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# The Effect of Different Sound Frequencies on Some of Pandanus amaryalifolious Leaves Extract

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**Abstract:** In this work the effect of sound with different frequencies on some of Pandanusamaryalifolious leaves extracts was measuredat different seasons in Khartoum State, Omdurman, Sudan. A noticeable results were detected

**Keywords:** Pandanusamaryalifolious, sound waves, seasons.

## Introduction

Most of the information about our physical surrounding comes to us through our senses of hearing and sight, sound and light are waves. A wave is carries energy from one place to another without a transfer of mass. Sound is a mechanical wave produce by vibrating bodies, when (source)is set in to vibrational motion the surrounding air molecules are disturbed and are forced to follow the motion of the vibrating body. the vibrating molecules in turn transfer their motion to adjacent molecules causing the vibrational disturbance to propagate away from the frog when the air vibration reach the ear (receives) they cause the eardrum to vibrate, this produces nerve impulses that are interpreted by the brain .The sound is transmits according to a material medium between the source and the receiver and the distant. The sound transfer by compression and rarefaction in the medium initially by the vibrating sound source ,intensity of sound are determined by the magnitude of compression and rarefactions in the medium and frequency is measured in cycles per second and designated by (hertz )(1 Hz = 1 cycle per second )[1].The distance between the nearest equal points on the sound wave is called the wave length (λ), we can circulate the speed of sound wave (v) by know the material that propagate the sound, in air at 20◦C the speed of sound is about $3.3 \times 10^4$ cm \sec and in water it is about $1.4 \times 10^5$ cm \sec , in general the relationship between frequency .There are four important phenomena which described a sound waves reflection refraction, interference, and diffraction[2,3].

## Sound Wave

Sound is a form of energy that can be heard by humans ear Fig (2.4) sound is a mechanical longitudinal wave and as such consists physically in oscillatory elastic compression and in oscillatory displacement of a fluid ,therefore the medium acts as storage for both potential and kinetic energy, they can travel through any material medium with a speed that depends on the properties of the medium , As the waves travel the particles in the medium vibrate to produce changes in density and pressure along the direction of motion of the wave . These changes result in a series of high –pressure and low – pressure regions, if the source of the sound waves vibrates sinusoidal, the pressure variations are also sinusoidal. We shall find that the mathematical description of sinusoidal sound wave is identical to that of sinusoidal string waves [4].

- Sound waves are divided in to three categories that cover different frequency ranges:
- Audible waves are waves that lie within the range of sensitivity of the human ear (20 Hz – 20K Hz) they can be generated in a variety of ways such as by cords and loud speakers.
- B-Infrasonic waves are waves having frequencies below the audible range (below 20 Hz) elephants can use infrasonic waves to communicate with other even when separated by many kilometers.
- Ultrasonic waves are waves having frequencies above the audible range (above 20K Hz) the ultrasonic sound emits easily heard by dogs,although humans cannot detect it at all, ultrasonic waves are also used in medical imaging.

## Reflection of Wave

Reflections are treated by the introduction of so-called boundary condition, Suppose that we have a taut string, one end of which is attached to a large mass, and that we produce a transverse “pulse”. The pulse will move along the string at the rate $\sqrt{S/\mu}$ where S is the tension and μ the mass per unit length, when the pulse reaches the clamped end of the string, the amplitude at this end must necessarily vanish. This means that the pulse close to this end will be compressed and the force across the string will increase significantly. Since the endpoint cannot move, the compressed string experiences a force in the opposite direction, which creates an imbalance between the amplitude and the travel, speed, compelling the pulse to turn back along the string. However, the wave that travels backwards will have amplitude opposite to that of the original (incoming) pulse, No energy is lost. Since loss on account of friction requires the frictional force to work over a certain distance, while we have assumed that the end point is completely fixed. Another extreme is that where the end is free to move. This can be achieved, for example by holding the string at one end and allowing it to fall freely downwards and let the end move freely in air (disregarding air resistance).A pulse transmitted along the thick string will move normally until it reaches the boundary between the two strings. The disturbance that reaches the thin string will give it a significantly greater impact than if the string were of a uniform density. There is again a mismatch between amplitude and velocity, resulting in reflection, but the result in this case is a reflected pulse with same amplitude as the original pulse In this case some of the wave (and energy) will also propagate along the thin string. If the thin part has a significantly smaller density, almost all energy will be reflected The terms “a massive structure” and “a thinner or thicker string” (signifying linear mass density) are not sufficiently precise word, and it is better, when one is discussing production and transmission of sound, to use the term “acoustic impedance”, defined as acoustic pressure (sound pressure) divided by acoustic volume flow rate ,The fraction that is reflected or transmitted depends on the relative impedance change in relation to the impedance of the medium the wave originates from. If there is no impedance change, nothing is reflected; if the relative impedance change is infinitely large, all energy is reflected [5].

