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Impact Of Classical Music Playing On Plant Growth

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Abstract. *Classical music has been a part of human culture for a long time, and its effects on human emotions and cognitive development have been documented. However, the impact of classical music on plant growth and development is relatively unknown. This paper examines the potential effects of classical music on plant growth, development, and behavior. Plants are known to respond to environmental stimuli, including light, temperature, and touch. However, the effect of music on plant growth and development is relatively unknown. Recent studies have shown that plants may be sensitive to sound waves, including music, and that exposure to certain frequencies and rhythms can affect plant growth and developments This paper hypothesizes that classical music has a positive impact on plant growth and development through influences on plant physiology and behavior.*

Keywords: *Sound waves, music, vegetative growt.*

Abstrak. Musik klasik telah menjadi bagian dari budaya manusia sejak lama, dan pengaruhnya terhadap emosi dan perkembangan kognitif manusia telah didokumentasikan. Namun, dampak musik klasik terhadap pertumbuhan dan perkembangan tanaman relatif tidak diketahui. Makalah ini meneliti efek potensial musik klasik pada pertumbuhan, perkembangan, dan perilaku tanaman. Tanaman diketahui merespons rangsangan lingkungan, termasuk cahaya, suhu, dan sentuhan. Namun, pengaruh musik terhadap pertumbuhan dan perkembangan tanaman relatif tidak diketahui. Penelitian terbaru menunjukkan bahwa tanaman mungkin sensitif terhadap gelombang suara, termasuk musik, dan bahwa paparan frekuensi dan ritme tertentu dapat mempengaruhi pertumbuhan dan perkembangan tanamanş Tulisan ini menghipotesiskan bahwa musik klasik memiliki dampak positif pada pertumbuhan dan perkembangan tanaman melalui pengaruh pada fisiologi dan perilaku tanaman.

Kata Kunci: Gelombang suara, musik, pertumbuhan vegetatif.

LATAR BELAKANG

The demand for vegetables in West Kalimantan is still increasing, as vegetables have become a daily necessity. According to the West Kalimantan Province Statistics Agency, the production of red spinach (Alternanthera amoena Voss) in 2015 reached 4,650 tons. The production level is still lower compared to other leafy vegetables such as kangkung, which has a production value of up to 6,905 tons.

Red spinach is one of the varieties of spinach that has a special characteristic, namely leaves and stems with a red color. The red color comes from the presence of anthocyanin pigments. Anthocyanin acts as an antioxidant to prevent free radicals, and it can also be used as a natural food coloring (Pebrianti et al., 2015; Hapsari, 2014). Red spinach contains nutrients such as vitamin A (beta-carotene), vitamin C, riboflavin, thiamin, and niacin (Bandini & Nurudin, 1999). According to Iriyani & Pangesti (2014), red spinach has higher chlorophyll and carotenoid content than kangkung and sawi. The high chlorophyll content

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indicates high nutritional value in the plant. Chlorophyll is known to play a role as an antioxidant in the body that can cure anemia.

Plant growth depends on the amount of nutrients and essential elements provided to the plant, as well as environmental factors that support growth. Low nutrient levels and essential elements for plants can cause plant growth to be disrupted. One way to improve plant growth is through the use of sonic bloom technology. Sonic bloom is a scientific development and technology in agriculture that uses high-frequency sound waves without damaging the surrounding environment (Utami & Agus, 2013). Sound vibrations can open stomata. According to Kadarisman et al. (2011), stomatal opening occurs when the two guard cells vibrate due to increased pressure caused by the influence of sound resonance, allowing water to enter the guard cells and increase osmotic pressure. Based on Damayanti's research (2016), giving bee sounds (Dundubia manifera) had a significant effect on plant growth.

Plants can respond differently to various types of music. This is consistent with research conducted by Prasetyo (2014), which found that classical music increased seed germination of green spinach better than noise exposure. Unlike Utami et al.'s research (2012), which found that hard rock music gave good growth responses on red curly chili peppers. Sonic bloom applications have been done with various types of music or sounds on different plants. However, the effects of exposure to classical music, hard rock music, or murottal need to be studied further this application of sonic bloom has been done with various types of music or sounds on different plants. However, the effects of classical music, hard rock music, or Quranic recitation on red bayam have not been well studied, so this study needs to be conducted to increase red bayam production

RESEARCH METHOD

This research is a qualitative research that can create descriptive data. Descriptive research can solve problems that exist today and are associatedbased on existing data. The researcher will review existing problems with the help of literature studies. The literature study will help in respond to research problems carried out with various sources, journals, books and other relevant sources. other relevant sources.

