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SOIL TYPE AND PLANT GROWTH

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ABSTRACT

In this paper we are looking at the differences in growth rates of plants in different marketed types of soil. The plants that are being studied are *Zinnias* and the soils that are being used are all from the common brand Miracle Grow. The types of soil used in the experiment are as follows: Miracle Grow Moisture Control Potting Mix, Miracle Grow Potting Mix, and Miracle Grow Seed Starting Mix. The differences in these soils' ingredients list and the different advertisement of names and what the soil would be ideal for, lead to the idea that the different make ups of the soils would be better for seed germination. The study was conducted for three weeks, looking at the growth of the seeds that were placed in the three distinct kinds of soil. From the three distinct kinds of soil, there were five samples done all with the *Zinnias* seeds in them. The environment conditions and watering done were the constants for this experiment. The plants were allowed to grow for the duration of the three weeks but were watered and their height was measured on a schedule

Keywords: Zinnias, Plant Growth, Soil Composition, Seed Germination

INTRODUCTION

Soil composition can affect how well and fast plants are able to grow. This can be from several factors, pH, nutrients in the soil, and water holding capacity. (*How Does Soil Type Affect Plant Growth?*, 2023) To study this idea of soil composition affecting the growth of plants we studied three different types of soils with different, labeling and ingredients to compare the differences in plant growth. From this comparison of growth in the three soils, it can be found which soil is the best for plant growth.

The plants we are using in this study are *Zinnias, Zinnias* are known for their fast growth and its sturdiness. Germination generally occurs within 7-10 days (about 1 and a half weeks) and they bloom within 60 to 90 days (2-3 months). While moisture control is not extremely necessary, the plant generally prefers moist soil and not too much water. Considering the plant is an easy-to-grow flower, we found that it would be perfect to run for this experiment. (*How to Grow Gorgeous Zinnias from Seed*, 2024; *How to Grow Zinnias*, n.d.)

There are three different kinds of soil we are using to test the hypothesis, Miracle Grow Moisture Control, Miracle Grow Potting Soil, Miracle Grow Seed Starting Mix. We wanted to use this brand as it is one of the most well-known and popular, and we chose these three soils because of the way they are labeled in sales, this eludes the fact that one should be better overall for growth. There are some differences seen in the soils' composition, which could be the reason for the differences in growth. The content lists are as follows: Miracle Grow Moisture Control Potting Mix; sphagnum peat moss, (one or core of the following. Processed forest products, peat, and/or compost), coir, perlite, fertilizer (see below), and a wetting agent. Miracle Grow Potting Mix: This product is formulated from (one or more of the following: processed forest products, peat, coir, and/or compost), and sphagnum peat moss, perlite, fertilizer, and a wetting agent. Miracle Grow Seed Starting Mix: This product is

formulated from sphagnum peat moss, perlite, fertilizer, and a wetting agent.

Soil specifically designed to aid in the germination of seeds will help the seeds to grow faster, then soil designed to control moisture will be the next best to grow seeds the fastest, and generally designed soil will be third in helping grow plants the fast. Different soils are better designed to aid in the growth of seeds, but between regular, moisture, and seed starting soils, what works best?

The purpose of this study is to highlight the importance of proper soil usage in flowers. What works best? What can you expect from the usage of different potting soils? All are important questions when finding out what soil works best for your plant goods.

METHODS AND MATERIALS

To test our hypothesis, we will be conducting this experiment in the green house. This location was chosen for the constant environment, of about 18-24 degrees Celsius. The samples were placed on the same tray so that we could keep them in the same location in the greenhouse. The plants were also watered on a regular basis, every Monday, Wednesday, and Friday. The watering consisted of the hose on mist setting and spraying each cup for about 3 seconds. This was to ensure they had enough water to get them to the next day of being watered, and so the soil was completely and evenly saturated with water. Both the conditions and watering habits were the controls for this experiment. Ensuring that all the samples had the same environment made it to where the water, sunlight and temperature would not influence the plant growth, and it would just be the soil contents considered.

To set up our samples we took small paper cups, 5 samples of each soil, and poked 9 drainage holes in the bottom of each cup. The labeling of the cups is as follows: *Miracle Grow Moisture Control Potting Mix* samples; MC 1-5 for each of the 5 samples: *Miracle Grow Potting Soil* samples; PS 1-5 for each of the 5 samples: *Miracle grow Seed Starting Potting Mix*; SS 1-5 for each of the 5 samples. To finish setting up our samples we first filled the respected cups with the soil they were labeled for, leaving about 4 cm from the top not filled with soil. Ater tapping the cup lightly to make sure the soil was rates of each sample per soil type.