**Acoustic Impedance**

There are several variants of acoustic impedance. “Characteristic acoustic impedance” $Z_0$ is defined as:

$$Z_0 = \rho c \qquad (1)$$

Where ρ is the mass density of the medium (kg/m$^3$), and c is the speed (m/s) of sound in this medium. $Z_0$ depends on the material and its units are Ns/m$^3$ or Pas/m.

The characteristic impedance of air at room temperature is about 413Pa s/m. For water, it is about 1.45 × $10^6$ Pa s/m, i.e. about 3500 times larger than the characteristic impedance of air. Differences in characteristic acoustic impedance determine what fraction of a wave is transmitted and what fraction is reflected when a “plane wave” reaches plane interface between two media. The big difference in characteristic acoustic impedance between air and water means that sound in the air will be transmitted into water only to a small extent, and sound in water will penetrate into air only to small extent. Most of the sound will be reflected at the interface between air and water. The sound speed in air or water was given (using c instead of v) as [6]:

$$c = \sqrt{K/\rho} \qquad (2)$$

Where K is the modulus of compressibility and ρ is the mass density. Upon eliminating ρ by using the definition of characteristic impedance in Eq. (2), we get:

$$Z_0 = K/c \qquad (3)$$

Different measure is often used "Acoustic impedance” Z is defined as:

$$Z = \frac{P}{V_S} \qquad (4)$$

Where p is the sound pressure, v is the particle speed (over and above the contribution of thermal movements) and S is the pertinent cross-sectional area [7]

## Material & Method

**Apparatus:**

Thermometer, pyrometer, source of sound, ruler, three samples of plants of (*Pandanusamaryalifolious).*

**Experiment Setup:**

The three samples *(Pandanus Amaryalifolious*) were placed at shade
(At Omdurman-Sudan) as shown.

Fig. (1) Left photo before exposure/Right photoafter exposure to sound

**Method:**

*Pandanus Amaryalifolious* plants were grown in a greenhouse super market at Omdurman, Sudan. There were watered two liters day after day, two of them had been exposed two a different types of sound (plant No.2) exposed to Holy Quran with wave length close to (528 nm) and (plant No. 3) exposed to music with wave length close to (741 nm) daily and the third one (plant No. 1) kept without exposure.

Thedistant from source of sound to plant about 80 cm during the period from (14/9/2018) to (30/5/2019). Temperature and atmospheric pressurehad been taken every day after exposure, the period of exposure was (1 hour and 27 min).

In physical shape length, number of leaves and weight of plant (before and after) watering had been taken after 15$^{th}$ day regularly. Results are shown at table (2.1)

The readings were taken at the period of eight months from14th of September 2018 to 30$^{th}$ of May2019. The average temperature was (31.5$^{0}$C) the average of the pressure was (101.4 K.pa), and the average of humidity was (14.8 %)

## Results:

**Weakly Tests**

Table (2.1) Physical Appearance of Plant (1)

| Time Of Test | No Of Leaves | Length (Cm) | Weight Before watering(Kg) | Weight After watering(Kg) |
|---|---|---|---|---|
| Begin of Oct | 9 | 43.2 | 26.5 | 28.5 |
| Mid of Oct | 15 | 43 | 27 | 28 |
| Begin of Nov | 18 | 43 | 26 | 28.5 |
| Mid of Nov | 20 | 44 | 26 | 28 |
| Begin of Dec | 22 | 42.8 | 27.5 | 29.5 |
| Mid of Dec | 25 | 34 | 27 | 28 |
| Begin of Jan | 29 | 36 | 25 | 27 |
| Begin of Feb | 34 | 40 | 26 | 27.5 |
| Mid of Feb | 35 | 42 | 26 | 28.5 |
| Mid of Mar | 43 | 41 | 25 | 28 |
| Begin of Apr | 46 | 40 | 26 | 28 |
| Mid of Apr | 46 | 45 | 25 | 27.5 |
| Begin of May | 59 | 45 | 26 | 27 |