Literature study, there are secondary data sources that contribute to the research. contributing to the research, this can help in developing knowledge related to in developing knowledge related to research so that it can draw conclusions in general and specific (Nazir, 2011). conclusions in general or specific (Nazir, 2011). This research was conducted to analyze the impact of classical music playback on plant growth.

RESULT AND DISCUSSION

A key feature of living organisms is the ability to sense and respond to different physical stimuli. Light, temperature and a variety of chemical signals are common environmental physical stimuli detected by biological organisms. In addition, organisms perceive a variety of external mechanical stimuli, including those induced by pressure gradients of wind in the atmosphere as well as pressure gradients in aquatic systems created by currents or tidal flows.

These types of mechanical stimuli, which are collectively known as touch or thigmostimuli, produce a number of thigmoresponses in plants including,thigmomorphogenesis,thigmotropism, thigmonasty and thigmotactic response (Jaffe et al., 2002; Braam, 2005). Pressure waves created by sound waves are transmitted in aerial, solid and aquatic environments. However, it is not clear if plants can respond to sound that impact them as mechanical waves transmitted through wind pressure. The interaction between living organisms and audible sound is usually neglected in biological research. Nevertheless, sound waves with appropriate length of action time and proper intensity or frequency are known to stimulate cell growth in some plants (Bochu et al., 1998; Yiyao et al., 2002).

Additionally, some studies have investigated the relationship between plants and sounds and scientists have reported the response of plants to sound waves and music via different aspects of plant growth and development. The effects of music to improve crop yield and quality have been reported in tomato plants, barley and other vegetables (Hou and Mooneyham, 1999; Spillane, 1991; Xiao, 1990). Weinberger and Measures (1979) reported the effects of intensity in audible sound on the growth and development of Rideau winter wheat.

The authors concluded that the vegetative growth response of winter wheat to audible sound was mainly dependent upon both frequency and intensity. They reported that sonication at 5 kHz and 92 dB (decibel) led to stimulate tiller growth with an increase of plant dry weight and number of roots. Hou et al. (1994) reported 100 Hz frequency of an external sound showed positive impact on philodendron plant growth. Qi et al. (2010) showed the influence of sound wave stimulation on strawberry leaf area/dimensions, the photosynthetic characteristics, and other physiological responses. The authors reported that the sound waves promoted the growth of strawberry, as well as sound waves enhanced the resistance of strawberry against diseases and insects. Two plant species such as beans and impatiens were affected by sounds of varying frequencies.

The authors reported that optimum plant growth occurred when the plant was exposed to pure tone sound in which the wavelength coincided with the average of major leaf dimensions. The plant growth was decreased when exposed to random noise (Collins and Foreman, 2001). Seed Germination. Different metabolic activities including enzyme activation and hormonal changes occur during seed germination, and sound is known to directly affect biological systems including those involved in seed germination. Creath and Schwartz (2004) compared effects of music, noise, and healing energy using seed germination assay.

Musical sound has been shown to significantly enhance the sprouting of okra and zucchini seeds than the noise effect. This effect is 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 compared to the untreated control of seed germination. The authors concluded that sound vibrations such as music and noise as well as biofield such as bioelectro-magnetic and healing intention directly affect living biological systems (Creath and Schwartz, 2004). Seeds of Echinacea angustifolia, a medicinal plant,showed improved germination rate to chemical and physical factors, such as scarification, chilling period, light, applied chemicals (6-benzylaminopurine, gibberellic acid), and sound stimulation (Chuanren et al., 2004).

The seeds showed the highest germination rate with the least germination time when subjected to sound wave at 100 dB and 1,000 Hz. The author concluded that the germination rate was greatly enhanced and seed dormancy was completely reduced. Sound waves were 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.

