EFFECT OF DIFFERENT SOIL TYPES ON GERMINATION AND SEEDLINGS GROWTH OF COWPEA (Vigna unguiculata L.) AND GROUNDNUT (Arachis hypogeae L.)

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Abstract

A study was conducted to determine and to disseminate the effect of different soil types on germination and seedlings growth of cowpea (Vigna unguiculata l.) and groundnut (Arachis hypogeae l.) and to ascertain the permeability of sand and loamy soil with regard to germination and seedlings growth. The experiment was carried out in a controlled environment to evaluate the effect of the different soil. Number of seed that germinated per day when planted on different soil types, height of seedlings, and width of seedlings and leaves number on seedlings was used as parameters. Among the soil characteristics assessed, the results obtained showed that seed sown in sandy soil germinate and emerge faster than the seeds planted/sown in loamy soil. It was also observed that loamy soil retain water, much nutrient and moisture compared to the sandy soil which does not retain water and contain micro pores(drainage pores), leeching of nutrient and loss of moisture which result in abnormal growth of the seedlings. Also based on this experiment, the seedlings on the loamy soil show natural and normal growth due to the fertility of the soil when compared to the sandy soil which shows abnormal growth in height and pale coloration (hues) of leaves. Although seedlings on sandy soil show rapid growth with poor performance compared to the seedling on loamy soil with natural and normal growth. The results were used to deduce the best type of soil for cowpea and groundnut cultivation.

Keyword: Soil; germination; cowpea; groundnut

Introduction

Grain legumes represent an important component of agricultural food crops consumed in developing countries and are considered vital for achieving food and nutritional security among the smallholder farmers (Sitou and Maredia, 2011). They are also an important source of income for the poor farmers and vital in improving soil fertility. This is because of their ability to fix the freely available atmospheric nitrogen into the form that can be utilized by plants, thereby reducing the need for mineral nitrogen fertilizers. It is estimated that one third to one half of the total nitrogen added to agricultural land come from legume-rhizobia symbiosis (Sitou and Maredia, 2011)

Cowpea (*Vigna unguiculata* L. Walp.) is a legume grown under rain-fed conditions in the tropics (Sangakkara 1998). Although it occupies a smaller proportion of the crop area than cereals, it contributes significantly to household food security in West and Central Africa. Compared with many other crops, the cowpea has received little attention from plant breeders and large efforts need to be made to break the yield barriers. If cowpea production is to keep pace with other crops, especially cereals, its yield potential must be improved. Groundnut is also a warn season crop requiring abundant sunshine for normal growth and development and is much cultivated in regions with an annual rainfall of about l00cm3 for high yield and good quality; a frost free growing period of four to six month is need with a brief spell of dry weather during fruit ripening and harvesting. The crop is frequently sown on loose, friable sandy soil of poor fertility. W ell drained sandy loam soil are the most favorable for growing groundnut (Kochhar l998). Moreover, cowpea has an important unique ability to fix nitrogen even in a very poor soil. It is also shade tolerant and therefore compactable as an intercrop with many cereals and root crops (tuber crops) (Kochhar l998). The Pease are propagated or planted by seed. Seeds used for planting are retained from the previous harvest, though some farmers may buy them locally from the market (Singh et al 1997). The cowpea and groundnut are planted from the beginning to the middle of the season, it is also grown mostly in small or big Held, in pure stand or intercropped with many cereals maize, sorghum etc. with other crops such as yam, cassava, potatoes etc. on mound, beds or ridges. When grown as a soil crop, it is often the first crop in a rotation. The plant management mainly consist of two or three manual weeding, the use of inorganic fertilizer is not common (Singh et al 1997).