Anova: Single Factor

level on top, we poked 5 holes in the soil with our pinky finger. Then we place 2 of the seeds into each of the holes, this gives a total of 5 seeds per cup. This method of putting multiple seeds in the same cup and in the same hole, is to have security that at least one seed should have the hopes of germinating. After placing the seeds in the holes, we lightly covered them with the soil displaced form making the holes.

The first day the plants were placed in the greenhouse was day 1, they were measured at 0cm, and were watered as described above. For every Monday, Wednesday, and Friday that the plants were checked on the following process took place, the samples were watered in the processes mentioned above, and then the sprouts were measured. The process in measuring the sprouts is as follows: after watering we took the cm side of a ruler and placed it lightly on the soil at the base of the sprout, making sure not to press the soil down, then taking the measurement in cm from the top of the tallest part of the plant. We also recorded how many sprouts were in each cup.

The statical test we will be using is ANOVA. We are using this test because we are comparing the averages of growth between the 5 samples of each soil type. This test will provide the averages and variances to compare the growth rates of each sample.

RESULTS

The following are the results collected from the experiment, including an ANOVA analysis and multiple graphs showing growth

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SUMMARY

Sample	*Count*	*Sum*	*Average*	*Variance*
MC1	8	9.7	1.2125	0.526964
MC2	8	19	2.375	1.902143
MC3	8	23	2.875	4.982143
MC4	8	18.1	2.2625	2.165536
MC5	8	4.2	0.525	0.605
SS1	8	0	0	0
SS2	8	25.8	3.225	1.565
SS3	8	20.6	2.575	1.462143
SS4	8	7.6	0.95	0.725714
SS5	8	12.9	1.6125	2.16125
PS1	8	15.1	1.8875	0.746964
PS2	8	24.7	3.0875	3.469821
PS3	8	28.2	3.525	1.313571
PS4	8	27.8	3.475	2.539286
PS5	8	25.7	3.2125	3.049821

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	139.9912	14	9.999369	5.511246	7.96E-08	1.787079
Within Groups	190.5075	105	1.814357			
Total	330.4987	119				

Figure 1: *This figure shows the overall breakdown of the 15 samples studied, including the average of their growth and the variance of the samples. Which are used to compare the differences in the samples' overall growth overtime. It also gives the P-value which is used to assess the probability.*

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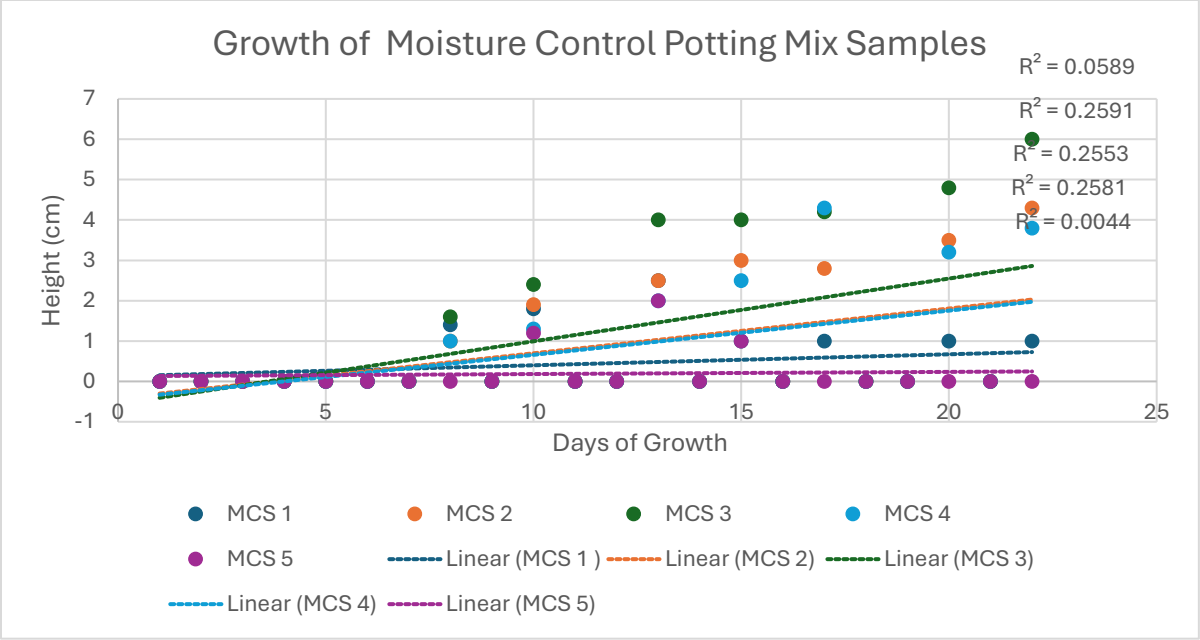

