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Biodiversity Lab Report

Introduction

Biodiversity is a marker of a functioning and healthy ecosystem and it supports the ecosystem's functions and services. To keep these services running smoothly, an ecosystem depends on certain behaviors and ecological principles which cannot exist without species diversity. Biodiversity ensures competition between species and leads to predation, which is an important way to control populations and move energy throughout the entire ecosystem. A variety of species also provides a large pool of predator and prey populations, which ensures a plethora of nutrients being cycled through the system while also keeping a balance between the populations. Not only animals benefit from species diversity as plants are reliant on having a variety of species to facilitate pollination and seed spread, leading to increased reproduction. Having a greater number of species present in an ecosystem also provides increased genetic diversity. Expanding the gene pool ultimately decreases risks involved with genetic mutations and inbreeding. Risks such as reduced fitness and decreased survival rates become more prevalent as biodiversity is lost.

Biodiversity is also vital in affecting ecological, economic, and societal functions. It holds several important values including monetary, utilitarian, ecological, and aesthetic values. If there is a reduction in biodiversity, the system functions are disrupted and less able to supply humans with services needed. Agriculture and croplands are an important part of ecological functions that benefit humans and biodiversity aids in providing profitable farming and sustainable agricultural practices. Intercropping is such a practice that uses biodiversity to encourage growth of multiple species that benefit each other when grown together. Legumes typically provide the

main source of nitrogen and act as a natural fertilizer for the plants it is cropped with. With a greater field of crop species to choose from, farmers can pick several plants that will provide the maximum benefit in terms of crop growth and health. The soil benefits from the addition of nutrients and roots, evolving to withstand a greater variety of plant species in future crop seasons. Farmers and consumers witness a greater crop yield using this practice and the process of farming becomes more profitable, stimulating economic growth. Unfortunately, modern technology and machinery present barriers that prevent widespread implementation of intercropping because most modern machines are designed for a specific type of crop. Once the crop diversity increases, the process of harvesting becomes more difficult and time-consuming, which is the main reason modern agriculture still rely on practices such as crop rotation.

In this experiment, I tested the hypothesis that plants grown with other plants of the same species will compete more and grow less than plants grown with plants of different species. Specifically, I predicted that peas, green peppers, and lavender would grow taller in a mixture than in monoculture. To test this prediction, I planted peas, green peppers, and lavender as monocultures and as a mixture then recorded plant heights after 7 weeks.

