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The Design of Automatic Audio Frequency Foliar Fertilization as Alternative Technology to Increase Productivity Result of Plant

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Abstract - *Automatic Audio Frequency Foliar Fertilization is a technology that improves between the nutrients performed on plant leaves by giving the sensation of sound waves in plants. Automatic Audio Frequency Foliar Fertilization is technology device leaf fertilizer integrated with Sound waves which will run automatically, more practical and compatible. This technology device consists of two main devices of active speakers that will issue a sound with a certain frequency and sprayer fertilizer. The results of the tests that have been done to produce the sound frequency between 1200 Hz up to 1600 Hz with average noise of 5%, with the debit of nutrient spraying for the plant of 96 ml per 30 seconds. Giving exposure treatment Wave The sound of classical music with the provision of nutrients in mustard plants by Automatic Audio Frequency Foliar Fertilization gives a real effect on the growth of the average height of the plant is 2.14 cm per 2 days.*

Key Words*: *Automatic, Audio Frequency, Sprayer

1.INTRODUCTION

Sound wave technology such as music is one of the technological breakthroughs in the agricultural sector. Currently, the utilization of the effects of sound waves can be used to increase plants productivity. (1), stated that the technology is known by the name sonic bloom. This technology was first created by Dan Carlson of America, in 1980 this technology began to be disseminated for commercial purposes. Sonic bloom technology that utilizes natural sound waves with frequencies between 3000 Hertz - 5000 Hertz can stimulate the opening of the leaf mouth (stomata) so as to increase the efficiency rate of nutrient absorption (micro element) through the leaves that are beneficial to the plant.

According to (2), to improve the yield of plants productivity in quality and quantity required alternative technology. The technology is also known as the name of Audio Organic Growth System (AOGS) which basically, this technology is the fertilization of leaves with the solution of fertilizer containing trace minerals with high-frequency sound wave combined to stimulate the opening of stomata.

Although sonic bloom technology or AOGS has been known and exist for a long time and can improve the quality and quantity of crops, according to (3), the application of sonic bloom technology in Indonesia is still relatively small. This is due to many things, low farmer knowledge of sonic bloom technology and the use of sonic bloom or AOGS technology that is not practical yet requires a lot of manpower and not yet compatible. Device technology sonic bloom or AOGS to generate sound waves still have to import and its use is still dominant manual.

Based on this technology is designed device Amadio Frenzi (Automatic Audio Frequency Foliar Fertilization) is a leaf fertilizer technology combined with sound waves that will run automatically, more practical and compatible. This technology device consists of two main devices of active speakers that will issue a sound with a certain frequency and fertilizer spayer. The mechanism of this technology device is arranged by arduino uno so it will run automatically with the specified time. The two main devices will be arranged in tandem, the sound waves coming out of the active speakers will vibrate the leaf mouth membrane (stomata) to open and the target of nutrient spraying is directed to the leaf so that it can be absorbed maximally by the open stomata. The existence of automation in this tool provides advantages that can reduce human labor.

2.METHOD

2.1 Activity Stages

2.1.1 Time and Place

This activity was held in Jubung Village Sukorambi Sub-district, Jember District from 29 June 2018 to 5 July 2018

2.1.2 Design

The Automatic Audio Frequenzy Foliar Fertilization device is designed can be easily operated by farmers. Planning and design is the first step of making the device. Planning of making this device must be done properly for the appropriate device can work optimally. Design Automatic Audio Frequenzy Foliar Fertilization Device can be seen on Fig-1.

