INTERNATIONAL BACCALAURET DIPLOMA PROGRAMME

BIOLOGY
EXTENDED ESSAY

Word Count:3855

Research Question: How does the agricultural technique (hydrophonic and soil) effect on the harvesting time of strawberry (fragaria) plant?

Table of Content

1.INTRODUCTION

Growing up, I and my cousins had a strong affinity for agriculture because to the legacy our senior family members left us, especially our grandfather who worked as an agricultural engineer. Over the years, he actively participated in many agricultural activities and conducted research in our nation, gaining considerable knowledge and skill in agricultural engineering. Furthermore, he was afforded the opportunity to investigate various farming methods via his global travels. During a particularly special family trip to the Netherlands, my grandfather took advantage of the chance to introduce us to cutting-edge farming methods. I look back on that experience with a fresh appreciation and understanding, even if at the time I was a young person and didn't care. My interest in modern agricultural methods, especially aqua farming, was sparked by the sight of agricultural farms incorporated into the aquatic environment. I had the false idea about people who never spoke and never get involved in problems or difficulties after this occurrence.It's incredible how writing can force me to concentrate on the trip and give me the impression that I'm experiencing it all over again when I write for extended periods of time. My research will look into and distinguish between the potential productivity and efficacy of an aqua-farming approach, a cutting-edge agricultural system that is used in many nations worldwide, and the conventional soil farming techniques that have been a major part of my family's history. This experiment, which is motivated by my grandfather's narrative, will lead the field of agricultural advancements. Additionally, I am eager to investigate this experiment, which is motivated by my grandfather's narrative, will lead the field of agricultural advancements. Furthermore, since this comparison research includes our early years, I'm eager to learn more about the subtleties of cotton growing that bring those forgotten days from our youth to life. This research informs me about the ways in which agriculture may bridge the gaps between tradition and industrialization while also honoring my grandfather's history and educating us on aspects of agriculture that we may not be familiar with.

1.1 Agricultural Technique/Reason:

For this specific study, the strawberry plant (Latin name: Fragaria) was chosen by the scientific purposes. The goal to get the respective results by means of the technical levels influenced significantly in the decision process. Thae fragaria is the ideal subject to use in theories as well as research because of what comes naturally to it and how well it can be planted. First, Fragaria companies produce many variants and seedlings of creation using the selection of plants to supply the markets, thus improving it easy for individuals to cultivate their own plants as there

is variety of cultivars. Owing to this, it contributes to the exploration and hypotheses testing of scientists by giving them research possibilities that are aligned to certain experimental designs and research goals. Moreover comparative studies might be facilitated due to availability of a variety of cultivars which in impact the versatility of study of growth patterns, yield, and influence of different approaches on plant growth respectively. In addition to this, Fragaria is a valuable object of study because of relatively great variety of different environments for growing of which it even has an integrated protection system. The fact that Fragaria is appropriate for experiments in a number of agricultural settings is due to its wide adaptability to countryside temperatures and types of soil, but the other crops require certain environmental factors for optimum growth, which they, of course, cannot survive everywhere. This gives liberal students the ability of looking at a lot of essential environmental conditions that affect plant growth, physiology, and output. When we come to harvesting and productive times, Fragaria, due to its technical side, is superior to both of its closest competitors. The seedy generation process versus that of strawberry seeds is a speedy procedure in comparison to most other crop growing. The pace of experimentation is accelerated by this quick propagation cycle, which also enables researchers to carry out more trials in less time. Furthermore, Fragaria grows rather quickly; harvestable material can usually be obtained 7 to 8 weeks following planting. The short time lag between planting and harvesting improves research study efficiency and provides rapid information on plant growth, fruiting patterns, and production potential.

1.2 Environmental Reason:

From a scientific point of view, one of the reasons why the Fragaria plant was chosen is because it is a plant that is known to be susceptible to soil-borne pathogens and nematodes. yield and vegetative losses. To combat these, before planting disinfecting the soil in various ways is required. For this purpose, strawberry soil disinfection in cultivation areas methyl bromide has been widely used. However, methyl bromide can damage the ozone layer. and the use of these products in groundwater, soil and cultivated because it causes bromine residue in products in many countries in 2015, and in our country in 2008 as per the Montreal Protocol as of prohibited for use. (Kaynakça ver).

