Analysis of sound frequency exposure at growing phase of Chrysanthemum Sp. (Case study: Exposure by Quran recitation)

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Abstract. Sound wave technology or Sonic Bloom technology has long been applied to plants. Sound waves affected the plants at different frequencies, sound pressure levels, presentation periods, and distances from sound sources. The aim of this research is to determine the effect of sound technology exposure on certain frequencies on the beginning of shoot growth, plantlet height, leaf number, and stomata opening width. The experiment was conducted by comparing chrysanthemum plants exposed to Quran recitation (Surah Al-Fatihah) at an average frequency of 1237.8 Hz for 2 hours for 8 Weeks After Culture (WAC). The results showed that Quran recitation and media interactions occurred in plantlets height after 4 WAC and leaf number after 8 WAC. The exposure of Quran recitation had affected on plantlet height after 2 WAC. The treatment influenced the number of leaves after 4 WAC, and the number of roots after 6 WAC. In testing the opening of the stomata, the leaves that given al-Fatihah recitation treatment, having a stomata opening wider than the leaves that were not treated (control). This study is the beginning of research to find the right frequency to stimulate growth in plants.

1. Introduction

Chrysanthemum (Chrysanthemum sp.) is a mainstay commodity in the horticulture industry which has very bright market prospects. Flowers, which are known as one of the "King of Cut Flowers", are increasingly in demand. In addition to the various shapes and types, the colour of the flowers is very varied, with a combination of colours that are so beautiful. Chrysanthemum plants easily adapt to new environments. Chrysanthemums can grow on various media, on the basis of these characteristics, the growth of chrysanthemums in vitro will be able to provide maximum results when given the effect of waves on plants grown in vitro in a short period of planting [1].

One important factor determining the success of the growth of in vitro culture is the media. Media in vitro culture generally use materials with high purity levels. Media that is often used in in vitro culture is Murashige & Skoog (MS) media, because it has completed essential salt elements compared to other media. In addition, other media that are often used are leaf fertilizer, this medium is used as an alternative to MS media [2].

Plant growth is influenced by the number of cell proliferation and elongation from cells [3]. Proliferation and prolongation of plant cells that continue to occur is very important for the production of new organs, which will have a significant impact on overall plant growth. One factor that can affect plant growth is sound waves. According to Yiyao et al. sound waves with certain frequencies and...
intensities can have a positive effect on various plant biological indices including seed germination, root lengthening, plant height, callus growth, cell cycle, signal transduction system, enzymatic and hormonal activity, and expression genes [4].

Each plant specifically has the ability to respond to certain sound frequencies. Sound waves with certain frequencies and intensities have been shown to have a significant effect on various biological, biochemical, and physiological activities including gene expression in plants [4]. Increased productivity using sonic bloom technology is influenced by the intensity of the length of exposure. The in vitro sonic bloom study using al-Qur'an recitation surah al-Fatihah treatment was conducted by Hashim et al. [5]. The results showed that the cells proliferation based on the growth kinetic analysis is higher for the cells exposed with Qur’anic recitation as compared to the Arabic poem and control groups.

Based on this background, it is expected that the treatment of exposure to the Murrotal al-Qur'an can increase the growth of Chrysanthemum sp in vitro. This is possible because it is based on the fact that the Murrotal al-Qur'an with the frequency produced can stimulate cell prefoliation and cell elongation so that it can accelerate the process of plant growth.

Sonic bloom is a technology that combines high frequency sound waves and organic nutrients, proposed for better plant growth to rise its production. The research of Istirochah et al. aimed to determine the effect of sound wave frequency and deficiency strain on stomatal opening, nutrient uptake efficiency through leaf and soybean yield. The use of sonic bloom technology with plant exposure at a frequency of 4 kHz could increase deficiency tolerance to 75% soil moisture content. Soybean seed yield increased 40.89% and seed protein content increased 10.3% [6].

Since the discovery of sonic bloom technology, many researchers conducting research with a variety of different frequencies and for different types of plants [7-10]. Mulyadi et al. examined the effect of “Sonic Bloom” to the Acacia mangium Wild germination and seedling growth [11]. The results of the research are the following: (1) The seed germination with “Sonic Bloom” provided germination of better percentages of 82%, than treatment without “Sonic Bloom”, i.e. only 34%; (2) With Sonic Bloom, the height of 80-days old seedling is 129.6 cm higher than the plants without “Sonic Bloom” of only 90.7 cm; (3) the diameter of 80-days old seedling with “Sonic Bloom” is 0.24 cm higher than those without “Sonic Bloom” having diameters of only 0.19 cm. The research concludes that sonic bloom treatment is very useful for the seed germination and the growth of Acacia mangium Wild seedling.