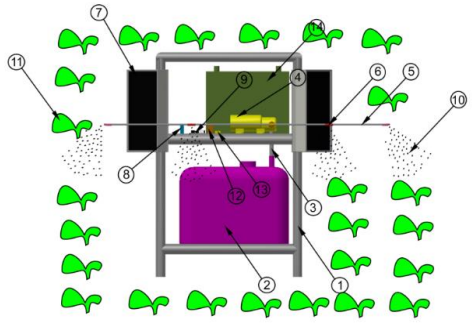

Fig-1. Automatic Audio Frequency Foliar Fertilization

Caption:

1. The main framework of the audio-farming tool
2. Liquid fertilizer storage tank
3. Pipe fertilizer from the tank
4. Water pump to drain and raise pressure
5. Pipe 6 mm to increase the pressure of fertilizer speed.
6. Nozzle produces spraying mist form
7. Active speaker with music audio output.
8. Battery as power source
9. Arduino automatic control
10. Liquid sprayer fertilizer form of mist
11. Plants
12. Relay
13. Timer
14. Battery accu

The design of the frame is made light and practical to facilitate the use of the tool but still can sustain other components strongly. The main material used in the manufacture of skeleton using hollow iron 25 mm x 25 mm with 2 mm thick and paired plywood 5 mm as a place to install components. Battery accu 12 V 65 Ah as main power source has power equal to P = 12 V x 65 Ah = 780 Wh used as source for Arduino, audio and pump. Battery with 780 Wh power are selected because they can meet the power requirements of four audio and pumps. It can be seen that an audio with 15 watts of power so that four audio has 60 watts with a time of 3 hours so it takes power W = P x t == 60 watts 3 hours = 180 Wh and a power pump 65 watts with usage time during one minute so it takes power W = P x t = 65 watts x 60 sec = 3900 Ws = 1,083 Wh. Power required in one pump usage and four audio at 181,083 Wh.

Liquid fertilizer tank with a capacity of 15 liters is placed at the bottom with a water pump capable of flowing liquid fertilizer 4liter / min mounted on it. The water pump is powered by a 12-volt battery charge placement alongside the pump. Liquid fertilizer is poured with a small 6 mm tube and atomized with a nozzle that has an outlet diameter of 0.3 mm. Nozzle installed 45^{o} to get wider coverage. Audio on the system using 4 active speakers that are installed in 4 corners of the frame. The goal is to emit sound frequency waves spread well around the device within a radius of 10 meters. The active speaker is powered by a 12 volt battery and is connected to the amplifier as an audio frequency amplifier.

Arduino as the brain on the system is programmed to turn on the audio with a duration of 3 hours then turn it off. In addition the arduino is also programmed to spray automatically with a duration of 30 seconds when the audio on the system has been on for 1 hour. In this system there is also a series of pump rellay and RT1 DS7 timer circuit as timering system for watering on plants. The relay serves as a circuit breaker in the sprayer pump system. When the timer control has shown the time of watering the rellay will be in high condition on the arduino program, meaning the rellay is in normal condition close so that the current will flow and ignite the sprayer and when the watering time has run out then the rellay will automatically be in low condition in the arduino program, rellay under normal conditions open relay will continue the current to power the pump so that the sprayer can water the plants.

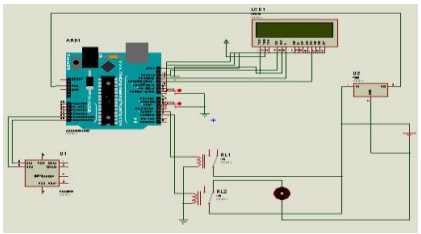

Fig-2. Arduino Uno Circuit and Sprayer Pump

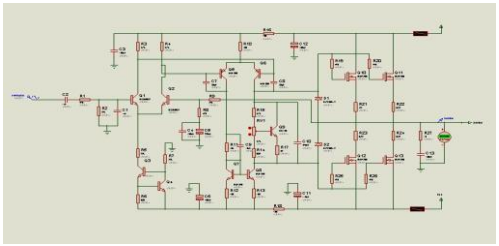

Fig-3. Amplifier Circuit

The software design on this system is an arrangement of programming commands embedded into the arduino microcontroller chip using arduino IDE software. In this system there are two main command is the command to set the flame and live the water pump that will spray into the plant and the second command is the command to set the flame and life of the speakers

```
void alarm1() {
  if(hour >= 6 && hour <9 ){
      digitalWrite(3, LOW);
    } else {
      digitalWrite(3,HIGH);
    }
```

