Effect of compost tea on yield of *Pleurotus ostreatus* and prevention of dry bubble disease

Group 1-50

Abstract

This study aims to investigate the effect of compost tea on the growth of grey oyster mushrooms (*Pleurotus ostreatus*) as well as its effect in combating Verticillium dry bubble. Compost tea, bleach solution and water were applied to *P. ostreatus* grow bags to find the effectiveness of compost tea in increasing yield and reducing growth of dry bubble disease over a single *P. ostreatus* growth cycle. The water setup showed the lowest yield of *P. ostreatus*. Bleach solution showed an increase of 393% in yield of *P. ostreatus* compared to water, while compost tea increased the yield by 286%. None of the setups showed signs of dry bubble disease, likely due to the antifungal properties of bleach and the potential antifungal properties of compost tea. However the water setup had a different species of mushroom growing alongside *P. ostreatus*, likely due to water's lack of antifungal properties.

Introduction

Dry bubble disease, or *Lecanicillium fungicola*, is a mycoparasite that attacks many common agricultural mushrooms, and causes unsightly lumps that affect sales, and in severe cases can cause utterly deformed and undifferentiated white masses of mushrooms. It causes significant losses in the mushroom industry, and the usual countermeasure, fungicides, tend to reduce the yield of the mushrooms. Additionally, recent studies have shown that it might be gaining a resistance to popular fungicides (Gea et al., 2012). Several such fungicides are also at risk of becoming illegal soon due to environmental concerns.

Compost tea has shown potential in the past in reducing the growth of dry bubble disease, particularly in organic farms where other options such as fungicides are not available (St. Martin, 2014). However it's still not widely used as there is a lack of

understanding of the mechanism behind how the bacterial content of compost tea reduces dry bubble disease. Its consistency has also yet to be proven, as there is a lack of research into it. Therefore, we wish to investigate the effect of compost tea on the yield of *Pleurotus ostreatus* as well as the growth of dry bubble disease.

Objective

The objective for this experiment is to research on the effectiveness of compost tea on growth of mushrooms and reduction in growth of dry bubble disease, as compared to water or bleach with water, as to see if compost tea can be used as an alternative to fertilizers and pesticides in one.

Hypotheses

For the *A. niger*, the hypothesis was, "The set-ups with compost tea will have a smaller amount of clearance of mycelial growth compared to the set-ups with water but more than the set-ups with bleach and water after three days." For the *Pleurotus Ostreatus*, the hypothesis was, "The set-ups with compost tea will have the largest mass of mushroom compared to the set-ups with water, and bleach with water after 2 weeks."

Materials and Methods

Synthesis of Compost Tea

600g of newspaper was added into a plastic container, with two boxes of redworms in soil. 20g each of spinach stalks, spinach leaves and plain white bread was added in as well. This mixture was mixed daily for the first week, and once every other day for the next 2 weeks. Thus, the compost tea mixture was prepared. The redworms were removed along with any excess bits of newspaper that were not broken down, and 2 litres of water was added to the soil remaining. A dri-fit t-shirt was used to strain

the compost and a brown liquid remained. 10ml of honey was added into that liquid, and a fish air pump was used to aerate it while it was mixed. The mixture was put into the refrigerator to be stored while we obtained the *Pleurotus ostreatus*.

Fig 1: worms were used to compost the vegetables

Fig 2: compost tea

<u>Growth of *Pleurotus ostreatus*</u>

Compost tea, a 50% bleach solution and plain tap water was added into 3 identical spray bottles obtained from Daiso. The cardboard area marked out on the grow bags were removed and an "X" was cut into the plastic in the grow bag for 3 grow bags. Each grow bag was labelled with the liquid used to spray it and each grow bag was sprayed 3 times a day, at 8a.m., 12p.m. and 4p.m. for 5 consecutive days from Monday to Friday and a two day break from Saturday to Sunday for a period of 2 weeks in which *P. ostreatus* was able to complete a single growth cycle from spore to cap.