1.3 About Methyl Bromide in Agriculture:

Agriculture has traditionally used methyl bromide (CH3Br) as a strong soil fumigant to fight diseases, weeds, and pests. Its efficacy does, however, come at a high environmental cost. Methyl bromide is categorized as an ozone-depleting substance (ODS) and has been subject to regulation under the Montreal Protocol because of its contribution to the thinning of the ozone layer when emitted into the atmosphere. Because of its extreme volatility and persistence, it can remain in the atmosphere for weeks or months at a time, which contributes to its widespread distribution and exacerbates the ozone hole. Furthermore, because methyl bromide can seep into the soil and contaminate groundwater, creating hazardous byproducts, it poses a concern to ecosystems found in soil and water. Methyl bromide exposure is hazardous to the human health checking the developments of acute poisoning, neurological complaints and respiratory irritation. Recognizing the dangers, the manufacture of substitutes as well making laws to conduct gradual reduction of using it has been put in force. Among these, organic farming is thought to be a credible and true solution to environmental and public health problems in agriculture; hence safer alternatives such as biological control agents, integrated pest management systems, and alternative fumigants are being encouraged. This highlights the significance of sustainable pest control practices through which international collaboration plays a key role. The sprouting process will be done with cotton, and the seedling growing will take place in the soil and a petri dish full of water.

2.METHODOLOGY

2.1 Aim and Research Question:

The main purpose of this research work is to value hydroponics and soil cultivation under normal conditions. The main driving force of this research is the necessity to discover whether the application of hydroponic methods can substitute traditional soil agriculture, facilitating the problem of fertilization and agrochemical use to excessive production on soil health. By comparing the growth rates of plants cultivated through hydroponics and soil farming, this research aims to ascertain whether hydroponics can offer comparable or superior rates of plant growth while reducing the reliance on synthetic fertilizers and minimizing environmental degradation. Through systematic analysis of key growth parameters, including plant height, biomass accumulation, and yield, this study seeks to provide empirical evidence on the efficacy of hydroponics as a sustainable cultivation method. Ultimately, the findings of this research endeavor aim to inform agricultural practices and contribute to the ongoing discourse on

sustainable farming solutions. Therefore upon this paper I will focus on the research question of:

"**How does the agricultural technique (hydrophonic and soil) effect on the harvesting time of strawberry (fragaria) plant**?" My hypothesis for this research question is that hydrophobic will have a much faster effect with my previous knowledge of agriculture with soil. The reason behind this is that the seedlings will always grow in an oxygen-rich environment, especially thanks to the water engine, and will not need additional water nutrients.

The aim of this paper will be on evaluating the results of the experiment conducted and drawing a conclusion upon the validity of the evaluations.,

2.2 Hypothesis

"**How does the agricultural technique (hydrophonic and soil) effect on the harvesting time of strawberry (fragaria) plant?"**

2.3 Method Development and Planning:

a. Seeding:

Design an appropriate method to support or reject the proposed hypothesis and answer the following questions This research question posed many challenges. The first was the design of the research. Conducting an adequate experimental system for both farming systems. The first step was to complete the process of sprouting strawberries from their seeds. The importance of this step was to grow my own seedlings in the experiment. At this point, I did my research and found that cotton would create the most favorable conditions for the growth of strawberry seeds, and then the germinated seeds would be used in the seedling stage in the presence of soil and additional nutrients. These additional nutrients are various trophs, perlite, boiled eggshell, coconut peat and vermiculite. At the same time, I also found out that these germinated seeds should be transferred to voyils with soil and should be grown in a bright environment with an optimal temperature of 18-22 degrees.

b. Hydrophonic Agriculture:

One of the most important points was to carry out the detailed research necessary for aquatic agriculture. This was because I was unfamiliar with hydroponics and the optimal temperature and brightness of the strawberry plant for flowering and harvesting is only available for a short season. As a result of my research, I realized that I needed styrofoam, net pots, air pump, air

stone, seedlings, nutrients A and B, pH meter, pH reducer and EC meter to set up the necessary setup for aqua farming and I procured these materials. Again, as a result of my research, I learned that the optimal EC value required for aqua farming is between 1.0 and 2.5 for strawberry plants, the temperature should not fall below 22 degrees, and the pH value should be less than 6.5, and that strawberry is a plant that cannot grow in calcareous soils.

c. Soil Agriculture:

Since soil farming is a procedure that I am more familiar with and have experienced in the past, I was able to benefit from my past experiences. At this point, I had no materials to use other than 5-liter test pots for soil cultivation, fertilizer to replace the A and B nutrients used in hydroponics, and saplings. However, as a result of my research, I learned that 1 gram of fertilizer can be mixed with 1 liter of water for a 5-liter pot and watered 2-3 times a day for the first three days, and I planned my irrigation plan around this.

