

## COMPARATIVE APPROACH TO STUDY THE EFFECT OF SOUND FREQUENCIES ON PLANTS GROWTH WITH DIP\*

BY

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### ABSTRACT

*Plants are always have diversified effect of number of environmental parameters in their growth cycle and these sound waves effects the plants' growth, and it influences the yield result and crop quality. The demand of the efficient technology in the agriculture science sector has increased because of the growing population. Applying the preferable sound frequency to the plant is always very effective technique to increase the plant growth and to increase the productivity of that plant which will definitely help to attain the financial profit. Exposing plants to audible sound frequencies can be more trustworthy technique with digital image processing. The population of world which is increasing every day gives a challenge to scientists and researchers to investigate the every possible way to utilize new and green techniques consequently the production of food get enhance.*

*This review study is planned to show the hypothesis that Plants accept the vibrations and does sound effects are on the plant growth.*

### KEYWORDS

Sound frequency, Plant growth, Digital Image Processing, Economic Benefits.

### I. Introduction

If the plants are exposed to particular environment so they also reacts in the same way as humans. There is for eternity the effect of climate conditions like temperature, cold, luminosity on humans and just resembling humans plants are also get affected by certain weather conditions. There is a extensive range to carry out additional research in this interdisciplinary area. There are many scientists and agricultural and biological researchers are working to make a system which will help to increase crop growth without any chemical fertilizers, but up till now there is no such system built. As there will be more flowers and

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fruits to the plant after exposing that particular plant to specific frequency so it indicates that sound simulations can increase the yield production.

Just by applying the sound frequencies and music the plant growth get increase with no use of harmful chemicals, it reduces the environmental pollution and helps to maintain the healthy status of all the living beings on the earth.

Plants experience the music or sound frequencies they have been exposed to and show the effect of those particular sound waves on its growth. Some plants growth increases after exposing them to specific sound frequency and some plants growth can stop for some frequencies. The range of these frequencies differs for different species. Exposing plants to audible sound frequencies can be more reliable and progressive technique using Digital Image Processing. [1][2]

**II. Related Work on Effect of Sound Frequencies on Growth of plants.**

The numerous sound frequencies shows certain kind of effect on plants growth, in this section, the impact of various frequencies on plant growth are studied.

The scientist Hassanien et al., 2014 performed the research on the cotton, cucumber, etc and observed the shoot growth after applying te various sound frequencies range. [16]

Bochu et al., in the year 2004 observed the changes in the Changes in hormone levels after applying the sound frequency of 1400 Hzs. [21]

The study performed by Gagliano et al., 2012, stated that Root tip of maize plant bends after applying the frequency of 100-300Hz. Jeong et al., 2008 applied frequency of 3000-4000Hz torice plant and observed the shoots, increased expression of light Responsive genes, Enhanced tolerance to drought stress.

I. Khait1, R. Sharon3,, 2018 performed the experiments on Tomato & Tobacco. Results suggests that animal, and perhaps even other plant, could use sound emitted by plant to expand information about the plant's conditions. Plant emits sound, and that drought-stressed plant. [Table-1][16-21]

Frequency (Hz)	Plant Type	Sound Exposure Tissue	Impact on plant growth	Reference
500Hz	Arabidopsis	Shoot	defense-related genes get enhanced and also	[18]

			mechano-responsive stimulus genes get enhanced.	
100– 1000	Cotton	Shoot	Production is improved.	[16]
100– 1000	Cucum ber	Shoot	Production is improved.	[16]
1400	Chrysa anthemum	Mature cell	hormonal differences are observed.	[21]
100– 1000	Lettuce	Shoot	Increased yield	[16]
100, 200, and 300Hz	Maize	Root	Root tip bending	[17]
3000- 4000 Hz	Rice	Shoot	Increased expression of light responsive genes, Enhanced tolerance to drought stress	[19]
classical music	bacteria and yeasts	Shoot	All the bacteria and yeasts used as test organisms were found to register better growth under the influence of music,	[7]
100– 1000	Spinach	Shoot	Production is improved.	[16]
2000-	Strawberry	Shoot	Photosynthesis	[22]