Results and Discussion

Aspergillus niger test

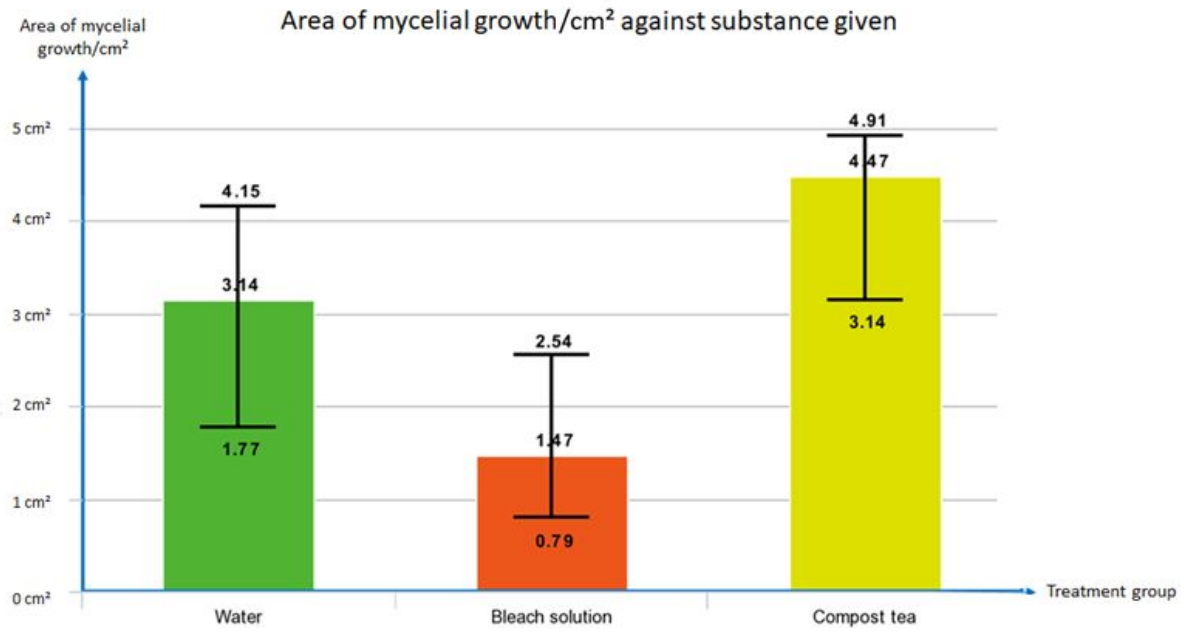

Figure 3: Area of *A. niger* growth in each setup

One set up yielded invalid results due to excessive spread of spores caused by mishandling while making the setups. The area of the clearance increases the most in the setup using compost tea, while the setup using water and bleach resulted in a very small increase in area. The area in the setup with water increased but not by as great a margin as in the setup with compost tea.

From these results we can conclude that the mixture of bleach and water was highly detrimental to the growth of the *A. Niger*. It also shows that water enables the growth of *A. niger*, while compost tea boosts it further. Compost tea increases the amount of mycelial growth by 30% more than the setup with water, and 67% more than the setup with bleach. The bleach, as a known fungicide, was effective in reducing the

amount of *A. niger*. Contrary to our expectations, the setups with compost tea actually had a higher area of *A. niger* on average compared to the setups with water. This shows that it acted as a nutrient solution for it, but did not have the antifungal properties we expected. A potential reason is that for *P. ostreatus*, compost tea may increase the number of fruiting bodies (general harvest) in Vivo and may reduce fungal infection/dry bubble disease. This may be due to *P. ostreatus'* own defense mechanism in balancing growth/development and managing fungal infection (Ludwig-Muller, 2015).

