functions such as supporting the growth of plants both in natural plant communities and those grown for food, fibre or energy.

Fungi share a major part of the microbial biomass. Fungi are also critical decomposers in soil habitat and they derive nutrients for their growth in organic matter. Fertilizers in any organic or inorganic material of natural or synthetic origin that is added to a soil to supply one or more plant nutrients which is essentially for growth of plants the objective of this study is to determine the fungi population in the soil associated with organic and the soil associated with inorganic fertilizers.

The results showed that total microbial biomass of fungal colonies was generally more in soil with organic fertilizer when compared to soil with inorganic fertilizers. Fungal diversity of 25colonies were obtained in organically fertilized soil while 13colonies were found in inorganically fertilized soil. A highly significant difference (≤ 0.05) statistically was observed between population of fungi from organic and inorganic soil types justifying that organic soil contained more fungi than organic. The fungi species isolated in this study include *Aspergillus* species, *Aspergilus candidus, mucus* species, *pencillum* species and *rhizopus* species with *Aspergilus* having greatest percentage abundance 40% followed by *Penicillum* sp 32% and next was *Mucor* species 16% and lastly *Rhizopus* species 12%.

Key words *Fungi colonies, organically fertilized soil, inorganically fertilized soil, Aspergillus sp, Penicillum sp, Rhizopus.*

Introduction

Soil represents a favorable habitat for microorganisms and is inhabited by a wide range of microorganisms. Soil organisms contribute to important soil functions such as supporting the growth of plants both in natural plant communities and those grown for food, fibre

and energy. They absorb, neutralize, transform compound that might otherwise become pollutants in the environment. Soil microbial diversity is influenced by both organic and inorganic matters. Soil organic matter is generally used to represent the organic constituents in the soil, excluding undecayed plants and animals tissues, their partial decomposition products and the soil biomass (Dick, 2000; Barn *et.al* 1999) .They explained that soil organic matter provides a favorable habitat for microorganisms to grow compared to inorganic soil.

Nabayi and Babatunde(2014) explained that in most of the aerated or cultivated soils, fungi share a major parts of the total microbial biomass. Many important plant pathogens and plant growth promoting microorganisms are fungi. Fungi are also crtitical decomposers in soil habitat like bacteria and fungi derive nutrients for their growth in organic matter (Bossio *et.al*, 2000). Growth of microorganisms and crops can be controlled and influenced by using organic or inorganic fertilizer (Zak, *et.al* 2000).

Organic fertilizer

Organic fertilizers have been known to improve biodiversity and long-term productivity of soil, (Enwall, et.al, 2005; Birkhofera, et.al, 2008) and may prove a large depository for excess carbon-dioxide. (Lal, 2004; Rees, 2009; Fliessbach, et.al, 2009). Organic nutrients increase the abundance of soil organisms by providing organic matter and micronutrients for organisms such as fungi mycorrhiza, (PIMENTEL, et.al, 2005). (which aid plants in absorbing nutrients), and can drastically reduce external inputs of pesticides, energy and fertilizer, at the cost of decreased yield (Mader, et.al, 2009). In general, the nutrients in inorganic fertilizer are both more dilute and also much less readily available to plants. According to the University of California's integrated pest management program, all organic fertilizers are classified as 'slow release' fertilizers, and therefore cannot cause nitrogen burn (Healthy Lawans, et.al, 2010). Organic fertilizers from composts and other sources can be quite variable from one batch to the next . Without batch testing, amount of applied nutrients cannot be precisely known. Nevertheless, one or more studies have shown they are at least as effective as chemical fertilizers over long periods of use

inorganic fertilizers nearly always are readily dissolved and unless added have few other micro and macro plant nutrients nor added any 'bulk to the soil'. Nearly all nitrogen that plants use is in the form of ($NH_{3)}$ or (NO_3) compounds. The usable phosphorus compounds are usually in the form pf phosphoric acid (H_3PO_4) and potassium (K) is typically in the form of potassium chloride (KCI). In organic fertilizers, nitrogen, phosphorus and potassium compounds are released from the complex organic compounds as the animal or plant matter decays. In commercial fertilizers, the same required compounds are available in easily dissolved compounds that require no decay-they can be used almost immediately after water is applied. Inorganic fertilizers are usually much more concentrated up to 64%(18-46-0) of their weight being a given plant nutrient, compared to organic fertilizers that only provide 0.4%. The objective of this study is to determine the abundance of fungi found in organic and inorganic fertilized soils.

Materials and methods

Study area

The study was conducted in Afaka farm, Kaduna. Average tempreture of Kaduna is about 23degree C and the town is located at latitude 10degree 25N to 10degree 37N and longitude 7degree 24E to 7degree 30E. the town is located in Igabi Local Government Area of Kaduna Metropolis. Afaka farm is about 20km away from Kaduna city centre and it is managed by Igabi Local Government Authority.

Soil samples were collected by sterile methods from organic and inorganic fertilized soil in Afaka farm and brought to the laboratory in air tight polytene bags for further analysis. Isolation was done by serial dilution.

