PREVENTION OF DOWNEY MILDEW DISEASE IN GRAPE FIELD

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ABSTRACT

Downey mildew disease is the major disease of the Grape field. The fungus causes yield losses by decay or cause to decay by the action of premature defoliation of vines due to infections. The development of the disease is faster, within six hour the spread of the disease get multiplied by twice. Once it is affected it will diminish the quantity & quality of Grapes, it reduce the Photosynthesis process. In traditional system, farmer visually check the Environmental condition, if it is suitable for disease development then he applies pesticide spray on leaves of Grape field. In our proposed system we can prevent the Downey Mildew disease. This system is electromechanical system. It takes Temperature & Humidity as an input. This is an automatic system, the farmer need not to check the disease visually. As soon as Environment condition matches for Disease development, the system will spray hot air & pesticide on the leaves of Grape field. The Grape field has roof like structure called a canopy. Hot air & pesticide is carried by pipes & sprayed by sprinklers. Hot air is created by using solar heater. Solar heater gives pressurized hot air. We spray hot air on leaves of Grape field, in order to resist disease development. We use this hot air in day time & we will use pesticide spray at night time. Prevention is always better than cure. Instead of waiting for disease development, we can prevent this disease on Grape field. If disease is prevented then Export quality grapes can be produced & Farmer can have more profit from Grape production.

Keywords: Embedded system, solar energy, electromechanical system.

I. INTRODUCTION

In the Grape field Downey mildew disease is the biggest threat to the plant. Native of Downey mildew disease is North America. Downey mildew disease caused by fungus Plasmopara Viticola. Vinifera cultivars is the most susceptible for this disease, Wild species are more resistant. Downey mildew comes naturally in the rainy season when humidity of environment is high. After the cutting of plants for grape production, in the first 40 to 65 days, the leaves of grapes are delicate &immature. At that time this disease comes. It can reduce profitability by 50%. The correct identification should be done in time. Little delay in identification can harm plant.

There are two favorable conditions for Downey mildew disease as 10 to 23 degree temperature or 23 to 27 degree temperature with relative humidity greater than 80%. Then destruction to the grape starts. Downey Causes deformed shoot, cluster growth reduction, premature defoliation causes delayed ripening of fruit, young berries will turn light brown, becomes soft then fall off the cluster easily. Downey mildew disease comes because of fungus growth on the back side of the leaf. That’s why its name is Downey mildew. Before proceeding towards prevention we should know how disease comes. If temperature remains in between 10 to 23 degree, Then Plasmopara Viticola pathogen grows rapidly. Another suitable temperature for this is from 23 to 27 degree with greater than 80% relative humidity.

Once the fungus grows on back side of leaf, it finds stomata to enter in to the leaf tissue. If they don’t get sufficient amount of stomata they will break 3 layers of leaf & get entry in to the leaf tissue. These three layers are cutin, pectin &cellulose. Once it enters in to the leaf tissue. Its effect comes in the form of yellowish spots on upper side of leaf & white spot on back side of leaf. As mentioned earlier, if pathogen don’t get enough stomata’s to enter in to leaf. It will enter by breaking 3 layers. These three layers are easy to break in first 40 to 65 days. Because all these leaves are delicate in these days.

Once the leaves are getting older then there is no threat of Downey mildew as its immune system increased to resist that disease.

II. NEED OF PREVENTION

The fungus creates Plasmopara Viticola pathogen, which creates oogonium, oospores, sporangia, zoospores & it creates infection to leaves. In another cycle it creates sporangia->zoospores& it creates infection to leaves. The duration of first cycle is 2 days & duration of second cycle is 6 hours. If we failed to detect this disease for first 2 days then this disease pathogen production get multiplied by every 6 hours. It will create huge destruction to grape field & ultimately it reduces profitability. So prevention of disease is more important.

When Plasmopara Viticola get sufficient amount of atmosphere (10 to 23 degree Celsius temperature & greater than 80% relative humidity). It starts affecting grape leaves, berries & twigs. It forms whitish growth on the back side of leaf. These spot kills the plant tissue. Thus photosynthesis process gets stopped at there. Let us see how disease gets created in following two steps. [41]

1) There are organs (Antheridium) [41] Producing male gamets & immature ovarian egg (oogonium) within which fetus is developing. The fusion (Karyogami) of these two nuclei is done. It produces fertilized female zygote (oospores). Germination of oospores leads to sporangium. Sporangium is nothing but container in which Sporangia's are stored. In one sporangium contains near about 40000 to 50000 sporangia. Germination of sporangia leads to zoospores. Zoospore again infects leaves, debris & twigs. This process takes 3 to 6 days.

2) The dormant twigs [41] get affected due to vegetative part of fungus (mycelium). It again forms sporangia & then zoospores are created. This process takes 6 to 8 hours.

An infected leaf gives sporangia, it again forms zoospores. This process takes 6 to 8 hours.

The first step takes 3 to 6 days, second step takes 6 to 8 hours. In second step disease production is get multiplied. Therefore Prevention of Downey mildew disease is required for first step.

III. METHODOLOGY: PREVENTION OF DOWNEY MILDEW DISEASE

The electromechanical system is shown in figure 1. We use temperature sensor & humidity sensors for measuring temperature & humidity in the grape field.