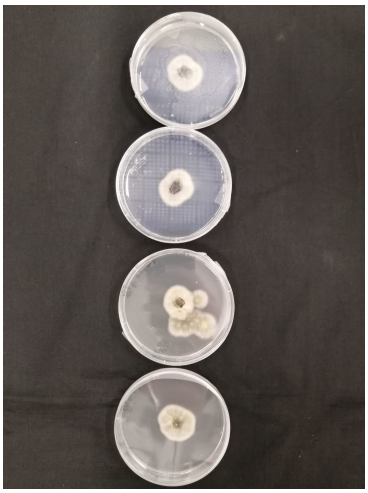

Fig 4: agar dishes with compost tea

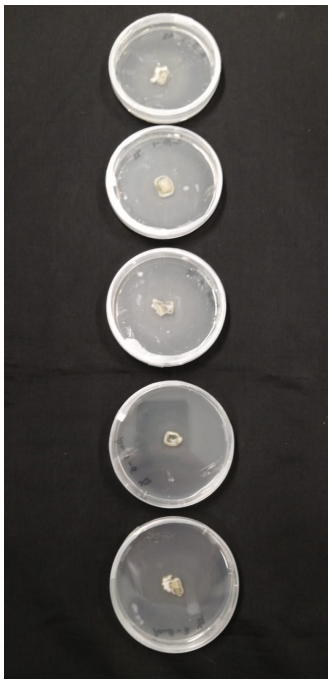

Fig 5: agar dishes with bleach solution

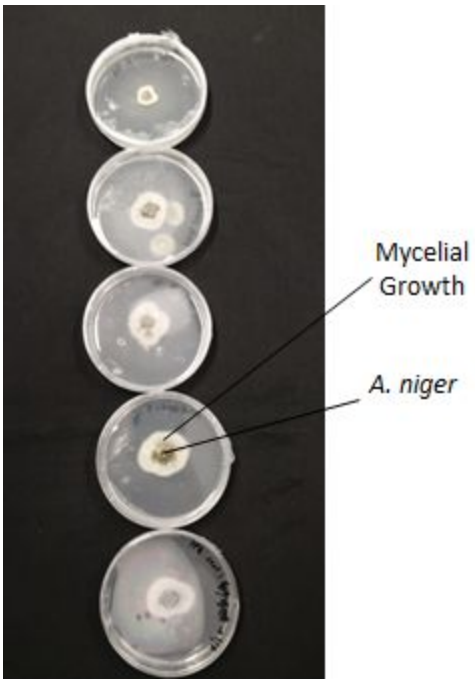

Fig 6: agar dishes with water

Pleurotus ostreatus test

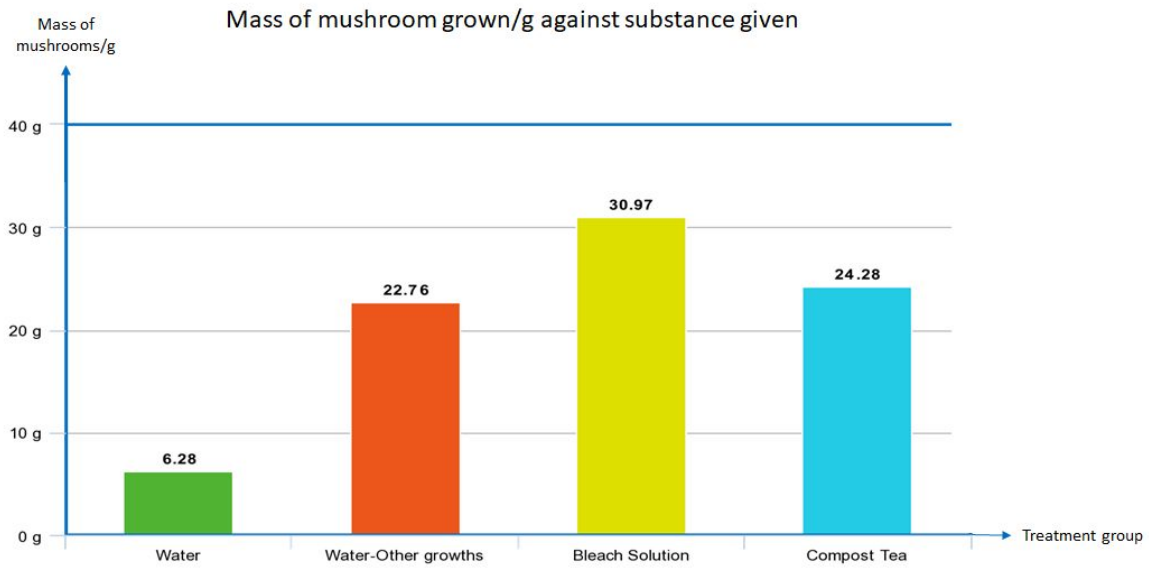

Figure 7: Mass of mushroom growing in each set up/g

From these results, it can be concluded that the compost tea was effective at increasing the yield of *Pleurotus ostreatus* as compared to the set-up using water, increasing the yield by 286%. However the bleach solution increased the yield by 393%. None of the setups showed signs of dry bubble disease growing on them. However, the water setup had a mushroom growing on it that was distinctly different from *Pleurotus ostreatus*, and had an appearance similar to *Pleurotus eryngii*. The other mushroom weighed a total of 22.76g, greatly outweighing the mass of *Pleurotus ostreatus* in the setup by 16.48g.

Contrary to what was predicted, the bleach solution increased the yield of *P. ostreatus* more than the water setup. A potential reason for this is that *P. ostreatus* is not significantly affected by the presence of bleach, therefore the antifungal properties it provides helps to stave off other fungi that may compete with it for resources. In the

water setup, without any antifungal properties, a different mushroom growing on it which competed with *P. ostreatus* for resources leading to the small yield of that setup.

The compost tea was also less effective in increasing the yield of *P. ostreatus*, potentially due to the bleach eliminating all parasitic fungi, allowing for the *P. ostreatus* to grow well, and the compost tea eliminating parasitic fungi to a lesser extent, as it provides nutrients to both the host and parasitic fungi, thus it is up to the immune system of the host to defend against the parasitic fungi.

