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Role of music on seed germination: A mini review

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Abstract
Music plays important role in the growth and development of plants. The audible sound that human can hear falls into frequencies ranging from 20 hz- 20, 000 hz (hertz). Exposure of seedling and mature plant to green music, classical music and nature sounds, gayatri mantra, pirith, elevates the levels of polyamines and increased the uptake of oxygen. There is a positive impact on overall plants like wheat, spinach, horse gram, soya and paddy. Musical vibrations have stimulated seed germination of certain plants. The frequencies in these vibrations facilitate the physiological processes like nutrient absorption, photosynthesis, protein synthesis and an over all development of healthier plants with better yield.

Keywords: seed germination, music, frequency, seed dormancy

Introduction

In nature, plant are exposed to various environmental conditions which effects, the growth and development of plants, as they can recognize to signaling and respond it according, to the perception. The signaling can be in form of light, electromagnetic, physical, acoustic or chemical. The basic phenomena in volves the perception and further processing of signaling/ energy in the form of waves. They develop their sensory organs in such a way that the waves could propagate for subsequent metabolic response [1].

One such factor is sound, which have greater impact factor on Biological Index of plant that can promote or suppress growth. Sound is an oscillation of waves of pressure transmitted through gases, liquids or solids. As waves propagate they transport energy. The amount of energy of the wave determines the measures of the sound wave and its travelling time. The audible sound that humans can hear falls into frequencies ranging from 20 Hz - 20,000 Hz (Hertz). While sound wave above this range is known as ultrasound and that below this range is known as infrasound, Sound wave is transported through a medium via the mechanism of particle with them.

Sir Jagdish Chandra Bose was one of the pioneers to study the behaviour of plants in responses to various stimuli [2-4]. Living organism has the ability to sense and respond to different physical stimuli, light, temperature and a variety of chemical signals, that are common environmental physical stimuli detected by biological organisms. External induced pressure gradients are in aquatic system [5]. Musicial sound has a significant effect on number of seeds sprouted compared to noise and untreated control and sound vibrations directly affected living biological process [6]. Seed are sometimes treated with ultrasound to help the germination process [7-8].

Foliage planted along freeways to reduced noise pollution often grow differently than foliage [9]. High frequency, sound tone is known to increase the rate of sprouting of alyssum seeds while random noise seems to have opposite effect [10]. Exposure of seedling and mature plant to green music classical music and nature sounds such as those of birds insects, water etc elevates the levels of polyamines and increased the uptake of oxygen in comparision with the control [11]. Musical or sound can also have detrimental effect on plant growth certain types of music have positive effects on the and even played at very low frequency volume to significant leaf dimension [12]. Indian classical ragas had a positive impact on overall plants like wheat, spinach, horse gram, soya and paddy. Musical viberations stimulated seed germination of okar and zucchi [13-14]. Indole Acetic Acid (IAA) is essential plant hormone that helps in plants growth and development. IAA contents in plants were found at an increased level in site species of vegetable plants when exposed to musical acoustic level in six species compare to control plant [15].

The effect of religious chanting on plants growth have been studied in many centuries around the world including India, China and Nepal. Even though, reports of research on effect of pirith on plant growth are limited in India but mantras in Hindu veda, such as Gayatri and Agnihotra mantra have been used to test their effect on plant growth performance. Their studies showed that Gayatri mantra has a remarkable influence on the growth of medicinal plant and efficiency of curing disease in certain plants [16]. These mantras have also shown a overwhelming effect on seed germination and growth on rice plant [17].

Fujian provinces East China have stated that Buddhist chant playing in the paddy field has helped to increase rice production by 15% and also yield larger grains, while the paddies with no music suffered from pests [18]. A study conducted on the effect of music with low frequencies on the germination rate, has revealed that the music with low frequency increased germination rate.[19]. Studies show that soft rhythm of music and sounds have influenced plants to grow healthier [20].