Fig-4. Command design

programming Speaker

The above command is a command to On and Off from the speakers. In the above program is used as a command where the rellay will be in the normally close position (speaker On) at 6 o'clock and will return to the normally open position (speaker Off) at 9 am.

```
void alarm2() {
  if(hour == 7 && minute <1 && second <31){
      digitalWrite(2, LOW);
    } else
      {
      digitalWrite(2,HIGH);
      }
}
```

Fig-5. Command design

Programming Sprayer

The above command is a command to On and Off from the sprayer. In the above program is used to set the rellay in the normally close position at 7 for 30 seconds when the speaker has been on for an hour. In the condition of the speakers have been on for an hour stomata will open so that sprayer will spray nutrients into the leaves.

2.1.3. Testing Tools

Testing tool is done to know the tool can run in accordance with the design. The voltage test is performed to determine the voltage drop over a certain time interval. Nozzle spray testing to determine the spray discharge for 30 seconds. Testing of tools performed on plants to determine the effect of tool effectiveness on the plant.

3. RESULTS AND DISCUSSION

The results of the design can be seen in Fig-6. The automatic audio foliar fertilization device consists of arduino uno, audio system and sprayer. Arduino circuit there are 2 buttons that function to set and reset the time. LCD (Liquid Crystal Display) is used to display the time. The system audio circuit consists of amplifiers, speakers, and audio storage. MicroSD is used as sound storage for audio input. The sprayer circuit uses a 12 v 65 watt dc pump supplied with a 6 mm PU hose and with a 0.3 mm diameter nozzle.

Fig-6. Automatic Audio Frequency Foliar Fertilization

3.1 Baterrai Testing

Battery as the main source in this tool because the battery supply arduino uno, audio system and sprayer, so it is necessary to test to know the performance of the battery itself. Based on the results of monitoring the battery performance is known through Watt meter can be seen in table-1.

Table -1. Results of Performance Monitoring Battery with Watt meter

Days to-	V	A	W	Wh	Ah	Vm
1	12,04	0,52	6,2608	90,6251	7,527	11.74
2	12,03	0,52	6,2556	91,1032	7,573	11.70
3	12,02	0,52	6,2504	92,2415	7,674	11.86
4	12	0,52	6,24	91,008	7,584	11.70
5	11,96	0,52	6,2192	91,793	7,675	11.84
6	11,92	0,52	6,1984	90,3298	7,578	11.82
7	11,82	0,52	6,1464	92,6333	7,837	11.82

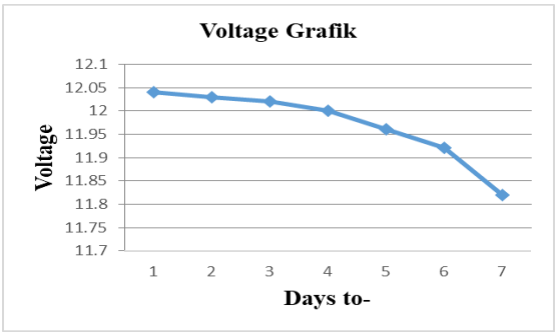

Chart -1: Volltage Chart

Test results using a watt meter showed a decline on the 1st day of 12.04 volts to 11.82 volts on the 7th day.

Voltage drop due to power from audio system working 3 hours / day, 30 second sprayer / day and Arduino Uno working 24 hours / day.

3.2 Frequency Testing

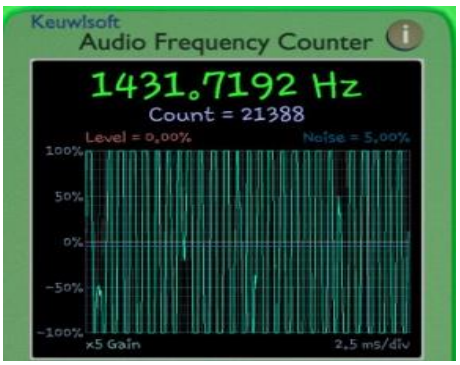

Fig-7. Frequency Testing Result

The result of frequency test using Audio Frequency Counter software with classical music instrumentation song is 1431,7129 Hz. Audio output frequency shows a fluctuating value between 1200 Hz up to 1600 Hz with an average noise of 5%.

