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BCOR 012 L09

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Plant-fungal symbiosis negatively impacts the growth of sweet corns, *Zea mays L.*, in terms of low fertilizer[1]

Abstract: Plant-fungal symbiosis is very common in nature. Fungi are good at breaking down nutrients to exchange with plants for carbonates.[2] The specific benefits of the plant-fungal interaction to corn plants' growth was studied under the condition of presence and absence of arbuscular mycorrhizal fungi (AMF)[3] *[here is your specific factor based on your own hypothesis]*. The hypothesis was that decreasing the amount of fertilizer would result in[4] *[the specific results you got from your hypothesis]*. Surprisingly, the results showed the plants' growth without AMF had better development.

Materials and Methods[5]

Planting the corn seeds

Eight pots were labeled with treatment or control, alive or dead and other information for distinguish the plants from others. Two pieces of paper towels were placed and pushed into the bottom of each pot. The soil mixture contained calcined clay and sand at 1:1 ratio was added to each pot, reaching 2/3 of the pot. Then 25ml of water was added to wet the soil. 2 tbsp of

[1] short creative title summarizes the whole experiment
[2] general information about the general topic on plant-fungal symbiosis
[3] specific information about this particular lab on symbiosis of corn plants and arbuscular mycorrhizal
[4] This is the hypothesis about the symbiosis of corn plants and arbuscular mycorrhizal. Students will come up their own hypothesis based on different factors.
[5] The introduction was not required by the assignment; therefore, there was no introduction. After the abstract, it is the materials and methods.

mycorrhizae inoculums with alive spores was sprinkled into two of each treatment and control pots, and the step above was repeated for mycorrhizae inoculums with dead spores. More soil was added to cover the inoculums. A hole was made to place the germinated corn seed with root tip down using a spatula. There was one spatula only for dead spores and the other one only for alive spores. The seeds were covered with soil. The corns were watering by 35 ml every day for three months. The control corns and the treatment corns were *[here is the specific amount of factor I treated with my corns]* every month respectively.[6]

Plant and root cleaning

The plants were removed from the pots to dispose the soil carefully. The soil left was wash off in distilled water, and the paper towel was removed from the roots as well. Rinses were repeated until the roots were quite clean with little soil and paper towel. The conditions of each plants must be tracked in order not to mix the conditions of each plant.

Data collection

The *[different types of data collected about the corn plants]*[7]of each plant were measured. Some parts of the roots were cut off and placed in a 15 ml tubes that were labeled with conditions of the plants. All the tubes were filled with distilled water and stored.

Clearing and staining method

The roots from the tubes were placed in a weight boat and rinsed with distilled water to wash off any soil and debris left. After that, the roots were placed back into the tubes. 10 % KOH was added into each tube to cover the roots. The tubes were heated in warm water bath (85℃) for 30 minutes. The 10 % KOH was poured out into the KOH waste container using nylon mesh, then the roots were rinsed with distilled water three times. The histological cassettes of each plant

[6] Students will come up with their own hypothesis with specific values.
[7] Students can choose their own types of data to collect.

were labeled with plant ID with pencil, and then they were placed in the nylon mesh with twist ties between each cassette. The whole nylon mesh with cassettes was carefully placed in 200 ml of boiling ink solution for 5 minutes. The roots in cassettes were transferred back to weight boats in order to get rid of the excess ink for 20 minutes.

Mounting roots

After the slides were labeled with plant ID, a small drop of distilled water was dropped in the center of each slice. After that, A piece of root was place in the center of the slice according to the plant ID. The slice was gently covered by a cover slip with no air bubbles. The sample was place under the microscope to count the number of vesicle and arbuscular mycorrhizae and identify the concentration of them.[8]

Results[9]

The growth conditions of the treatment corn plants were not overwhelmingly higher than the control plants. The [*this is where types of data you collected are named*] of treatment corns were slightly higher than the control group, which were [*here would be your measurements*] (Fig.1)[10].

[8] The materials and methods should include enough detail for people with biology background to repeat the same experiment; however, basic and commonly known knowledge and skills should be included.
[9] The results should only report the data collected without any explanations about the data. Explanations should be written in the discussion.
[10] Figures need to be referred to the text. Figures are often with the text, but it can depend on your TA.