Certain Updates on the Effects of Sound Wave on Plants are carried out, Tested for 28 days on single bean with single frequency. The experiments are conducted for observing the effect of specific sound frequency on plants growth under control conditions and non parametric test are carried out with single frequencies. Recent studies have stated that audible sound stimulation has a great prospective to improve not only the plant growth but also the quality of products but that is only the biological. . This study has established that a capable audible sound method condensed the germination period of Mung bean and enhanced the seedling growth of Mung bean. The effective mechanisms effect of sound frequencies on plants growth is still obscure. Nonetheless, sound is efficient for stimulating the germination and growth of Mung bean signifying that this technique has potential in Science and technology. In order to recognize the effects of sound on plant growth and to build up system for enhancing agriculture production, more experimental studies need to be prepare and it is essential to do collaboration work with Computer science researchers and agricultural researchers and so on headed for developing appropriate system which will help to increase the plant growth.[4][5]

How can plant recognize sound and thus react to precise pressure stimulus with no a hearing appendage? The root of *Zea mays* were observed to turn in the direction of sound frequency of 100–300 Hz in the midst of the experienced frequency of 0–900 Hz in the hydroponic system, representations that sound induce structural response in plant. Even little ecological stimulus such as touch or wind change the transcriptional level of plant. A fresh study described similarities and difference between response to sound and mechanical ambiance at the gene expression stage. This ropes the concept that sound frequencies provides a particular stimuli to plant, different mechanical vibrations. In adding together, sound vibrations increases the rate of expansion by varying the cells metabolism of yeast, but reduces biomass manufacture. These effect implies that sound affect the cells level rather than the explicit structure of the organisms. Here, it concentrates on new finding of plant response to sound wave treatment based on transcriptomes and proteomic technologies. The author, Claudia Gonzalez Viejo performed the research just on the effect of sound frequencies on the foamability properties of plants not on whole plant growth. Further studies demonstrated that the growth of plants by applying the Indian classical music. Further Musical notes are applied on the plants and these studies are performed to explore the Effects of Sound Vibrations on Consciousness of plants. [Table-2][3-9][22]

Even though sound frequency is not a observable or chemical stimuli, plant exposed to sound frequency (a physical forces) produces growing amount of mRNA, suggestive of

that sound induce change in plant at the transcriptional levels. Certainly, two gene, the fructose, biphosphates aldolase (*ald*) and Rubiscos small sub-units (*rbcS*) gene, which plays decisive role in photosynthesis, were specially induce in rice followings 125 and 250 Hz sound treatments. Continuous disclosure to sound frequency is thought to improve plants growth by promoting CO<sub>2</sub> obsession. These finding can be credited to sound-mediate photosynthesis-related gene expressions and increase CO<sub>2</sub> fixations. A similar reading showed that the expressions of gene in the Gene Ontology category mechano-stimulus receptive, signaling related, redox homeostasis, biosynthesis, and defense increased in response to exposure to 500 Hz sound wave in *Arabidopsis*. These result implies that sound vibration give a stimuli to plant. More widespread researches are needed on the purpose of the identified gene and the signaling networks. Numerous questions still remained to be answered, such as “which part of the response is specific to sound and “Can plant recognize the sound frequency and other mechanical signal in a different way?”[10-11]

There are article recognized with study on the impact of subjecting seed and plant to sound wave or magnetic field. The majority by far of these studies manage ultrasonic’s (above 20000 Hz) or subtonics (beneath 20 Hz) frequency concentrating on impact at the cellular and genetic level. Little has been finish with audible sound frequency (20–20000 Hz) on seed or entire plant [13].

Reference	Findings
[3]	Acoustic Biological effects on plants growth is carried out.
[5]	Observations on seed germination.
[22]	Effect of sound frequency is observed only on the foam ability properties not on whole plant growth.
[7]	Observation Based Research On single Species.
[6]	Only Indian Classical Music is applied.

[9]	Observations on single species with single frequency.
[10]	Tested for 28 days on single bean with single frequency.
[11]	Conducted under control conditions and non parametric test with single frequencies.
[8]	Machine Learning is used in farming but not specially to observe growth of plant.
[2]	The root growth is observed not the whole plant.
[5]	Music is tested on single plant.
[14]	Conducted under control conditions and non parametric test with single frequency.

Table 2: Analysis of Literature survey on effect of sound frequencies on plant growth.

#### A. Key Findings from the literature Review

In the last few decades, there have been an increasing number of studies dealing with the effect of sound on plants, they are molecular biology-related research, and few are on Physiological Reactions of plants. There are scientific literatures related to study on the effect of sound waves on the subjecting seeds and plants. The huge majority of these papers deal with ultrasonic or subsonic frequencies studying effects at the genetic levels. Few has been done with audible frequencies on seeds or on entire plants and it has been done is mostly with single frequency. Past studies have exposed that there are some frequencies which influences the germination of seed and the growth of plants. Some studies are focused only on the sound based root growth detection and some are on the Foam ability Properties of plants. Past studies demonstrated that musical sounds considerably affect the quantities of seed sprouted contrast with untreated control whether and sound vibration uncomplicatedly influences living wage of biological systems. Most of the last experiments are done only on the single species of the plants and data were analyzed by using non-parametric tests and they are observation based, the past studies are not providing accuracy to the result as no any technical tool is used.