It has been reported that the effect of pirith on growth and

yield performance was higher when compared with pop music, thus implying that the rhythmic chanting of pirith is the most appropriate type music that improve performance of *Oryza sativa.* Interaction and effect of low frequency audible sound waves with the germination and growth of pea seeds 660 hz, 680 hz, has a detrimental effect on germination, weight gain and stem elongation. It has also been found, that the radiation has direct effect on the production of enzymes, mainly alpha amylase in the plant system. Playing an appropriate tune has been found to stimulate the plants synthesis of its appropriate protein [21]. Different metabolic activities including enzyme activation and hormonal changes occur during seed germination and sound is known to directly affect biological systems including seed germination. Creath and Schwartz (2004) compared effects of music, noise and healing energy using seeds than the noise effect. These-effect were independent of temperature, location of the experiments, seed type, specific petri dish and person doing the scoring. The healing energy also had significant effect like sound compare to the untreated control of seed germination. The sound vibrations such as music and noise as well as biofield such as bioelectric-magnetic and healing intention directly affect living biological systems [19]. Seeds of *Echinaceae angustifolia*, a medicinal plant, showed improved germination rate to chemical and physical factors also, such as scarificaton, chilling period, light, applied chemicals (6- benzyl aminopurine, gibberellic acid) and sound stimulation [22]. The seed showed the highest germination rate with the least germination time when subjected to sound wave at 100dBand 1000 Hz. It was concluded that the germination rate was greatly enhanced and seed dormancy was completely reduced. Sound waves are also found to enhance the germination index, height of the stem, relative increase rate of fresh weight, activity of the root system, rooting ability, and the penetrability of the cell membrane of paddy rice seeds. It has also been reported that 400Hz AND 106 dB showed positive effect on the growth stimulation of the paddy rice seeds, but higher frequency and intensity of sound wave were harmful. [23]. The effects of sound on the mathematical parameters like quantitative seed germination process [24]. Differential germination rate was observed as a function of time using various frequencies of noise from 100 to 9000 Hz.Root elongation was found related to cell metabolism and positive relationships between root growth and different types of music was reported [25].

Rhythmic classical music and rhythmic music with dynamically changing lyrics, positively affected root elongation and mitotic division in onion root tips during germination. A correlation between root elongation and mitotic index (MI) further showed improved growth when compared to control [26]. The contents of soluble sugar, protein, and the amylase activity in chrysanthemum increased significantly in response to sound waves, whereas certain intensities (100 dB) and frequencies (1,000 Hz) indicated that sound stimulation could enhance the metabolism of roots and the growth of *Chrysanthemum*. [27]. Sound waves of certain frequencies also enhanced root development of paddy rice. [23] There are many reports about the effect of mechanical vibration including frequency and amplitude on seed germination. It promotes seed germination in *Cucumis sativa* and *Oryza sativa* using 50 Hz[30] When fixed amplitude of vibration at 0.42 mm and vibration frequencies above 70 Hz was provided in *Arabidopsis thaliana*, the seeds showed increased rate of germination. The increase in the germination rate was based on the acceleration calculated from the frequency and amplitude of vibration [29]. The percent of germination and seedling growth of trees such as red pine, tamarack, and white spruce showed no significant positive effect to sonication at 1 MHz with an intensity in the range of 0.5-1.0 W/cm2, but Jack Pine showed significant increase in number of seedlings as well as its total length [30] and concluded that the stimulation of jack pine seed germination and seedling growth were related to localized micro heating and nuclear effects. The rate of corn seed germination enhanced and reduction of time needed for germination was achieved by immersing the seeds in an aqueous solution including dissolved inert gas with sonication at a frequency between 15-30 kHz and energy density between 1-10 W/cm2 [31].

Conclusion

From previous researches, it is concluded that music has a positive effect on the seed germination due to enhanced metabolic rate of growth and development. Various forms of music and their different frequencies have a enhancing role in seed growth parameters. Therefore, a immense scope is present in exploiting music as a tool for breaking seed dormancy and enhanced the yield.

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