ISOLATION OF FUNGI

The soil borne fungi was isolated and their total population was enumerated by following the method as given below:

First, soil samples were collected from both the organic and inorganic soils, then 3flasks (250ml) were taken and 90ml distilled water was transferred into each flask. Each flask was plugged properly, labeled 1-3 and autoclaved at 151b/inch^2 for 30minutes. 1gm of soil sample was weighed and transferred into the flask 1 containing 90ml. it gives the dilution 1:1 i.e 10-1ml, then it was shaken for 5minutes gently with a stirrer to get

homogeneous soil suspension. 0.1ml soil suspension was transferred to 10-1 dilution into flask 2 containing 90ml distilled water to get dilution 10-2 and then mixed gently. Similarly, 1ml of soil suspension was serially transferred from 10-2 dilution into flask 3 containing 90ml water to get the final dilution of 10-3 and mixed it gently. 1ml of soil suspension was aseptically poured from 10-3 dilution in different media plate. The plates were gently rotated so as to spread the suspension on medium. The plates were incubated at ± 25degree C for 4-5 days. Different media from potato agar medium, Marthin's Rose Bengal medium, etc. were prepared for isolation of fungi lactol phenol and cotton blue stain was used also called as mounting fluid. The slides were observed under microscope and fungi were identified by following the mycological literature

Results and Discussion

Table 1: Occurrence of fungal colonies in serial dilution in both organic and inorganic soils.

	Organic soil	Inorganic soil
Dilution	No. of colonies in serial dilution	No. of colonies in serial dilution
10-1	15	7
10-2	7	4
10-3	3	2
10-4	-	-
Total colonies	**25 (65.79%)**	**13(34.21%)**

Table 2: Percentage of occurrence of various fungus species colonies in examined soil.

Serial No.	Fungi from organic soil	Fungi from organic soil	Fungi from organic soil	Fungi from inorganic soil	Fungi from inorganic soil	Fungi from inorganic soil
	Species	No. of colonies	Occurrence %	Species	No. of colonies	Occurrence %
1	*Aspergillus ramose*	3	12.00		-	00.0
2	*A. niger*	5	20.00		3	23.10
3	*A.candidus*	2	08.00		1	07.70
4	*M. mucedo*	4	16.00		2	15.40
5	*Penicillum rubrum*	5	20.00		4	30.80
6	*P.puberrulum*	3	12.00		1	7.60
7	*Rhizopora oryza*	3	12.00		2	15.40
Total		**25**			**13**	

The results in Table 1 shows the occurrence of fungal colonies in serial dilution.The number of colonies in serial dilution 10^1 indicated 15 for organic soil and 7 for inorganic soil.In all a total of 25 colonies(65.79%) were recorded for the organic soil and 13colonies(34.11%) for the inorganic soil.Table 2 shows the percentage of occurrence of various fungal species.7 fungus species were identified.T-test analysis was done statistically between fungal populations from the two soil types.A high significant difference($P<0.05$) was observed indicating more abundance of fungi in organically fertilized soil .The genera with the greater number of species in fungi were *Aspergillus* followed by *Penicillum* sp.In terms of diversity there was no significant difference between the two soil type where only *Aspergillus remosa (A.remosa)was unidentified in the inorganically* fertilized soil. Fungi species isolated were seven(7). The genera with the greater number f species in fungi were *Aspergillus* (3 species), and *penicillum* (2 species) in the serial dilution plate method. The most widely distributed and abundant colony forming taxa were *penicillum (*13colonies), *Aspergillus(* 14 colonies) in both soil sample fields. The richest genera in terms of the number of species were *Aspergillus* and *penicillum.* The six fungi species were isolated and identified from organic and inorganic fields. Two species belonged to genus *penicillium* and three to *Aspergillus*. One specie belonged to each genus of *Rhizopuz and Mucor.*

Among 7 species of fungi, 6 species were isolated from both organic and inorganic fields while 1 species could not be found in inorganic field. The occurrence of many of the species in genus *Aspergillus* (3) and *Penicillium* (2) are probably due to their capability of producing a diverse range of antibiotics and myocotoxins which protect them from other soil organisms and may also hinder the growth of other fungi species. E.I. Frantroussi et.al, 2007 also agrees with the importance of the microbes in the soil. He explained that they play a major role in organic matter decomposition, biotransformation, biogas product and Decrease in population of microbes in organically fertilized soils may be due to some reasons which include over fertilization (NPK, 2012), "fertilizer burn" in accordance with salt index (Understanding soil index, 2012). Also regular use of acidulated fertilizers generally contributes to the accumulation of soil acidity in soil which progressively increases aluminum availability and hence toxicity and death of soil

microbes (Shrack, 2009). It is acknowledged now that farmers are becoming 100% dependent on water soluble in organic fertilizers sample soil noted to becoming sterile been devoid of soil natural micro flora and microphage. Thus soil structure may be destroyed (Shrack, 2009). Comparatively, (Enwall, *et.al*, 2005; Birkhofera, *et.al*, 2008; Lal,2004) explained the usefulness of organic fertilizers in a high terms of its improvement of biodiversity, long-term productivity, soil and creating a conducive habitat for micro-organisms. Alvers, *et.al*, 2000; Itu and Van Brugger, 2001; Tuld, *et.al*, 2000; Boehm, *et.al*, 2004; Deleij, *et.al*, 2003; Maloney, *et.al*, 2007 and workneh, *et.al*, 2008) all agreed in their studies that revelation of diversity of micro-organisms associated with various soil parameters such as disease suppression and organic matter decompensation were observed.

CONCLUSION

This study proved that organic fertilizers have great capacity to give a good atmosphere for microbial growth comparatively than in inorganic fertilizers because synthetic fertilizers depends on the chemical reactions while due to organic fertilizers, natural physiological activities occur among various microbes. The consequences of the present study is that the organic farm soils have a great capacity to give space to the microbial survival which renders a fruitful outcome in the form of good crop production having a great tolerance to atmospheric pathogens and diseases. At the same time, inorganic soil has less microbial diversity which proved that some bacteria or fungi species may be found in inorganic fields but not able to use properly the microclimate or micronutrients as can be used by organic microbes. The *Aspergillus ramose*, and have been found in ample amounts in organic soils while not a single colony has been found in inorganic soils. Furthermore, the results indicated that common practices of using synthetic fertilizers harm the soil quality if indiscrimately used and consequently low fertility of soil can be observed

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