What Did They Learn?

Mount Marty Students Cultivate A Few Botanical Lessons

BY BRENDA K. JOHNSON
P&D Correspondent

PHOTO: BRENDA K. JOHNSON
Taylor Wingert is in Dr. James Sorenson's botany class at Mount Marty College. She chose to study colors found in light that are optimal for growing plants with Kalanchoe. She conducted her experiments in the Otto Ullrich Botanical Laboratory.

Botany students find, plan and carry out plant experiments under the direction of Dr. James Sorenson at Mount Marty College. Their results are sometimes practical, often have technology flair, and show they are interested in finding results.

Students don't fake their interest in a project. Sorenson's botany students at Mount Marty College have just completed plant experiments. Each has chosen, planned, and conducted experiments like students before them for the past 23 years.

"They seem to be engaged with the plants and make comments about their projects," said Sorenson, who is also chair of the Division of Natural Sciences at Mount Marty.

These students are biology majors. They will complete their experiments, library research, and presentations in a couple of weeks. By students' conversations, what Sorenson says is true.

"It's to teach them to do research on something manageable and increase their appreciation of plants," he says.

We want to know what happens next from students' points of view. Five from the class agree to an interview near the end of school.

Students use time-lapse photos by cell phone, feed flytraps live flies, and try to disprove a YouTube experiment. They find where tomato transplants grow best and test different light wavelengths on plants.

MAGGIE BISGARD

Her cell phone proves what Maggie Bisgard from Yankton sees about her plants in the growth chamber.

"I'm studying circadian rhythms in plants," Maggie says.

It's like a plant's internal alarm clock. She picks the shamrock or Oxalis to study because the plant's response to light is easily seen. The four-leaf clover like leaves open in light and close in darkness.

"I put the Oxalis plants in a growth chamber so I could manipulate day and night and then vary the patterns," she says.

The chamber has controllable lights inside and natural light is excluded.

She wants to scramble the plants' natural response to light, somewhat like jet lag may mix up human sleep patterns.

"I started with a natural day/night schedule and then chopped them to a four hour dark period. Plants were confused!" she says.

She keeps notes of the Oxalis responses.

"Then I went to a 12-hour day and 12-hour night that was opposite natural day and night," she explains. "I saw their day reactions when it was dark (outdoors)."

She wants some proof of this response.

"I took a time lapse video," she says. On her cell phone she shows the plants' response frame to frame. She can speed it up to illustrate the opening and closing of the leaves and when it occurs. She shows that the light in the chamber causes Oxalis to respond. The plant opens and then closes, opposite to the natural world outside.

She has other observations that leave questions for future students. She documents with video that leaves take different lengths of time to open and close, when she uses six-hour days and nights, compared to the 12-hour day/night. The Oxalis plants with controlled temperature and humidity of the full sun greenhouse, while the Oxalis in a hallway with north-facing windows have a different response. She learns how to keep her experimental plants healthy.

"Plants take a lot of care," Maggie says. "You can overwater and underwater them. You want them responding accurately. It's a lot of work."

ALLISON CROSS

"I wanted to see how fruit flies affected the growth of Venus flytraps," says Allison Cross from Sioux Falls.

She organizes six Venus flytraps in two groups of similar sizes. She orders tiny lab grown fruit flies to feed only one group. Plants not fed flies are her control. She maintains plant care for both flytrap groups under the same conditions.

"They're flightless fruit flies. Otherwise that would have been a disaster," she says looking at others' plants.

She wants fresh food for the flytraps as in nature, not dead ones. The flies move about. She wants the counted flies to remain in each trap until it closes.

"I would add liquid Fly Nap on a Q-Tip in a culture dish with the flies and it knocked them out," she says. "I'd put 15 flies into each trap. Flies weren't moving but were alive."

She feeds each plant weekly for five weeks.

"It takes about a week for each trap to open again. It takes that long for the flies to be digested. If you trip the trap with nothing in it, it opens again in a few hours," she says.

She records observations.

"When the fed trap re-opens, there are only fly chitin exoskeletons in it," she says. "The plant secretes enzymes from the two lobes of the trap. Enzymes break down the flies and supplies nitrogen and phosphorous to the plants."

Venus flytraps are native in North and South Carolina. Soil is deficient in enough of these nutrients, so trap insects contribute nutrients.

She isn't surprised that the Venus flytrap plants fed flies grow up and out more than the control group. Control group plants stay clustered near the soil. That is her hypothesis. But the trap door response is still a puzzle. She speculates that the length of time the trap door stays open has to do with the number of flies in the trap.

OLIVIA DE WAARD

A YouTube science experiment inspired Olivia De Waard of Stickney. It showed that magnets appear to affect plant growth and she wants to test it.

She chooses tomato plants for her trials. They are hardy plants that grow enough within the semester to show results. All plants are of the same variety and are grown in the greenhouse under natural light.

Magnets are strong enough that they are attracted a metal surface about a foot above it. She uses magnets of the same size and strength from Radio Shack.

Magnetic fields have north and south poles. Opposite poles attract and like poles repel. She focuses on repelling forces in her experiments. The YouTube science experiment claimed that repelling forces are more effective magnetic treatment for plant growth.

Control plants have no magnets. She positions a magnet by tomato plant roots with north facing up. Other plants have a magnet by the plant stem with no particular pole orientation. Another set of plants have two magnets: one in the roots with the south pole facing up, and one by the stem with the south pole facing down. These magnets repel each other.

Her hypothesis is that magnets would make a difference in tomato plant growth. It surprises her to see the data when she recently measured and weighed the plants' roots and stems. Roots surrounded by opposing magnetic fields grow the best. Roots near just one magnetic field grow the worst. Stem growth is not affected by any combination of magnets. Control plants with no magnets grow normally.