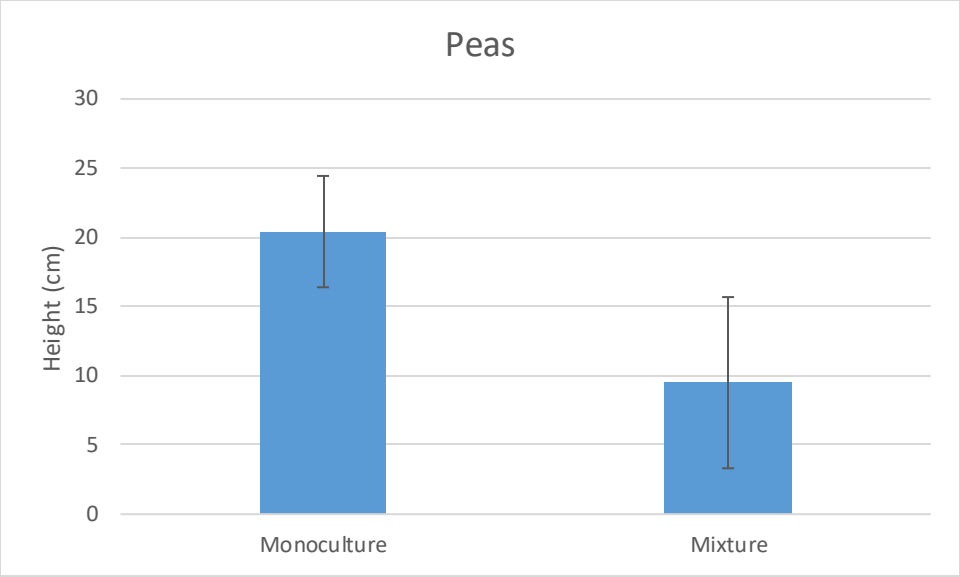
Methods

Our experiment uses lavender (*Lavandula angustifolia*), green bell pepper (*Capsicum annuum*), and peas (*Pisum sativum*) to observe the effects different cropping methods and biodiversity have on plant development. *Lavandula angustifolia* is native to the Mediterranean region and its wet winters and dry summers. English lavender is resistant to low temperatures and limited water consumption because it does not grow well in consistently damp soil and benefits from increased drainage. *Capsicum annuum* is native to Mexico, Central America, and northern South America and prefers warm, moist soil in a warm climate year-round. *Pisum sativum* was created as a cross between a shelling pea mutant and a snow pea cultivar to counteract

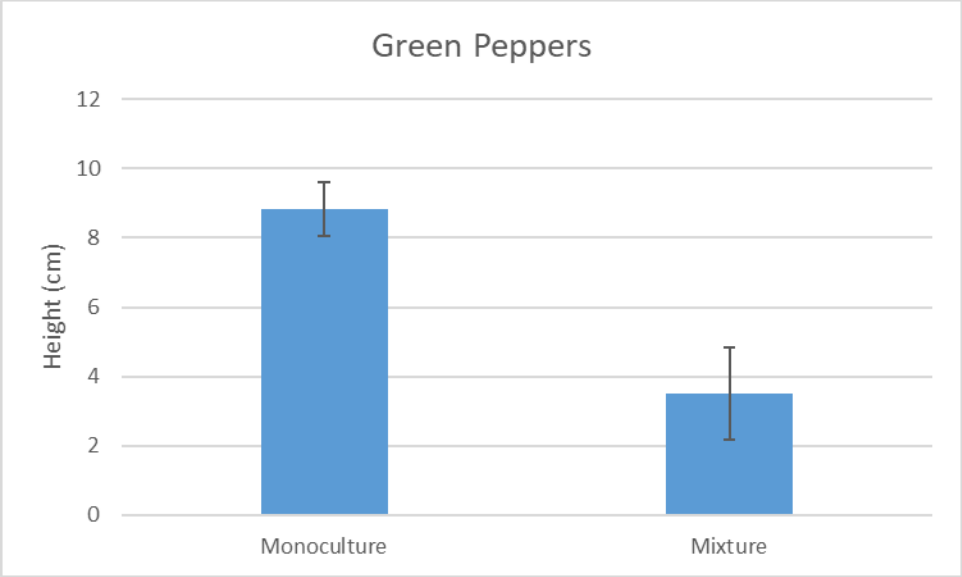
the twisting and buckling seen in some pea varieties in the late 1970s. Pea varieties grow well in cool temperatures and at high altitudes and tolerate lower temperatures and light frost. Sugar snap peas have more of a tolerance for higher temperatures but still prefer a cooler growing season. We chose our plant species based on what we believed would yield the best results, noting that legumes, such as peas, introducing nitrogen and nutrients into the soil, promoting crop growth. We chose lavender and green pepper for their aesthetic value and for the fact that lavender will not take up as much space and allows for the introduction of the larger vegetable crop.

The crops were separated into four groups: three monoculture groups containing three seeds of only one type of crop for each group, and one mixture group containing three seeds from every crop type, one seed per plant species. There were four replicates for each treatment to ensure experimental integrity and security. In total, there were four treatments of plants: monoculture peas, monocultures green peppers, monoculture lavender, and the mixture of all three plants. The seeds for all the crops were obtained from The Page Seed Company on Amazon and the soil used to plant them in was ProMix Myscchorizal Soil. The seeds were planted at a depth of ¼ inch from the soil surface and 1 inch away from each other within their respective pots. Finally, I monitored these crop groups and recorded observations related to biodiversity and species development.