Nutrient deficiencies, mainly nitrogen (N) and phosphorous (P), are the main soil fertility constraints limiting crop yields in West Africa (Bationo and Mokwunye 1991). N2- fixing legume crops such as groundnut (Arachis hypogea L.) and cowpea (Vigna unguiculata (L) Walp) are reported to improve soil fertility of cropping systems as a consequence of N supplied by legumes via biological nitrogen fixation (BNF) (Bagayoko et al. 2000; Bationo and Ntare 2000). Considering that in traditional systems, the legume shoots are exported and used to feed livestock but not incorporated in the soil as green manure, the N input effect of legume crops on

the succeeding crops could be overestimated when N fixed in the aboveground is considered (Bado et al, 2005)

Groundnut and cowpea are an important staple food crop in sub-Saharan Africa not only Nigeria along especially in Nigeria (Oyenuga, l959) the seeds form a major source of plant protein, vitamins, oil e.t.c to man and feed for animals. The young leaves and matured pods are eaten as vegetables. Economically, the sale of these crops and fodder earns a lot of income to farmers. In Nigeria, famers who cultivate/cut and store these fodder for sells at the peak of the dry season have been found to obtain as much as 25% of their annual income by this means, groundnut and cowpea also plays an important role in providing soil nitrogen to cereal crops(such as maize and sorghum). Furthermore in Nigeria, the greatest production of these crops comes from the northern region of the country.Cowpea grow best unfertile loamy soil with a rain fall of76O- l 520mm during the growing month it grows best in the 'dry areas of the northern part of west Africa. While on the other hand, groundnut grows well in rich, light, sandy loam with a rainfall of 5 liter- l270mm and well distributed. It is also a sun loving crop loose soil help the plant in boring its hurts in the soil. Best yield are obtained in soil rich in lime and when a rotation system is used. (Anyanwu *et al*, l979). Most of the plant grows in almost neutral ground that has got nutrient naturally. According to Thompson and Troel (l975), fertilizer is source of plant nutrient that can be added to the soil to supplement its natural fertility. The supply plant needs directly rather than indirectly through modification of such properties as soil PH and structure. There is usually dramatic improvement in both quality and quantity of plant growth when appropriate levels of fertilizer are added to effect changes from traditional and subsistence type of agriculture to a modern mechanized agriculture is accompanied by market increase in the use of fertilizer of different kind.

According to Anyanwu *et al*, (2003), groundnut has a high calcium requirement for good fruit development. It needs direct Contact with calcium at the pod developing stage. Groundnut does not respond so much to fertilizer, if the soil is not that too poor in nutrient for it can always extract its requirement from the soil. The response of cowpea to fertilizer is however related to the previous cropping on the soil. If the soil is poor, the application of farm- yard manure or supper phosphate and potash gives increased yield. Nitrogenous fertilizer does not always give increase in yield but where nitrogen is deficient; an early application of fertilizer is beneficial under contrary, when soil is acidic, application of lime to stimulate nodulations done.

Material and Methods

Collection of seed The seeds of cowpea and groundnut were obtained from Monday market of Maiduguri, Borno state of Nigeria.

Testing Viability of Seed The seeds were tested for viability by using floating method, although it is not considered as hundred per cent best method of testing the viability of seeds, but it is

seventy percent good. The seeds were placed in a volume of water, the seeds that sink or settle at the bottom of the container are considered as the viable seeds, while the floated seeds on the surface of the volume of water were separated and discarded.

Soil sterilization; **the** soil sample were collected from University of Maiduguri premises and sterilized under the sun, or put under the sun to be sterilized. Both the sterilized loamy and sandy soil was placed into two germinating polythene bag labeled treatment T1 and T2. The experiment was set up in two ways with two different soil treatment i.e. sandy and loamy soils. There were two replications respectively.

Planting and date Reading; the seed were sown in each germinating polythene bag at about 3-4cm deep at the rate of two seeds per hole. While reading or collecting the data, the following parameters were observed after sowing to estimate the effect of different soil treatment on germination and growth of seedlings. Number of seeds that germinated per day, length of shoot/seedlings height measured with ruler**,** the diameter/ width of shoot/seedlings, the number of leaves of seedlings.

Analysis of the Data; the results obtained from the measurements were analyzed to determine the statistical differences in a simpler way.

Results

Number of Seeds that Germinated Per Day for Seven Days

As it was stated in the previous chapter, two seeds were planted in each polythene bag at a sowing depth of three to four centimeter.

Days		1	2	3	4	5	6	7
Sandy soil								
Treatment	T1	-	-	-	1	2	2	2
Treatment	T2	-	-	-	2	2	2	2
Loamy soil								
Treatment	T1	-	-	-	-	1	1	1
Treatment	T2	-	-	-	-	1	2	2

From the table above it shows that, the seed planted in sandy soil germinated and emerged faster more than those sown in loamy soil. This shows that sandy soil is quite lighter than loam and contains large particles and microspores as well as the porosity of sandy is higher than loam which is composed of finer particles and its porosity is low.