Figure 2: *This graph shows the growth of each sample of Zinnias in the Miracle Grow Moisture Control Potting Mix. The points plotted show the height of each plant on the days they were measured. There is a trend line for each sample to show the growth rate over time for each sample. Then for each line there is an "R^2" value, and they are listed top to bottom, sample 1 to 5.*

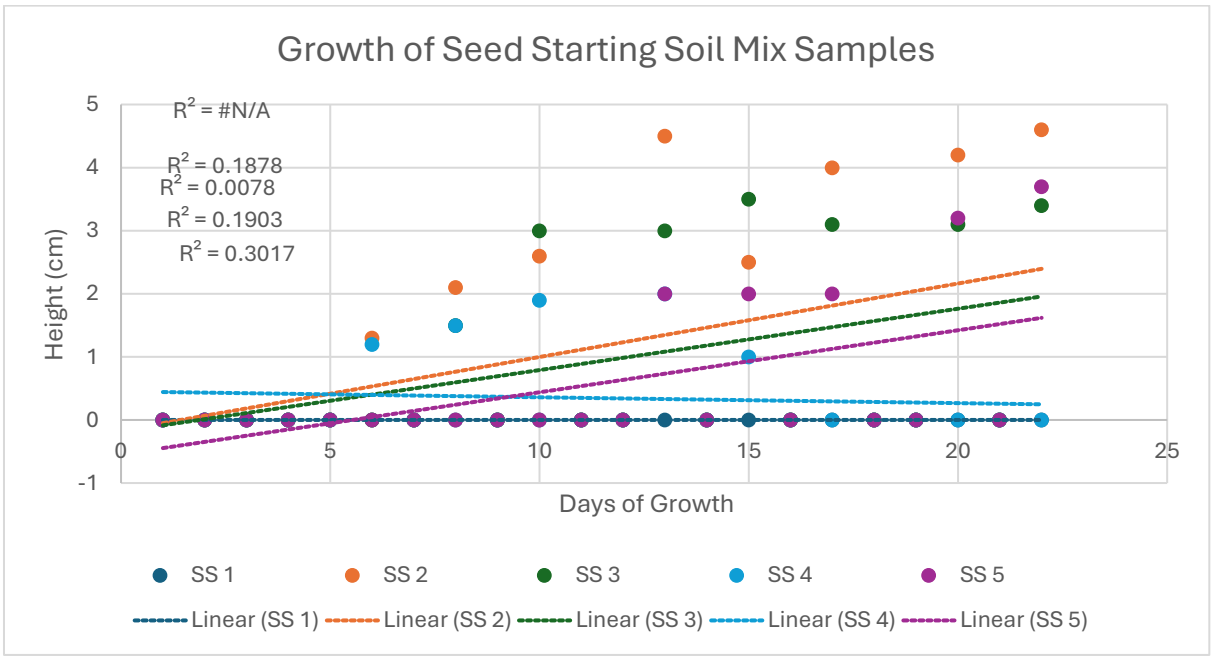

Figure 3: *This graph shows the growth of each sample of Zinnias in the Miracle Grow Seed Starting Soil Mix. The points plotted show the height of each plant on the days they were measured. There is a trend line for each sample to show the growth rate over time for each sample. Then for each line there is an "R^2" value, and they are listed top to bottom, sample 1 to 5.*