Figure 8: Grow bag treated With bleach solution

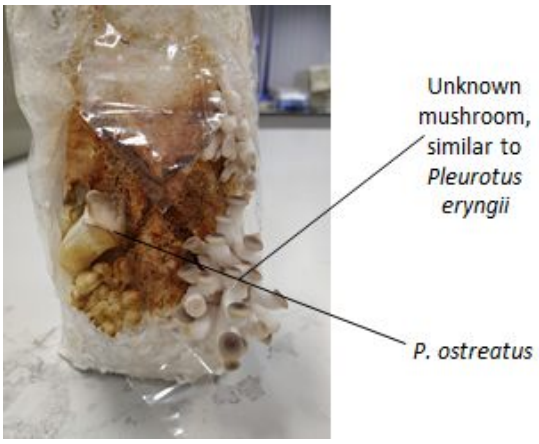

Figure 9: Grow bag treated with water, there is an unknown fungi growing with the *P. ostreatus*

Figure 10: Grow bag treated with compost tea

Conclusion

The compost tea failed to produce a higher yield than the bleach solution, but it did have a higher yield than the setup with water. It also did not have any other fungi growing alongside it. This indicates that compost tea can still be used in place of water to increase yield as well as prevent other mushrooms or parasites from growing and competing for resources.

However, the fact that it was less effective in doing so than bleach renders it less cost effective than conventional fungicides in most situations. It can still be useful in situations where otherwise disposed of organic waste is used to make compost tea, or in organic farming.

Future Research

There were several limiting factors regarding our experiment. We could only carry it out once because of time constraints, as the experiment had to be carried out over two weeks and had to be watered 3 times daily during that time. We also did not have access to commercial fungicides and had to use bleach as a substitute. There was also no presence of dry bubble disease in any setup which limited what we can learn about the effect of compost tea on it. For future research, the experiment would be repeated 5 more times to test for reproducibility.

References

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