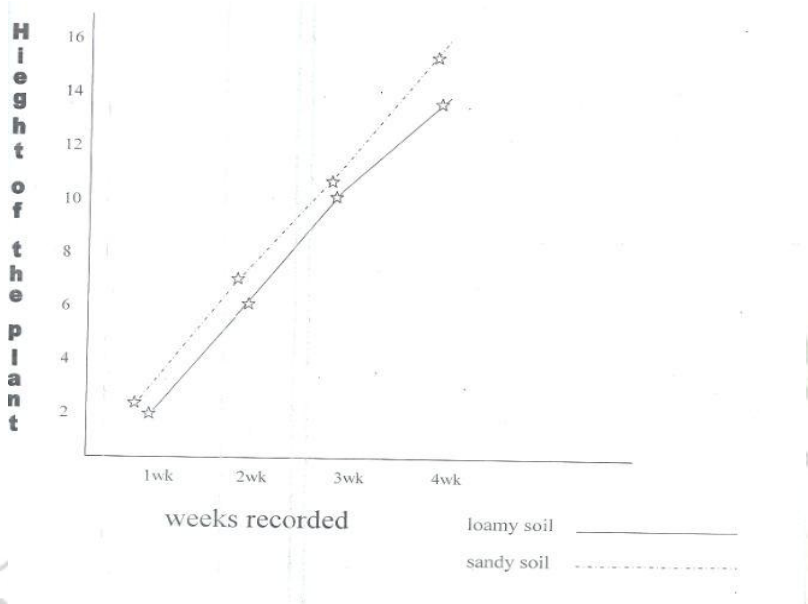
Therefore, the seedlings germinate faster, and broke through the sand with much ease.

Mean Length of Seedlings / Shoots (cm) of the Treatment

WEEK	1	2	3	4
Sandy soil				
Treatment T1	3.0	11.0	15.0	20.0
Treatment T2	2.0	3.0	7.2	10.0
Loamy soil				
Treatment T1	2.0	6.0	12.0	16.0
Treatment T2	2.0	6.0	8.0	10.0
Week mean value	1	2	3	4
Sandy soil	2.5	7.25	11.1	15.25
Loamy soil	2.0	6.0	10.0	13.0

From all indication, as the plant continue to grow the above table shows that there is increase in the growth of the plant planted on sandy soil than the one planted on loamy soil. This is so because; sandy soil does not hold the growth of the plant (seedlings) as in the loamy soil which contain much nutrient which is synthesized by the plant gradually for its growth and development. Furthermore, the retarded growth of the plant indicated above may be due to the compatibility of the loam soil which retained much water without draining it which alters the physiology of the plant.

Graphical representation of height of seedlings



Mean of Stem Diameter in (Cm)

Week	1	2	3	4
Sandy soil				
Treatment T1	1.4	1.6	1.7	1.9
Treatment T2	1.1	1.2	1.5	1.8
Loamy soi1				
Treatment T1	1.0	1.2	1.4	1.8
TreatmentT2	0.6	0.9	1 .0	1.5

Week mean value	1	2	3	4
Sandy Soil	1.25	1.4	1.6	1.85
Loamy soil	0.8	1.05	1.2	1.65

From the above table, the mean diameter value (dv) of shoots on sandy soil was higher than the shoot on loamy soil at the same period of four weeks respectively. This may be attributed to the development of seedlings.

Number of leaves on shoots for four weeks

Week	1	2	3	4
Sandy soil				
Treatment T1	4	6	8	10
TreatmentT2	4	6	8	10
Loamy soil				
Treatment T1	2	3	4	4
Treatment T2	4	6	8	12

The table above shows that the treatment (T2) (groundnut) planted on sandy and loamy soil produces the same or equal number of leaves at four Weeks respectively. On the other hand the treatment (Tl) on sandy also produces ten leaves at four weeks while on the loamy soil, the number of leaves was only four at four weeks. This is attributed to the failure of seed's germination.