3.3 Sprayer Testing

Sprayer testing aims to determine the amount of water sprayed in one work for 30 seconds. The spraying test of 1 nozzle for 30 seconds is 12 ml. Automatic Audio Frequency Foliar Fertilization has 8 pieces of nozzle so that in one working time spray 96 ml water. The water spraying debit is 0.0032 liters / sec.

3.4 Testing of green mustard plants (*Brassica juncea* L)

Tests performed on green mustard greens (Brassica juncea L) are intended to determine the effect of exposure to sound waves and the provision of nutrients to plant height and number of leaves. Plant height is a plant size that can be observed easily so often used as an indicator to measure the influence of the environment.

The test was performed when the green mustard plant (Brassica juncea L) for 7 days when the green mustard plant (Brassica juncea L) was 10 HST by observing every 2 days. The treatment of exposure to sound waves with the frequency of classical music sounds ranging from 1200-1600 Hz significantly affect the high growth of green mustard greens (Brassica juncea L) can be seen in Chart-2. Giving treatment of sound wave exposure to green mustard plants (Brassica juncea L) resulting in an increase in plant height by an average of 2.14 cm every 2 days.

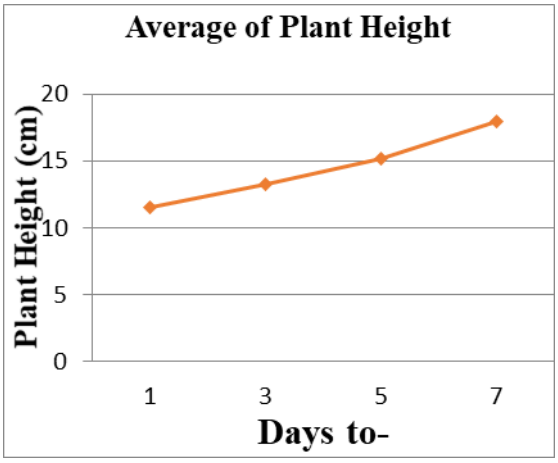

Chart-2. Average Graph of Plant Height

The number of leaves is one of the parameters that is easily observed and often used as an indicator of plant growth and plant productivity, especially mustard plants. Provision of sound wave treatment with a frequency between 1200-1600 Hz and the provision of nutrients given to the leaf significantly affect can be seen in chart-3.

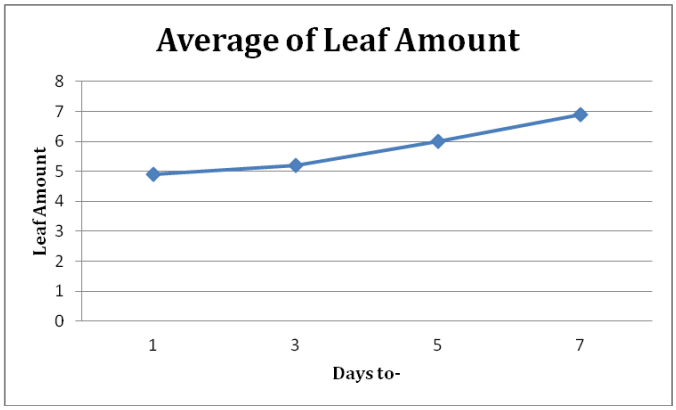

Chart-3. Average Graph of Leaf Amount

4. CONCLUSIONS

1. The creation of Automatic Audio Frequency Foliar Fertilization tool in accordance with the design planning.

2. Automatic Audio Frequency Foliar Fertilization tool for 7 days of testing has a voltage drop of 0.22 volts.

3. Automatic Audio Frequency Foliar Fertilization tool has an audio frequency output of 1200 Hz up to 1600 Hz.

4. Automatic Audio Frequency Foliar Fertilization tool has 0.2532 liter / minute spraying discharge

5. Application of Automatic Audio Frequency Foliar Fertilization tool has a real impact on the growth of the plant with an average growth of 2.14 cm every 2 days.

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