Based on this description, this study was conducted to determine the differences in the effect of exposure to Al-Qur'an recitation sound waves with plants that did not use recitation 1-Qur'an sound frequency on explants of Chrysanthemum sp in vitro. The Quran recitation is surah al-Fatihah (1237.8 Hz) read by Syeh Abdurrahman al Ausy. The Surah is analysed first using the Adobe Audition application to detect the frequency produced. The exposure that will be given is for 1-2 hours a day, so that the vibrations produced can affect the work of the cell either on cell growth or on the opening of stomata cells when the leaves grow, because the longer the sound exposure is done the faster the growth will occur.

2. Research Experiment

The experiments were carried out in a completely randomized design (CRD) with 2 factors, namely the planting medium and the wave of Quran recitation exposure.

1. The first factor is the recitation frequency with 2 levels, namely:
   - \(b_0\) = No treatment
   - \(b_1\) = Surah al-fatihah (frequency 1237.8 Hz)

2. The second factor is planting media with 3 levels, namely:
   - \(a_1\) = 3 gr of leaf fertilizer
   - \(a_2\) = MS0 (Murashige and Skoog media)
   - \(a_3\) = 1/2 MS (half concentration of MS media)

The combination of media and Quran recitation sound waves can be seen in table 1.
Table 1. Treatment combination.

| Planting media | MS₀   | MS₁/₂ | Hyponex |
|----------------|-------|-------|---------|
| Control        | a₁b₀  | a₂b₀  | a₃b₀    |
| Quran recitation | a₁b₁  | a₂b₁  | a₃b₁    |

Culture plants were divided into 2 groups, namely control and Quran recitation. a₁b₀ means that chrysanthemum is grown on leaf fertilizer media without the addition of al-Fateh reading. a₂b₀ means the culture plant using half concentration of MS media and no recitation treatment. Segment a₃b₀ is a plant cultured with hyponex media without sound treatment. Hyponex is a crystalline inorganic leaf fertilizer commonly used in culture media. For segment in Quran recitation group, the different culture media integrated with the application of Quran recitation.

Each treatment was repeated 4 times. So that the total culture observed was 24 experimental units. Placement of the trial unit is done randomly.

The research is carried out in several stages, namely:

- Room sterilization
  - Room sterilization is done by cleaning the tissue culture laboratory room, such as sweeping dust, mopping the floor using disinfectants and wiping the tools inside the tissue culture laboratory.
- Sterilization of Tools
  - Sterilization of tools includes planting tools (subcultures) and culture bottles. Sterilize planting tools such as petri dishes, tweezers and scalpels. The wrapped tools are then sterilized using autoclave at 121°C for 1 hour.
- Media Making
  - Making the medium is done by mixing all the ingredients including MS 4.3 g, sugar 30 g, gelatine 7 g and aqua distillation. The medium mixture is then heated to boiling and put into a culture bottle of 20 ml each. The medium bottle is then sterilized using autoclave at 121°C for 30 minutes.
- Sterilization of Laminar Air Flow (LAF)
  - LAF sterilization is done by spraying alcohol in LAF then the inside of LAF is wiped to clean. LAF is then closed and UV turned on for 24 hours before planting or at least 1 hour before planting.
- Planting (Subculture)
  - The subculture is carried out by removing the plantlets and stored in a petri dish. The plantlets used are 30 days weeks after planting (WAP), originating from the Ornamental Plant Hall, Cipanas, Cianjur. The plantlets are then cut using a scaple and then planted into a medium bottle prepared. The part of the plantlets used as explants is 2 stem segments without leaves. In order for the planting process to be in a sterile condition, the mouth of the bottle is burned after opening or closing. Tweezers and scalpels are dipped in bottles containing alcohol and burned before use. Petri dishes are always kept closed when not in use.
- Analysing Quran Recitation
  - Analysing Qur'an surah al-Fatihah using the adobe audition application. Adobe audition is a multitrack digital audio recording, editor and mixer that is easy to use and has a variety of sound processing facilities.
- Play recordings
  - Before performing the recording as a treatment, the explants are already wrapped in a closed box, this is so that the rotated waves are effective in reducing noise (noise) that is not needed. The presentation was carried out for 2 hours at 10:30 WIB.
- Maintenance
  - Maintenance activities are carried out by maintaining the cleanliness and temperature of the room. The room temperature is between 27 ° -29 ° with humidity of 70% and the humidity in the bottle is around 90%. Spraying 70% alcohol into bottles containing explant samples so that the bottle is in a
sterile state. Contaminated bottles are immediately removed from the incubation room and then re-
sterilized.