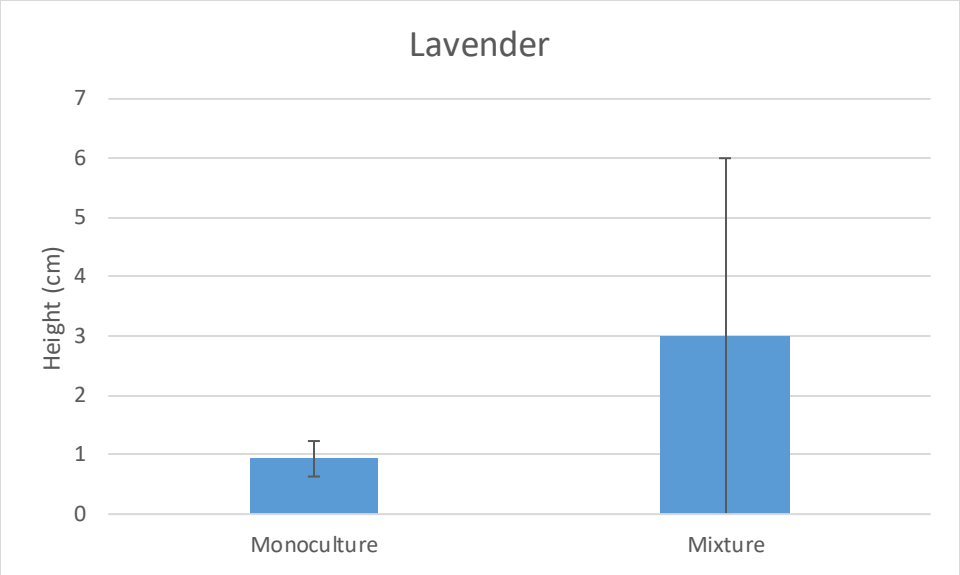
Results



Peas in monoculture grew taller than peas in mixture ($F = 2.190$, $P = 0.189$).



Green peppers in monoculture grew taller than green peppers in mixture ($F = 11.957$, $P = 0.014$).



Lavender in mixture grew taller than lavender in monoculture ($F = 0.470$, $P = 0.519$).

Discussion

As the results demonstrate, I did not find significant evidence to support my hypothesis. This could be due to a variety of reasons and it is important to consider design error in addition to other factors. One reason that hypothesis supporting evidence was not found could be due to the plant species I decided to use. Lavender is known to grow best at low temperatures and limited water so growing it in a warm greenhouse with a constant watering schedule could explain its limited growth both in monoculture and mixture. On the other hand, green peppers and peas are more tolerant to higher temperatures, which explains the greater heights seen in both crops. It is also possible that the size of pots I used for growing these crops was too small and led to increased competition for root space, stunting the growth of all plant species. The conflict between increased nutrients provided by biodiversity and a plant specie's native growing conditions may have been too great to provide any kind of benefit to all three crops. There is also the possibility that flowering and crop producing plants such as peppers and peas do not grow well with herbs such as

lavender because the structure of the plants is so different. This could explain why lavender grew a bit larger in a monoculture than a mixture.

Although my hypothesis was not supported by the evidence found during this experiment, it is still important to consider the results and how they can affect farming or gardening practices. Prior to choosing my seeds, I did not do any research on the plant species I was using so I did not know beforehand if they were going to be potentially compatible. My data could be used to help farmers and hobbyist gardeners learn how to choose plant species that will benefit each other. My data also demonstrates the importance of failing at an intercropping attempt in order to find the best combination of crops to support a thriving ecosystem. As a follow up experiment, I would like to try the experiment again using different crop species and a different potting method to see how different kind of species interact. I am curious to know what differences would be present if I used all flowering crops or if I used all legumes or all herbs.