### III. Different techniques and Sounds that can influence plant Growth

A. Classical music influence-The music which is played to plant should have a time limit about three hours. It helps to raise healthy and suitably. An over amount of music can show the negative effect on the plant. [12]

B. Molecular Music- This method has particular melody which regulates Biosynthesis. When the frequency is observed, each of these notes then it will be recorded into a sequence, or melodies. Sternwheeler effectively replicated the recorded melody for the chosen proteins. When these melodies were played, researcher observed that it enhances the manifestations of the corresponding proteins and accelerates the plant growth. As a result of this, there is greater yield production, plant having higher nutrients level and their life span is more. [13]

C. Sonic Bloom Techniques- It is developed by Dan Carlson find out that the melodies of Frequency producing in the range of 3000 to 5000 kHz help the stomata of plant. This helps them to take up nutrients more efficiently. This technique helps to find out the organic farms, mainly with low water availabilities. [14]

Ultrasonic and Infrasound-When the sound frequency extends further than the human audible range it is recognized as ultrasounds. With the development of electronics oscillators' researcher is able to experiment with ultrasonic's plant growth acceleration. Evidences support the theory that sound reacts as a catalyst, activating the manufacture of plant hormone called as auxin that can stimulate plant growth. [15]

### IV. Sound, Music and Standing Waves

Audible sound wave is nothing but a mechanical wave which results from the vibration of the particles of a medium through which the sound wave is traversing.

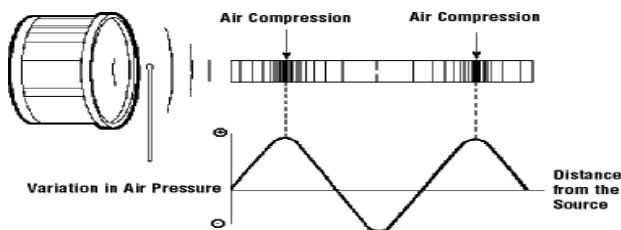


Fig 1: Generation of sound wave

Through the medium and the combination of its rate and density of energy transfer is referred as intensity of a sound wave.

Likewise, if a sound wave is traversing through a plant or plant seeds, then as the energy of the sound wave passes through the plant, the particles of plant or plant seeds

will be displaced both in right and left directions. The particles moves parallel to the direction in which the energy travels.

#### **A. Benefits of exposing plants to soundfrequencies**

As particular plants responds the specific sound frequencies it is neseccery to expose the plants to different sound frequencies then after observing plants for certain number of days it can be concluded that which plant grows more at what sound frequency. Thus by exposing plant to various sound frequencies it benefits to enhance the growth of plants which will result in higher food production and will meet the food need of growing population without using any chemical fertilizers and pesticides.[13-15]

#### **V. Result and Discussions Findings**

Subsequently after studying various literature surveys it is observed the Past studies have exposed that there are some frequencies which influences the germination of seed and the growth of plants. Some studies are focused only on the sound based root growth detection and some are on the Foam ability Properties of plants; most of the last experiments are done only on the single species of the plants and data were analyzed by using non-parametric tests and they are observation based, the past studies are not providing accuracy to the result as no any technical tool is used exposing plants to audible sound frequencies can be more reliable and progressive technique using Digital Image Processing.[4]

##### **A. Limitations**

It will be very tedious job to apply the multiplesound frequencies on plants with the different species.

##### **B. Scope for Further Research**

With the help of this approach the growth of plants can be enhance which will raise the food production of our country to meet up the need of increasing population and further work can be performed by applying sound frequencies to multiple species instead of restricting it too few.

#### **VI. Recommendations/Discussions**

It is observed from the previous theories that if the favored sound frequencies are applied to the plants then it will grow more and if plants are exposed to some deferent sound frequency then it may affect the plants growth.

#### **VII. Conclusion**

Recent studies have stated that audible soundfrequencies have impact on plants growth but there is not any technique (Algorithm) is used to prove the result as only biological survey is

done which is observation based, the exact mechanism to find out for which particular sound frequency plant grows more is obscure, there is a need to develop a new technology with digital image processing to enhance the food productivity.

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