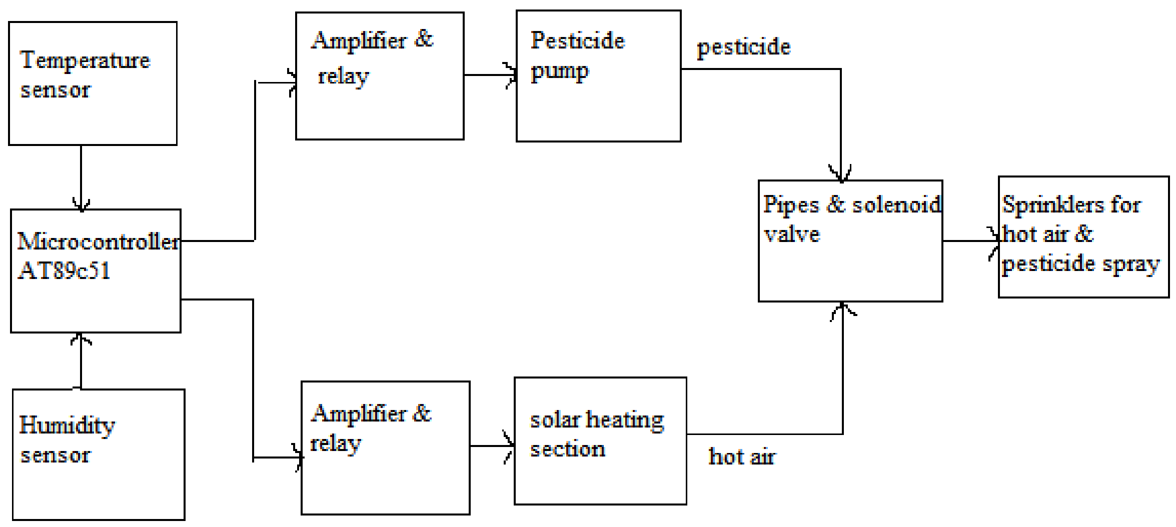

Figure 1: Electromechanical system for prevention of disease

We use ATMEL's microcontroller, it takes input from these temperature & humidity sensors. Amplifier is used, which converts microcontroller's 5 volt output in to 12 volt. Then it is given to relay. We use 12 volt Relay to switch on & off pesticide pump. The input to pesticide pump is pesticide from tank & output is pressurized pesticide. Then this pesticide goes from pipes to sprinklers, sprinklers spray the pesticide on the leaves of the Grapes.
On the other side, for hot air generation we have used solar tubes, there are fans are installed on the intake side of tubes. By using relay we can switch on & off these fans, output of the solar tube is hot air. We spray the hot air from the sprinklers.
The solenoid valves are used in this system. With the help of solenoid valve, we can switch on particular set of sprinklers. If we want to on all the sprinklers at a time, then it will create low pressure at the output of sprinklers. Thus by using number of solenoid valves, we can spray pesticide in to whole Grape field

Strategies for prevention of disease:

As we Mentioned above the favorable disease Condition are
1)10 to 24 degree temperature with Greater than 80 % Relative humidity
2) 24 to 27 degree Temperature with any Humidity.
Whenever favorable disease condition comes for disease development, we can prevent the disease by using following two strategies.
1) Use of hot air spray in to the Grape field:
This strategy is used in the day time period
2) Use of automatic Pesticide spray.
This strategy is used in the night time period

1) Use of hot air spray in to the Grape field

Figure 2: arrangement of solar tubes for hot air

Figure 3: air intake side

In this strategy we control favorable Disease Conditions. The temperature range from 10 to 27 degree is suitable for Plasmopara viticola Pathogen to create Downey Mildew Disease. One way is to maintain Temperature below 10 degree, but it is costly. Another way is to maintain Temperature at 35 degree, it is feasible. Above 27 degree temperature there is no threat of Disease. We set the temperature is 35 degree because tolerance of 35 degree temperature from 27 Degree Provides Safe Distance from Threat of Downey Mildew Disease. In figure number 2 shows arrangement of solar tubes. Due to solar energy, the air is heated up to 35 degree. In figure number 3, air is sucked by the fans in to the solar tubes. The number of solar tubes we are using is depends on desired output air temperature.

2) Use of automatic Pesticide spray when Disease condition matches

In Traditional system Farmers visually check for environmental Condition, and manually spray pesticide to avoid Disease.

In proposed system, we are using Temperature Sensor & Humidity Sensor. There is pesticide sprinklers associated with Solenoid valves we have to use in Entire grape field. This System will work as follows.

1)If Temperature sensor sense temperature range of 10 To 23 degree temperature & humidity Sensor sense Greater than 80% relative humidity, turn on the Pesticide sprinklers in Entire Grape field with Switching on & off Solenoid valves.

2) If temperature sensor sense temperatures range of 23 To 27 degree temperature, turn on the Pesticide sprinklers in Entire Grape field with Switching on & off Solenoid valves.

IV. RESULTS & DISCUSSION

By using above technology we successfully prevented the Downey Mildew disease of grape field. This technology we can use only in the Grape field because grape field has roof like structure & it is called as canopy. There are no leaves on the ground. Hot air & pesticide is sprayed all over the field.

V. FUTURE WORK

We have used this technology to prevent only Downey Mildew disease. By using pesticide sprinkling we can control & prevent disease. The number of pathogens needs different temperature ranges to create the disease. More research can be done to prevent & control the other diseases of Grape field by using our technology.

VI. CONCLUSION

As Plasmopara Viticola is dangerous pathogen causing Downey Mildew Disease. It reduces Profitability of farmer. With the help of cultural practices we can reduce the disease up to some extent. Therefore we can use novel approach of prevention to reduce the threat of the disease. Prevention is better than controlling the disease. It ultimately helps to produce good quantity & quality of Grapes; it will lead to have more profit for the farmer.

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