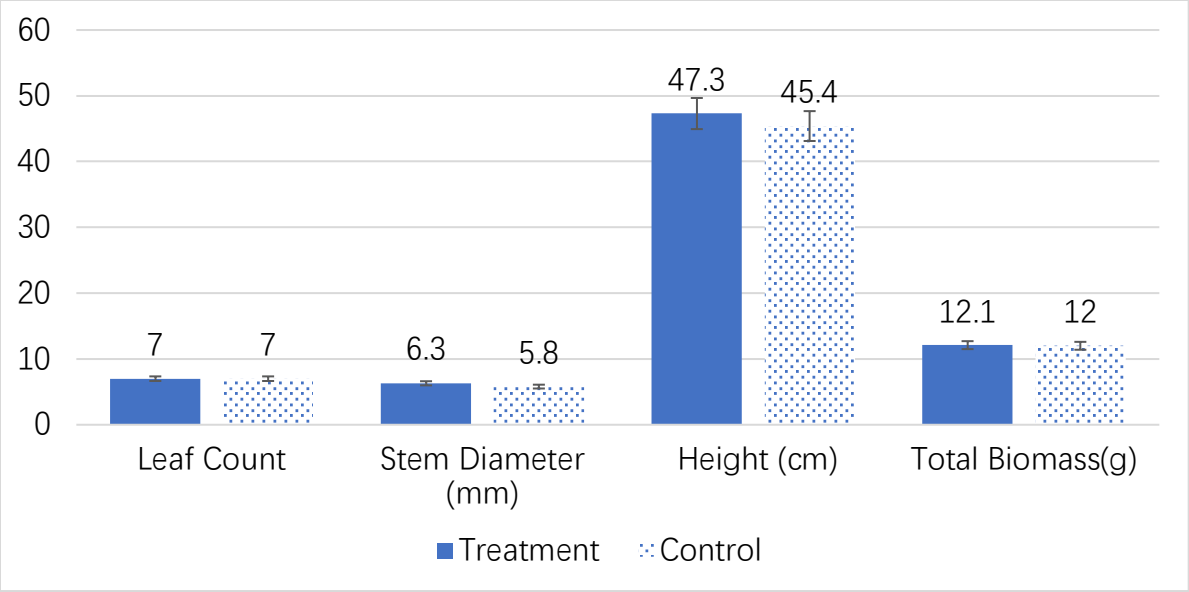

Fig. 1. *[These is where the types of data you collected are named]* of treatment and control groups of corn plants. Columns represent treatment and controls. Bars represents error deviation. [11]

The growth conditions of both corn plants with alive or dead mycorrhizal spores were really close, therefore, they were equally well-developed. The mean value of [*this is where types of data you collected are named*] of the corn plants with alive mycorrhizal spores were *[here are your own values on your data]* higher than those with dead ones. On the other hand, the mean value of [*this is where types of data you collected are named*] of the corn plants with dead mycorrhizal spores were *[here are your own values on your data]* higher than those with alive ones (Fig. 2).

[11] A figure should have a caption beneath the figure, including a number and a title. The title should include enough information for the readers to fully understand the figure without reading the text.