Variables:

Table 1:Independent and Dependent Variables Table

Idependent Variables	Different agriculture techniques: →Hydrophonic Agricultural Technique: The purpose of choosing the hydroponics technique is that it is frequently used all over the world and it does not have much use in our country yet. This technique was used in this experiment because it can replace traditional agricultural techniques. Another reason for using it in this experiment is that many plant species can be grown using hydroponics techniques. →Soil Agricultural Technique (Traditional) It was chosen because it is a traditional technique used in our country and around the world and it has the advantage of being used as a control group against hydroponics. Since this technique is both well-known and

	frequently used, it is expected to being replaced by hydroponics.
Dependent Variables	Flowering and fruiting (harvest) speed of the strawberry plant. This process will be obtained by daily process monitoring of both independent test systems in the context of the same conditions.

Table 2:Controlled Variables Table for Pre-Seeding in Cotton Environment

Controlled Variable	Significance	Method
Humidity	Seeds collect their nutrients in the first stage by taking advantage of the moist environment. The humidification process is important for the nutritional purposes of the seeds during the germination process.	Drinking water is applied to the cotton mechanism set up for germination with the help of a bottle every 12 hours.
Temperature	It enables the activation of enzymes and accelerates metabolic activity, initiating the germination process of seeds. As a result, it ensures healthy growth of seeds and increases the rate of chemical reaction. Optimal efficiency, basic competence is crucial. Energy is vital, correct control of temperature for success in the germination process.	In order to maintain the required temperature of 20-22 degrees for germination, the germination medium was kept on a heating device that provided this temperature.
Light	Light is a critical factor in the germination process. At first,	Regardless of day or night, the germination environment

	it creates a stimulating signal for the growth of seeds. Seeds can be light sensitive, and light initiates or completes the germination process. It is a source of energy for plant growth and enables food production through photosynthesis. Light is important for plant development and healthy growth.	created in cotton was kept in optimal 12-hour daylight every day, and during the remaining period, it was kept in a dark night environment.

Table 3:Controlled Variables for Post-Seeding in Cotton Environment

Controlled Variable	Significance	Method
Nutrients	Additional nutrients placed in the soil play an important role in meeting the necessary nutrients and needs during the seedling process after germination of the seeds.	→ Trophs and Perlite: It is used to aerate the soil. →Boiled Eggshell: It is used for the magnesium needed for the growth of soil and plants. →Coconut Peat Trophs: It is used to strengthen and accelerate the root development of the plant. →Vermiculite: It increases the water retention volume of the soil and accelerates root development. In addition, it provides the magnesium that the soil and the plant need.

Humidity	It provides moisture to the seeds, ensures proper development of the embryo and initiates metabolic activity. Without water, seedling may fail.	In the first three days, 2-3 times a day. Afterwards, the moisture value was optimized by irrigation with drinking water 3 times a week.
Light	It played an important role in the process of photosynthesis in order for germinated seeds to produce food for themselves during the seedling process.	Regardless of day or night, the germination environment created in soil was kept in optimal 12-hour daylight every day, and during the remaining period, it was kept in a dark night environment.
Temperature	In seedling, heat initiates and accelerates the germination process of seeds. Optimal temperature promotes metabolism by increasing enzyme activity and is necessary for healthy seedling. At this point the optimal temperature is between 18--22 degrees.	In order to maintain the required temperature of 18-22 degrees for seedling, the germination medium was kept on a heating device that provided this temperature.

Table 4: Controlled Variables for Hydrophonic Agriculture

Controlled Variables	Significance	Method
Nutrition	The fact that the seedling receives the necessary nutrients in the aquatic environment (excluding water) accelerates and strengthens the process in which the seedling receives	Nutrients A and B, which are called general nutrients used in hydroponics, were added to the strawberry within the optimal EC value of 1.0-2.5, once a week, by checking it with an EC meter.