Discussion and Conclusion

The present experiment on the effect of different soil types on germination of seedlings growth of cowpea (*Vigna sinensis L or V. unguiculata L*) and groundnut (*Arachis hypogeae* L) showed that the plant germinated on both soil types (sandy and loamy). The seeds planted on the sandy soil germinated and emerged faster than the one planted on loamy soil. This was attributed to the fact that the sandy soil was not heavy due to its porosity and do not hold the germination of the seeds. The seed planted /sown on loamy soil did not germinate and emerge faster on the same day with the sandy soil. This may be as a result of its non-porosity as it was stated earlier. As growth continues, the seedlings on the sandy soil grow taller than the seedlings on the loamy soil. This may be so because the seedlings on the loamy soil retained water and the plant did not

require much water. ln this case, the retention of water on loamy may lead to the retarded growth and the development on the seedlings as well.

According to Anyanwu, *et al*. (2003), groundnut may grow on almost any type of soil except heavy clay low in organic matter. It however prefers light sandy soil for good seed formation and it should be rich in phosphate, sulphur and on the other hand, cowpea is a very hardy crop adapted to a wide range of soil, it does best on well drained sandy loam soil but can do well on sandy or clayey soil. However, very fertile soil induces excessive vegetative growth and poor pod formation. That means, the fast growth of seedlings on sandy soil cannot be questioned. The stem diameter which was measured on weekly basis for four weeks was a bit different. in both the soil types. The stem diameter on sandy soil based on this experiment was a little bit higher than the one on the loamy soil which is negligible and thus may be attributed to the development of seedlings on the soil type. The leave number on both sandy and loamy on each plant (cowpea and groundnut) was however normal as it is supposed to be on the normal circumstance, except on loamy soil, the treatment T1 which fail to germinate. The parameter which was not accounted on the previous chapter but included in the discussion was the leave color or pigments (hues), shows a great and remarkable difference between the two types of soil used during the experiment. The seedlings' leaves on the loamy soil were completely deep green and show healthy growth compared to the leaves on sandy soil which was somehow pale green in color (hues). This may be as a result of much nutrients availability present in the loamy soil which shows a complete deep green coloration and healthy growth.

Brady, (l974) reported that nitrogen tends primarily to encourage above ground vegetative growth and import to the leaves deep green color with all plant nitrogen is a regulator that governs to a considerable degree to the utilization of potassium, phosphorus and other constituent. Moreover, its implications tend to produce succulence. Although the plant produces more yield when planted on sand loam than sandy soil because loam has greater moisture holding capacity and it is less prone to loss of nutrient through leeching. While on the other - hand, sand which contains micro pores has a lower water retention capacity and is more prone to loss plant nutrient which are insoluble through leeching. The effect of different soil types on germination and seedling growth of cowpea and groundnut cannot be overemphasized considering the nutrient requirement as well as the sunshine required by the two types of plants on different soil types. Based on this experiment the germination and seedling growth on sandy shows a little variation compared to the germination and seedling growth on loam soil except the seedlings' leave on loamy soil which was deep green and healthy. This experiment however was only measured for a limited period of time for about four weeks. As the growth of seedlings continues up to maturity and yield production, there is every tendency for the treatment on loamy soil supersedes the treatment on sandy in both growth and yield production which cannot be stated or quantified tor now.

The experiment on the effect of different soil types on germination and seedling growth of cowpea and groundnut showed that the plant germinate and emerge faster as well as the growth of seedlings on sandy soil was pronounced compared to the one on loamy soil. However, Soil is important as a medium for plant growth and for the support of much animal and human activity. The soil acts as a reservoir for nutrients and water providing the plants' needs for these requirements throughout their growth. The soil may also provide an environment for the breakdown and immobilization of materials added to the surface (in addition to the aforementioned plant and animal remains) such as fertilizers and pesticides and waste products such as sewage sludge, animal wastes and slurries, and composted refuse materials (Stephen *et al*, 2012).

It was also observed and noted that leaves on loamy soil was completely deep green color which shows the availability of nutrient in the loamy soil. It also shows a sign of healthier plants than the leaves of seedlings on sandy which shows a pale coloration which also indicates the lack or nutrient deficiency in the sandy soil,

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