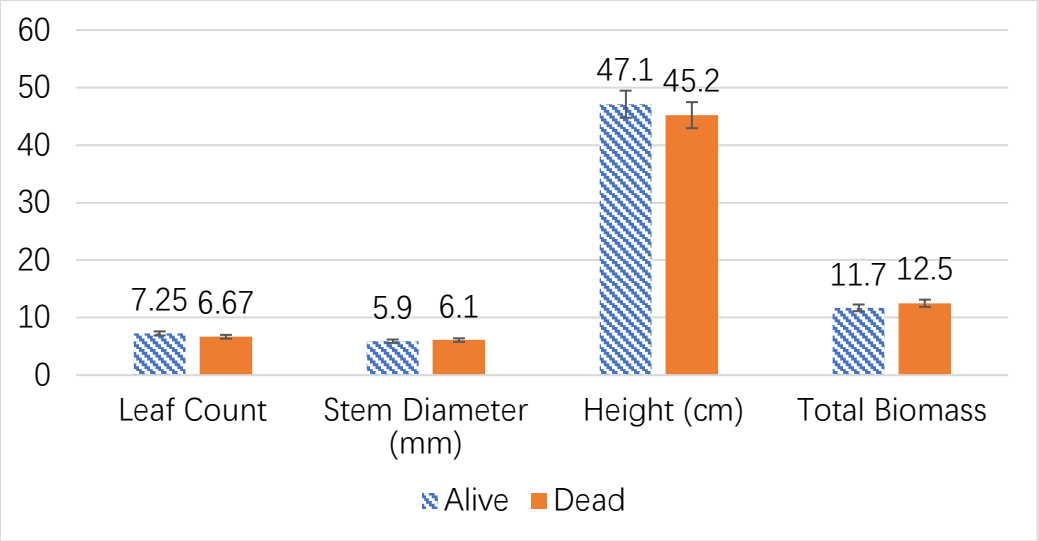

Fig. 2. The mean data of [*this is where types of data you collected are named*] of alive and dead mycorrhizal spore groups of corn plants. Columns represent plants with alive and dead mycorrhizal spores. Bars represents error deviation.

Table. 1. The concentration of arbuscular mycorrhizae in eight plant samples.[12]

Plant #	Alive or Dead	Treatment or Control	Concentration of Arbuscular Mycorrhizae
1	Dead	Treatment	Nothing
2	Alive	Treatment	Nothing
3	Dead	Treatment	Nothing
4	Alive	Treatment	Nothing
5	Dead	Control	Nothing
6	Alive	Control	Nothing
7	Dead	Control	Low abundance
8	Alive	Control	Median abundance

The arbuscular mycorrhizae were only found in sample #7 and #8 in control groups. The concentration of arbuscular mycorrhizae in sample #7 was in very low abundance. More arbuscular mycorrhizae were found in sample #8.

[12] A table should have a caption above the table, including a number and a title.

Discussion

The data of the experiment was against the initial hypothesis that *[here is where you restate your hypothesis]* the growth of the corn plants. The treatment group with [the specific value of factor in your hypothesis] actually grew better than the control groups with 25 ml of fertilizer every month (Fig.1).[13] What's more, not all the corn plants showed that have plant-fungal symbiosis, and even those plants formed symbiosis did not show huge advantages in growth. There was one corn plant fail to grow and died at the beginning of the experiment. Even that happened, our plants were still grow better than other groups' because all of the seven plants grew tall and did not dry out.[14] The limitation was that there were *[here is where you can discuss your limitation about your experiment]*. Another limitation was only a small number of *[here is where you can discuss your limitation about your experiment]*. *[here is what you can do to minimize the factor by your limitations]* should be collected and observed.[15]

Plant-fungal symbiosis has been existed for more than 400 million years (Verzeaux, Hirel, Dubios, Lea & Tétu, 2017). The benefits of the symbiosis are sufficient. Arbuscular mycorrhizal fungi (AMF) play an important role in nitrogen absorbance to help contribute to plant growth, garbage decomposition and soil gathering in agroecosystems (Verzeaux, Hirel, Dubios, Lea & Tétu, 2017).[16] However, in the experiment, it was not show obvious benefits. Some plants samples did not form plant-fungal symbiosis, but they grew as well as the ones with symbiosis. This might because the inefficient up taking of nutrients in both control and treatment group. Without N2-fixing or arbuscular mycorrhizal fungal symbiosis, crops can only uptake a small amount of fertilizer applied because the genotypes of N2-fixnig are usually not be selected by

[13] Briefly restate the main results at the beginning of the discussion. State that if the hypothesis is supported or rejected.
[14] explanations about why the hypothesis is supported or rejected
[15] Limitations about the experiment should be included in the discussion.
[16] This is an outside resource talking about the significance of the lab.

crops with excess fertilization (Verzeaux, Hirel, Dubios, Lea & Tétu, 2017). Even the two samples with symbiosis, there were not a high abundance of arbuscular mycorrhizae to help absorb nutrients. AMF play an important role in nitrogen absorbance to help contribute to plant growth, garbage decomposition and soil gathering in agroecosystems (Verzeaux, Hirel, Dubios, Lea & Tétu, 2017). From the experiment, a newer question was aroused that under what conditions would plant-fungal symbiosis formed.[17]

References

Verzeaux, J., Hirel, B., Dubois, F., Lea, P. J. & Tétu, T. (2017). Agricultural practices to improve nitrogen use efficiency through the use of arbuscular mycorrhizae: Basic and agronomic aspects, *Plant Science, 264, 48-56*

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[17] Future research related to the experiment according to the existed findings.