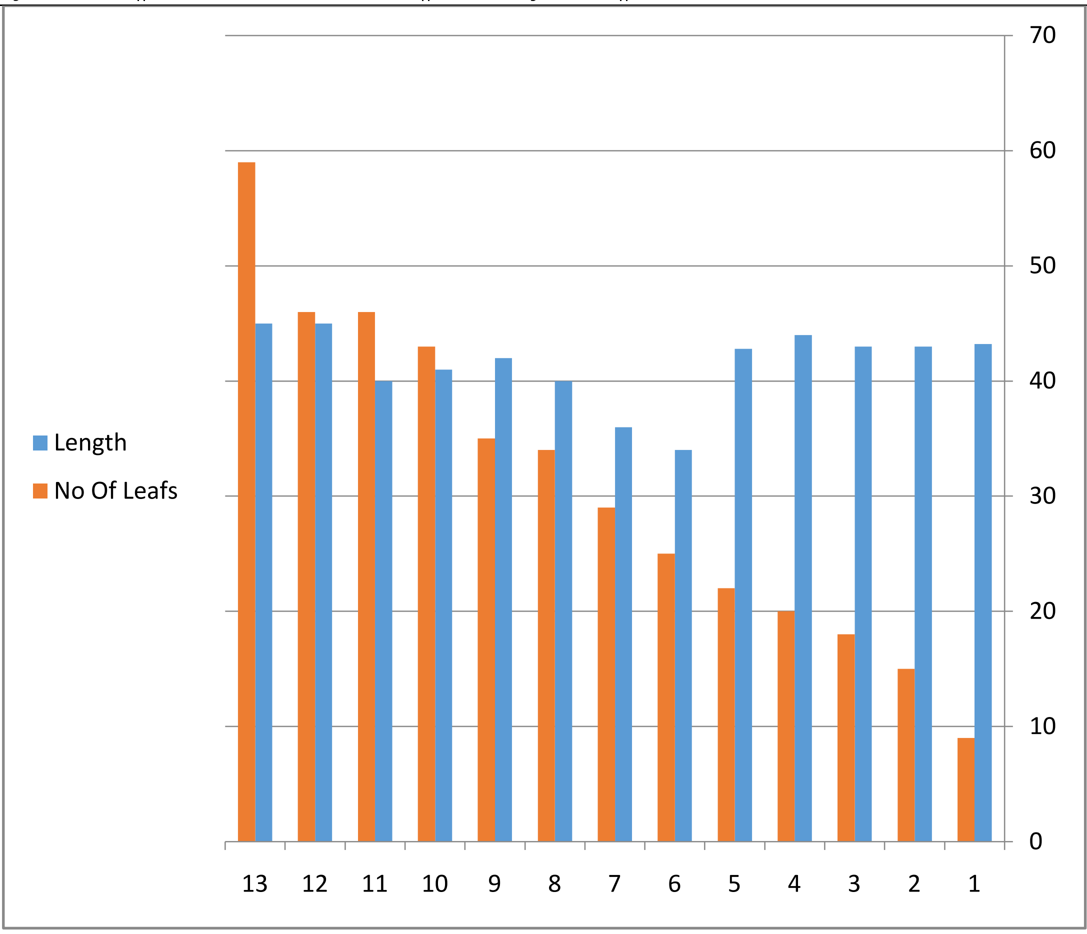


Fig. (2.1) Physical Appearance of Plant (1)

Table (2.2) Physical Appearance of Plant (2)

| Time Of Test | No Of Leaves | Length (Cm) | Weight Before watering(Kg) | Weight after watering(Kg) |
|---|---|---|---|---|
| Begin of Oct | 10 | 34.1 | 26.5 | 29 |
| Mid of Oct | 18 | 35 | 26.5 | 28.5 |
| Begin of Nov | 18 | 34.5 | 27 | 27.5 |
| Mid of Nov | 21 | 33 | 27 | 28.5 |
| Begin of Dec | 22 | 35 | 27 | 29 |
| Mid of Dec | 24 | 38.5 | 26.5 | 28 |
| Begin of Jan | 23 | 38 | 26 | 27.5 |
| Begin of Feb | 24 | 40 | 25 | 27.5 |
| Mid of Feb | 26 | 42 | 26 | 28.5 |
| Mid of Mar | 27 | 40 | 26 | 27.5 |
| Begin of Apr | 29 | 38 | 26 | 28.5 |
| Mid of Apr | 29 | 41 | 25.5 | 27.5 |
| Begin of May | 46 | 43 | 25.5 | 28 |

