



Responses of Strawberry (*Fragaria x anannasa*) Diseases to Path-Away Anti -Pathogenic Solution

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Introduction

Strawberry belongs to the family Rosaceae, genus *Fragaria*, and is among the most widely consumed fruits throughout the world. It is considered a high value crop with a special production requirement and a short shelf life (Ernst, 2003).

United States is the largest producer of strawberries in the world producing three billion pounds of strawberries in 2014 valued at nearly \$2.9 billion. Fresh market strawberries accounted for 81 percent of the total strawberry production, valued at \$2.6 billion. Processing strawberries accounted for the remaining 19 percent, valued at nearly \$241.8 million (NASS, 2015).

In the Philippines, strawberry is grown only in Benguet Province because of its geographic location and climate. It has been a lucrative source of income for Benguet farmers and enhances the revenue of Benguet Province. However, diseases are a major factor limiting both fruit and plant production in strawberry producing areas. Diseases are often difficult to control without accurate disease diagnosis and appropriate pesticide.

In Benguet, diseases caused by fungi, bacteria and nematodes are important limiting factors in strawberry production in the area. A research in 2010 by Villanueva yielded to observation of the following diseases: verticillium wilt, red stele, leaf scorch, leaf spot, leaf blight, gray mold and other minor disorders.

Objective:

The primary objective of the study is to verify which concentration of Path-Away an anti-pathogenic solution can best control disease of strawberry grown in Labo, Camarines Norte.

Significance of the study

Although strawberry is popularly grown in the coldest place in the country, production of this fruit is not enough to make its presence felt in most part of the Philippines. Production of strawberry in other areas will open possibilities for the availability of the fruit in other parts of the country like in the province of Camarines Norte at the same time increase the revenue of farmers in the lowland. Using an organic anti-pathogenic solution to combat pests and diseases without causing toxicity to plants, animals and environment suits our advocate on producing organically grown crops.

Methodology

Three concentrations of the Path-Away (PA) anti pathogenic solution were tested on strawberry. The treatments were as follows:

- T1- Control (distilled water)
- T2- 3% Path-Away
- T3- 4% Path-Away
- T4- 5% Path Away
- T5- Fungicide (as recommended)

Twenty (20) strawberry plants were planted for each treatment with three replicates in a raised bed. A ratio of 1:2 carbonized rice hull and vermicast was used as planting medium.

Raised beds were treated 5 days before transplanting and once a month there after. Fermented Plant Juice (FPJ) and Fermented Fruit Juice (FFJ) were applied regularly as soil amendment. Cultural practices such as watering, weeding, removal of old leaves were performed regularly to maintain the plants.

Occurrence of diseases were observed on each treatment and were documented and recorded. Plant parts of suspected diseased plant were collected and brought to the laboratory for isolation of pathogen. Pure cultures were examined under the microscope for identification.

Diseases on each treatment were compared to evaluate the effect of the different concentration of the anti-pathogenic solution in controlling incidence of strawberry diseases.

Results and Discussion

Table1. Diseases of strawberry observed at different treatments

Disease	TREATMENTS				
	D H ₂ O	3% PA	4% PA	5% PA	Fungicide
Anthracnose Flower blight	+	+			
Anthracnose Leaf spot	+				
Alternaria fruit rot	+	+			
Gray mold	+	+	+		+
Sclerotium rot	+	+	+		+

Table 2. Percent disease incidence on strawberry at different treatments.

Disease	TREATMENTS				
	D H ₂ O	3% PA	4% PA	5% PA	Fungicide
Anthracnose Flower blight	3	1	0	0	0
Anthracnose Leaf spot	5	0	0	0	0
Alternaria fruit rot	10	7	0	0	0
Gray mold	35	15	5	0	7
Sclerotium rot	25	11	3	0	4

Observation

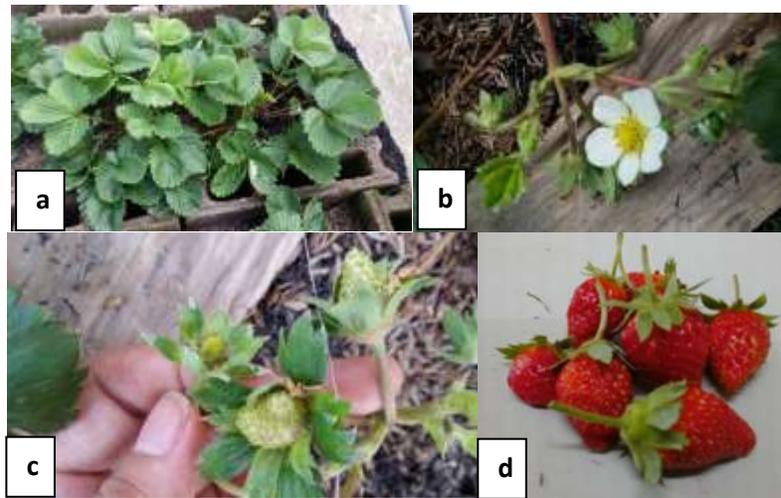


Figure 1. Healthy strawberry plants (a), flowers (b), fruit buds (c) and ripe fruits(d)



Figure 2. Anthracnose Flower blight (*Colletotrichum sp.*)



Figure 3. Anthracnose leaf spot (*Colletotrichum sp.*)



Figure 4. (a) Sclerotium rot caused by *Sclerotium sp.* attacking the crown
(b) sclerotia growing on the leaf petiole and (c) sclerotia on the root system



Figure 5. Alternaria fruit rot (*Alternaria sp.*)



Figure 6. Gray mold (*Botrytis cinerea*)

Discussion

There were five disease incidences observed in growing strawberries in Labo, Camarines Norte. Commonly observed were: Anthracnose flower blight, Anthracnose leaf spot, Alternaria fruit rot, Gray mold and Sclerotium rot. Gray mold disease caused by *Botrytis cinerea* has the highest disease incidence

Based on Table 1, at 3% PA solution (T2) the incidence of Anthracnose flower blight was reduced to 1% and anthracnose leaf spot was eliminated. At 4% PA, Alternaria fruit rot incidence was controlled while gray mold disease and Sclerotium rot incidence were significantly reduced to 10% and 3% respectively. However, while treatment of 5% PA totally controlled all the five diseases, the use of the Fungicide (Manzate 200) only reduced gray mold and Sclerotium rot to 7% and 4%.

The Path-Away anti-pathogenic solution is an organic broad spectrum anti-pathogenic solution. It is derived from natural resources with no added chemicals, drugs or alcohol and synthesized from all naturally occurring substances. Basing from the product's Material Safety Data Sheet, the solution is environmentally safe with extremely low toxicity to humans, plants, animals and the environment. It is considered as broadest spectrum action against diseases that attacks animals and plants. It is for this reason that we considered this solution in this study as it conforms with our advocate for organic production.

This ongoing study would also like to measure the responses of the strawberry plant on the same treatments as to the quality of fruit and yield during the dry season. Camarines Norte is a Type II climate where there is a prolonged rain from August to December that coincided flowering and fruiting of the strawberry.

Conclusion

At 5% PA, Gray mold, the most persistent disease of strawberry was totally controlled in contrast to the fungicide used (Manzate 200) that reduced incidence from 35% to 7%.

Similarly, Sclerotium rot was also totally controlled at treatment with 5% PA and was reduced from 25% incidence to 4% incidence using the same fungicide.

This, study revealed that at 5% concentration of the Path-away anti pathogenic solution, one of the most problematic pathogen of strawberry like *Botrytis sp* and *Sclerotium sp*. with no known specific control can be managed.

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