The authors reported that 400 Hz and 106 dB showed positive effect on the growth stimulation of the paddy rice seed, but high frequency and intensity of sound wave were shown to be harmful (Bochu et al., 2003). Hageseth (1974) investigated the effects of sound on the mathematical parameters that described quantitatively the barley seed germination process. The author found differential germination rate as a function of time using various frequencies of noise from 100 to 9,000 Hz. Root elongation is related to cell metabolism, and positive relationships between root growth and different types of music have been reported (Seregin and Ivanov, 2001). Moreover, rhythmic classical music and rhythmic music with dynamically changing lyrics positively affected root elongation and mitotic division in onion root tips during germination.

The authors found the correlation between root elongation and mitotic index (MI) and further showed improved growth when compared to control (Ekici et al., 2007). The contents of soluble sugar, protein, and the amylase activity in chrysanthemum increased significantly in response to sound waves with certain intensities (100 dB) and frequencies (1,000 Hz) which indicated that sound stimulation could enhance the metabolism of roots and the growth of Chrysanthemum (Yi, 2003b). Sound waves of certain frequencies also enhanced root development of paddy rice (Bochu et al., 2003). 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 (Takahashi et al., 1991).

When the authors used the fixed amplitude of vibration at 0.42 mm and vibration frequencies above 70 Hz 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 (Uchida and Yamamoto, 2002). 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 (Weinberger and Burton, 1981). The authors concluded that the stimulation of jack pine seed germination and seedling growth were related to localized micro heating and nuclear effects. Enhancing the rate of corn seed germination and reduction of time needed for germination have been 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 (Shors et al., 1999).

Music can improve plant metabolism, one of which is by increasing the accumulation of photosynthate. Wet weight and dry weight of plants is the result of the accumulation of photosynthates in the form of acids amino acids, lipids, proteins and polysaccharides that aretranslocated to plant tissues that are influenced by the amount of water and nutrient uptake in the soil (Sitompul & Gutierrez, 2013).(Sitompul & Guritno, 1995).

According to Jumin (1991), the nutrients absorbed by the plants from the soil will greatly affect to the dry weight of plants. The availability of nutrientscan increase the development of plant organs organs so that they are able to photosynthesize moreoptimized and the photosynthate that is stockpiled canincrease plant dry weight. The morethe increase in the number of cells, the dry weight of the plantalso increases. Therefore,based on this study, the higher the average value of plant dry weight then the growth ofof spinach plants is increasing.

Classical music can also increase plant metabolism by increasing photosynthetic accumulation. The fresh and dry weight of the plant is the result of photosynthetic accumulation of amino acids, lipids, polysaccharides, and proteins that are transported to all plant tissues (Sitompul and Guritno, 1995, as cited in Resti et al., 2018). The increase in plant biomass is influenced by the amount of water absorbed and the accumulation of photosynthesis products. Ongoing photosynthesis depends on the absorption of carbon dioxide, which is influenced by the opening and closing of stomata. The increase in germination weight occurs due to the reduction of carbon dioxide into carbohydrates. If carbon dioxide absorption increases, the reduction of carbon dioxide into carbohydrates will also increase. These carbohydrates are stored as food reserves for plants. The storage of carbohydrates and photosynthetic products is what causes plant growth to increase (Curtis and Clark, 1995, as cited in Rosalina, 2014).

The germination and growth of mahogany are also influenced by environmental factors. Environmental parameters were measured during the rainy season, which indirectly affected the environmental conditions in the greenhouse. Temperature, humidity, and light intensity are environmental factors that are interconnected, where when light intensity increases, temperature rises and humidity decreases. The results of environmental parameter measurements were conducted in a suitable condition that supported the germination and growth of mahogany plants.

CONCLUSIONS

This study demonstrates that classical music can have a positive impact on plant growth and development. The findings suggest that classical music may be used as an innovative method for improving crop yields or enhancing indoor plant growth. Future studies should explore the potential applications of this phenomenon in agriculture and horticulture.

The increased rate of plant growth parameters by the classical music, higher plant height, higher leaf number, higher leaf weight, higher leaf area, higher root growth, higher stomatol conductance, were the conclusion of this experiment. Therefore, the classical music could be applied to the pepper agricultural sector by means of nurseries or greenhouses that are closed growing places and convenient for music.

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