- Observations
  Observations were carried out according to the parameters of the observations discussed in the
response plan.

3. Discussion
Temperature is one of the determinants of explant growth in tissue culture processes. According to
George and Sherrington, temperatures suitable for explant growth ranged from 24-32ºC, with the
optimum temperature for 35 culture plants was 25-28ºC [12]. Temperatures in the laboratory range from
23.5-26.5 ºC with an average of around 25ºC per day. Temperature in the incubation room even though
it needs to be kept stable and optimally in the recommended temperature range. According to Basri, the
temperature of the culture room below the optimum temperature will make explant growth and
development slower, as well as when the culture room temperature is above 30º optimum temperatures,
this will make explant growth slow due to high respiration rate [11,13].

Radiation in the incubation room uses white fluorescent lamps with 4000-5000 lux light for 16 hours
/ day. Radiation in tissue culture needs to be done, because light is an environmental factor needed for
the growth and development of plants related to the photosynthetic process of plants [12].

Based on observations it can be seen that all explants planted on the media are able to produce new
shoots. Al-Fatihah recitation and MS0 (a1b1) treatment is able to bring up the fastest shoots, namely at 4
weeks after culture (WAC). This is thought to be caused by the interaction between Quran recitation
sound waves and the media capable of stimulating cell division so that it can accelerate the growth of
shoots. This is in accordance with what was said by Yiyao, states that sound waves with the right
intensity and frequency are known to be able to stimulate cell growth in some plants [4]. The results of
the variance analysis showed that there was an interaction between the planting media and the Qur'an at
observations of 4 WAC, while the independent effect of planting media was observed at 8 WAC and
the effect of independent recitation was observed on observation 2 WAC, 4 WAC, 6 WAC, and 8 WAC.

In the media treatment, treatment a1 (MS0) on observations of 6 MSK with an average number of
12.9 cm and 8 WAC with an average amount of 25.4 cm, was the best treatment and optimally for
plantlet height. MS0 is the best medium compared to 1/2 MS and leaf fertilizer, this is because the
composition of the salt content in MS0 is suitable for the needs of morphogenesis, meristem culture, and
plant regeneration [2].

In the recitation treatment, the observations of 2 WAC, 4 WAC, 6 WAC, and 8 WAC treatments
were best shown by b1 (frequency Al-Fatihah rate is 1237.8 Hz). There were significant results between
plantlets who were given recitation treatment with those not given treatment. The average explant height of
each MSK has a significant effect. These results can prove that the recitation effect on plantlets can
affect the growth velocity of plantlets. This is due to the stimulation of sound waves presented, so that
it has a significant effect on various biological, biochemical, and physiological activities including gene
expression in plants.

Based on the testing, at 8 WAC there was an interaction between media and means. In the table above
the best treatment is shown by treatment a1b1 (MS0 and surah Al-Fatihah frequency at 1237.8 Hz). These
results indicate an interaction between MS0 and surah Al-Fatihah. Interactions that occur between media
with recitation sound waves due to the emitted waves affect the process of cell division to be faster in
leaf formation at the initiation stage, so that the leaf formation process runs faster.

In sonic bloom technology, the stomata will be stimulated to open wider by the waves emitted. So
that this can have an influence on the process of metabolism that occurs. The observations that have
been carried out; the leaves of each treatment are prepared. The leaves are sliced transversely and then
stored in a preparation to be seen on a microscope, the results obtained as shown at figure 1.
Figure 1. (a) Opening of the murottal treatment stomata surah al-Fatihah 1237.8 Hz. (b) Stomata opening for no treatment.

In the results of the above observations it can be seen that there is a difference in widening the opening of the stomata. In the leaves given Quran recitation treatment, the stomata is opened wider than the leaves that are not treated. This technology is an organic and environmentally friendly technology that can stimulate leaf mouth (stomata) to remain open during photosynthesis so that it can increase the rate and efficiency of absorption of nutrients that are beneficial to plants, or by other words improve photosynthetic efficiency and end photosynthesis to increase production with good quality [14].

4. Conclusion
In this research, the interaction between Quran recitation and the best and most effective growing media for the growth of chrysanthemum plants was shown by the treatment of MS0 and Surah al-Fatihah (frequency 1237.8 Hz). There was a significant difference in response (height, number of leaves, number of roots, and stomata widening) of chrysanthemum explants which were significant between samples given Quran recitation treatment compared to no treatment samples.

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