In her experiment, possible effects of magnets on root growth do not appear to affect stem growth in any way. The roots of plants with one magnetic field near the stem grow better than roots of plants with one magnetic field near the roots. It is possible that roots are the only parts of the plant affected by magnets.

In her library research she finds a country where magnets are placed by the water supply to increase movement of water. From her data, plants with magnets grow more than control plants. She thinks that the plants with magnets by the roots grow the most. Magnets may affect roots' cellular structure or water movement within the roots. These are possible questions for future students interested in this topic. If more tests show that magnets are found to be beneficial for plant growth, then she thinks more could be done to make use of this finding.

"It was fun to do this experiment and actually get results that showed differences in the techniques I used," Olivia says. "I learned you may get unexpected results. I don't think other students (here) have done an experiment like this before."

ANNA KOLLASCH

"I determined if tomato plants grow better in the greenhouse or in Bede Hall where we used to grow plants," says Anna Kollasch of Whittemore Iowa.

Anna has been Dr. Sorenson's lab assistant the past three years and helps care for his lab plants. She experienced the struggle of adjusting controls in the new greenhouse the fall semester. Plants weren't growing in the same way there. She knows that test plants need to be grown optimally, so that other factors can be isolated for testing in experiments.

"I thought it was practical that a gardener might want to know," she says. "Do plants grow better in a window, under a grow light, or in the greenhouse?"

She compares the growth of tomato plants in three locations in Bede Hall to the greenhouse. In Bede Hall, a back room with little natural light has grow lights with 12-hour days/nights. She also uses a south-facing bay windowsill, and a north-facing windowsill. She has grown plants in these locations in past years. One set of plants is grown in full sun natural light greenhouse. The north windowsill Bede Hall plants are her control.

She plants the same variety tomato seeds in three pots for each test in January. She comments that temperatures in Bede Hall were generally warm in winter. Temperature and humidity are managed in the greenhouse. Her tomato plants grow slower at first in the greenhouse.

"Greenhouse plants took a long time (to germinate). Bede Hall south and north window plants grew fast at the start," she says.

"At the end of the experiment the greenhouse plants weren't as tall, but had thicker stems and were able to support themselves without leaning on anything They have a huge amount more root mass."

She weighs roots and shoots of all plants to compare growth.

Bede Hall plants are taller. Grow light plants are tallest of all and can somewhat support themselves. Roots are longer. South window plants are nearly as tall as the artificial light plants, but have to lean on the window for support. North window plants have few leaves, thin roots, can't stand without support, and seem to stop growing.

"At first I thought greenhouse plants were (not thriving), but as we went on, the greenhouse plants had blossoms on each plant. Bede Hall plants had no blossoms though taller," she says. "Greenhouse plants would have been ready (to transplant) outdoors soon. The greenhouse plant was a more stable, hardy plant. The longer plants stay under the grow light, the greater the chance they will be weak plants. Weakness seems to be lack of natural sunlight. Greenhouse wasn't a waste of money. It's good for plants; they grow strong. The greenhouse needs temperature regulation."

Plants that do not get optimal light but get plenty of water tend to put their energy into growing upwards quickly. This quick growth results in long cells that are full of water and are flexible. Plants receiving adequate amounts of light and water put equal amounts of energy into stem and root growth. The cells of these plants are smaller because they are dividing to grow instead of stretching. This means the plant has more cellular material and is stronger.

"It was easy to see that the plants in the greenhouse were the strongest plants, but I had no idea until I rinsed off the soil, the results (of root growth)," Anna says. Her surprise is beneath the soil.

TAYLOR WINGERT

"I wanted to know which lights are optimal for growing plants," Taylor Wingert of Valley Springs says.

She chooses colors found in the light spectrum. She places a different colored thin plastic sheet over each wooden box that her dad had made. She places plant pots inside each box.

Kalanchoe is the plant she chooses to test. It is a tropical succulent that forms tiny new vegetative plants in the margins of thick leaves, is the plant she chooses to test. Tiny Kalanchoe are planted in pots and are placed in each box with a colored sheet. She uses a clear plastic sheet for the control plants to grow under the same conditions.

"I found plastic sheets that allowed plants to absorb red and blue light grew the best," she says. "Plants absorbing blue light grew tallest and the most consistent growth was under sheets allowing red light."

Control plants grow well under clear plastic, although the cover was off a bit and plants didn't get the moisture needed. Her surprise is that plants absorbing yellow light grow so well.

She has yet to weigh plants with water content and dried plants, which may increase her findings. Her hypothesis is that plants grow well when they absorb red and blue light and that matches her results so far. She plans to research Kalanchoe plants as well.

"I would like to have explored plants that absorb yellow light more because plants grew well in it. It makes me want to see what is going on. Overall, I'm interested in wavelengths and how they affect plants. Dr. Sorenson said I could take a plant home this summer so maybe I'll learn more about it," Taylor says.

IS IT WORTH THE EFFORT?

"Plants are good experimental organisms," Sorenson says. "I love plants. They respond to stimuli and some have innate behavior patterns."

This plant experiment is an early experience for research students will do as a junior or senior at the college. Besides, animal experiments have many restrictions and are cost prohibitive to house animals.

A project like this has many drawbacks. Stock plants have to be maintained months ahead for use in January. Students have to find an experiment they want to work on. They maintain the plants as much as five months, even in the middle of the night. Projects can go awry. Some subjects are difficult to find library research to enlighten findings.

"It's lot of extra work for them and me," Sorenson says. "I've toyed with the idea of getting rid of it. It takes a lot of time and coaching."

But after more than two decades, he still looks forward to their presentations. He sees how students work out dilemmas and make sense of their experiment findings. Maybe students appreciate plants more.