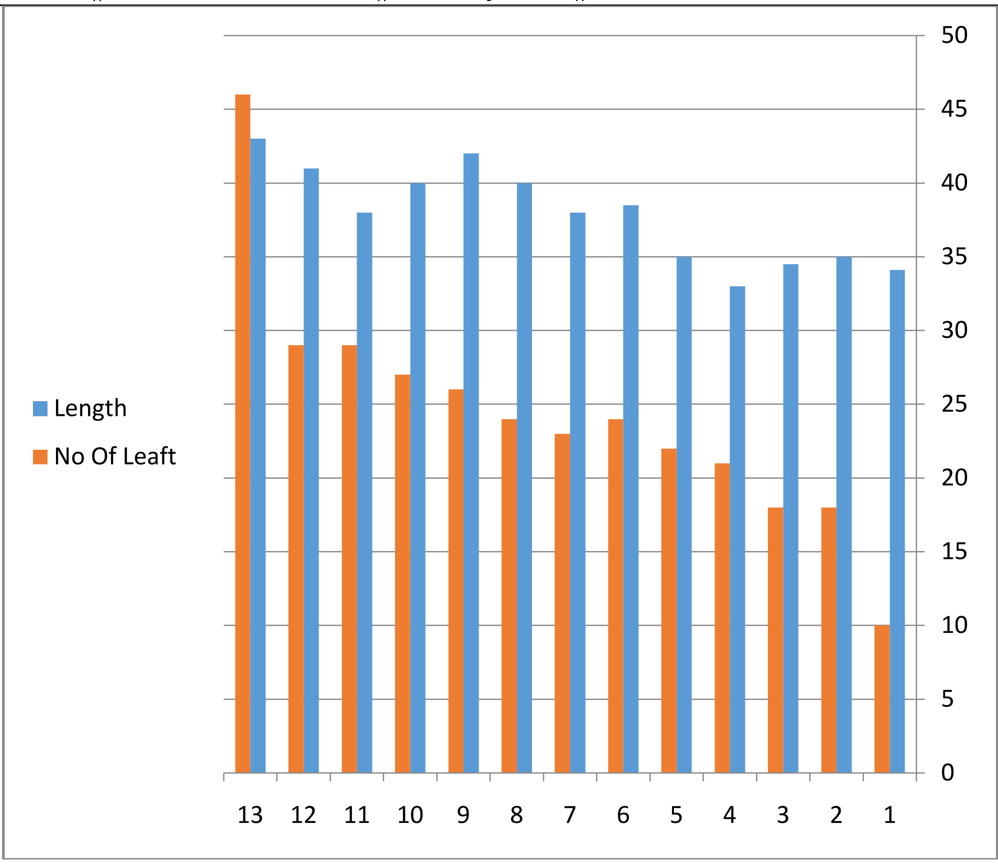


Fig. (2.2) Physical Appearance of Plant (2)

Table (2.3) Physical Appearance of Plant (3)

| Time Of Test | No Of Leaves | Length (Cm) | Weight Before watering(Kg) | Weight after watering(Kg) |
|---|---|---|---|---|
| Begin of Oct | 10 | 35 | 27 | 28 |
| Mid of Oct | 12 | 35 | 26 | 28 |
| Begin of Nov | 15 | 35 | 25.5 | 29 |
| Mid of Nov | 19 | 37 | 27 | 27.5 |
| Begin of Dec | 21 | 36 | 27 | 29 |
| Mid of Dec | 24 | 36.5 | 26 | 27 |
| Begin of Jan | 25 | 36 | 25 | 27 |
| Begin of Feb | 34 | 33 | 25 | 27 |
| Mid of Feb | 36 | 35 | 25.5 | 27 |
| Mid of Mar | 37 | 37 | 26 | 27.5 |
| Begin of Apr | 44 | 36 | 26.5 | 28.5 |
| Mid of Apr | 38 | 35 | 29 | 32 |
| Begin of May | 50 | 34 | 28 | 30 |