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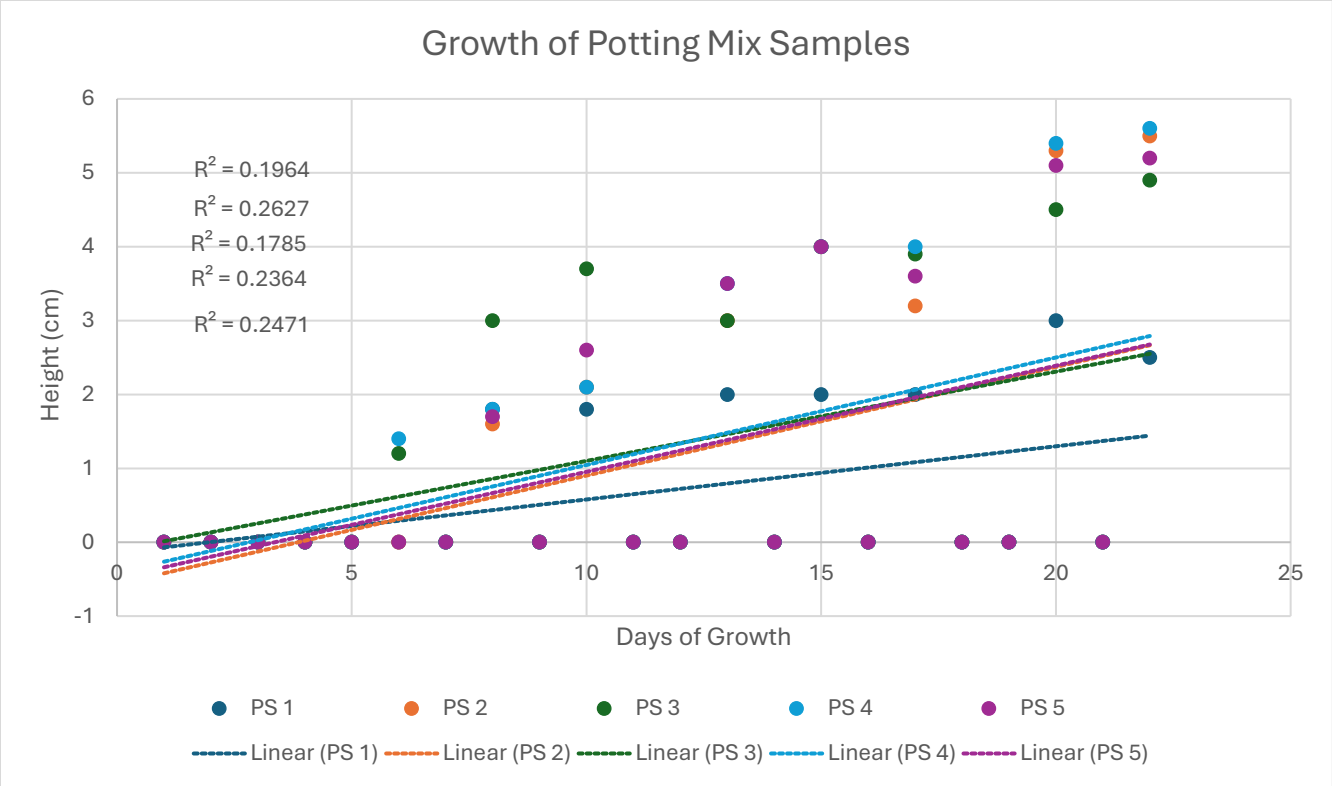

Figure 2: *This graph shows the growth of each sample of Zinnias in the Miracle Grow Potting Mix. The points plotted show the height of each plant on the days they were measured. There is a trend line for each sample to show the growth rate over time for each sample. Then for each line there is an "R^2" value, and they are listed top to bottom, sample 1 to 5.*

DISCUSSION

Through research, our study has concluded that the regular Miracle Grow Potting Mix is the best at maintaining higher growth rates while also projecting more plant quantities when compared to the other types of soil. This was found rather surprising when compared to the other soils which were specially adapted for both moisture control and seed starting specifically. This rapid growth and large quantity are likely due to additives in the soil. Additives such as peat moss controls moisture, where too little will keep little hold on water while a large amount will keep hold the water well. The regular Miracle Grow Potting Soil holds a balanced amount compared to both the seed starting and moisture control mix. The amount of Nitrogen found in the regular potting mix could also explain the faster growth as well. When potting soil has a balanced amount of these materials, growth and quantity can improve. However, various plants may have different requirements, so picking the best soil based on the requirements of the intended plant will generate the best rates of growth. Zinnias were the best plant for this project because of their fast germination periods. This study looks at the average plant requirements and rules that Miracle Grow Potting Mix is the best source of soil when starting plants.

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