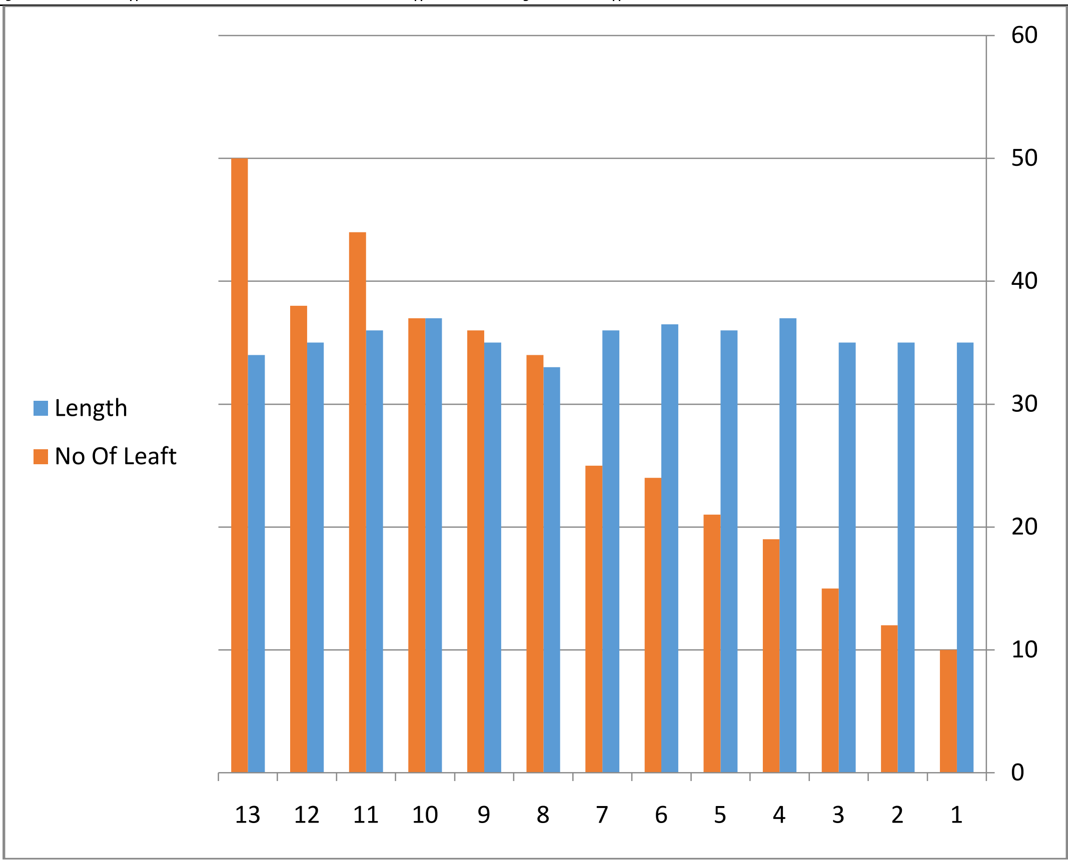


Fig. (.2.3) Physical Appearance of Plant (3)

## Conclusion

The experiment shows that the range of germination close to six leaves per week at sample (1) seetable (2.1), but at sample (2) and (3) the range of germination is between 4 to 5 leaves per week see tables (1.2) and (2.3) this behavior is in agreement with the effect of wave sound in photosynthesis plant.

The result can also explain the effect of wave sound at stretching, sample (2) was stretched (1.1cm \ month) see fig.(2.2) ,in sample (1) stretching was close to (0.225 cm \ month )see fig.(1.3) , when it was (-0.125 cm \ month) see fig. (2.3) decreasing of stretched consequence to the number of suckers.

The relationship between the number of suckers and width of leaf is so apparently clear in sample (2) and sample (3).

The sound waves perception in plants is a new field of research and need to be investigated thoroughly .the sound wave act as a growth regulator therefore, the sound wave can applied at crop plants like wheat, rice tomato cucumber and other plant to increase the agricultural crops.

The strength of the combined bound can be ultra-according to the wave length used, leading to different biological reaction inside the biological cell.

Change in biological molecular structure at biological cell can be used in future in medical and treatment field specially in cancer by control the cancer cell by altering the attributes ,formant and function ,this will also be beneficial in palliative treatment .

Sound waves can be used as a potential biotechnological application in plant growth promotion.

Sound waves increase the extraction of metabolites identified like tannins, flavonoids, saponins.

Leading to evolution at pharmaceutical industry and manufacturing.

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