	the nutrients it needs for both the plant to bloom and produce products in the future.	
pH	Because pH controls how acidic or alkaline the soil or nutrient solution is, it is significant for plant growth. Plants absorb nutrients based on the pH of the soil, and plants can better absorb nutrients when the pH of the soil is at the right level. Plant growth can be adversely affected by acidity, which can lead to toxicity or nutrient shortages.	An attempt has been made to achieve a pH value of 6-7, which is the optimal value in strawberry farming. A pH reducer was used at points where the pH value was high. This pH control was done with a pH meter every 3 days.
Light	Light is essential for photosynthesis in hydroponics, enabling plants to produce food and promoting growth. It also influences plant development, flowering, and fruiting. Thus, maintaining proper light levels is crucial for plant health and productivity.	Regardless of day or night, the growing environment created in water was kept in optimal 12-hour daylight every day, and during the remaining period, it was kept in a dark night environment.
Temperature	In hydroponics, heat affects the metabolic activity of plants and is necessary for basic processes such as photosynthesis. Optimal	In order to maintain the required temperature of 22-26 degrees for growth, the hydrophonic system was kept

	temperature promotes plant growth and is important for healthy development.	on a heating device that provided this temperature.

Table 5: Controlled Variable for Soil Agriculture

Controlled Variables	Significance	Method
Nutrition	The fact that the seedling receives the necessary nutrients in the aquatic environment (excluding water) accelerates and strengthens the process in which the seedling receives the nutrients it needs for both the plant to bloom and produce products in the future.	Nutrients A and B, which are called general nutrients used in hydroponics, were added to the strawberry within the optimal EC value of 1.0-2.5, once a week, by checking it with an EC meter.
pH	Because pH controls how acidic or alkaline the soil or nutrient solution is, it is significant for plant growth. Plants absorb nutrients based on the pH of the soil, and plants can better absorb nutrients when the pH of the soil is at the right level. Plant growth can be adversely affected by acidity, which can lead to toxicity or nutrient shortages.	An attempt has been made to achieve a pH value of 6-7, which is the optimal value in strawberry farming. A pH reducer was used at points where the pH value was high. This pH control was done with a pH meter every 3 days.
Light	Light is essential for photosynthesis in	Regardless of day or night, the growing environment

	hydroponics, enabling plants to produce food and promoting growth. It also influences plant development, flowering, and fruiting. Thus, maintaining proper light levels is crucial for plant health and productivity.	created in water was kept in optimal 12-hour daylight every day, and during the remaining period, it was kept in a dark night environment.
Temperature	In hydroponics, heat affects the metabolic activity of plants and is necessary for basic processes such as photosynthesis. Optimal temperature promotes plant growth and is important for healthy development.	In order to maintain the required temperature of 22-26 degrees for growth, the hydrophonic system was kept on a heating device that provided this temperature.

Risk Assesment:

Table 6: Risk Assesment Table

Hazards	Precaution
Ethical	An embryo was present in the plant seeds used in the experiment. Therefore, the experiment involved the usage of living things. The seeds, however, were provided expressly for the study and did not alter the ecosystem's integrity. A botanist stabilized the type and amount of fertilizer for the vegetation grown after the experiment was conducted to guarantee the health and safety of the living organism—in this case, the plant grown from seed.

Environmental	The environmental concern was the plastic waste generated during the stages of this experiment. The extra plastic waste generated during both germination and growing the seedlings was arranged and used so that it could be reused later.
Safety	Chemicals were used in the experiment (fertilizer and nutrients). While these products were prepared and added as a mixture in water, they were always used outdoors with gloves and clothing that would cover the entire skin.

2.4 Methods and Diagrams:

Materials and Apparatus:

→For Seeding Process:

1. Strawberry fruit.
2. 1 liter container
3. Cotton (100 gr)
4. Spray Bottle
5. Drinking water (5 Liters)
6. Thermometer ($\pm 0.05°C$)
7. Stretch film
8. Nutrients For Post-Seeding (Trophs,Perlite,Boiled Eggshell,Coconut Peat Trophs,Vermiculite)

→For Hydrophonic Agriculture:

1. Styrofoam
2. Net Pots
3. Air Pump
4. Air Stone
5. Seedlings
6. Nutrient A
7. Nutrient B

8. pH meter(±0.05℃)
9. pH reducer
10. EC meter(±0.05℃)
11. Thermometer(±0.05℃)
12. Drinking Water
13. 1 liter container
14. Seedling

→For Soil Agriclture:

1. Electronic Scale (±0.05℃)
2. 5 liter container
3. Thermometer(±0.05℃)
4. Fertilizer (2 gr)
5. Drinking Water
6. Soil with trophs
7. EC meter(±0.05℃)
8. Seedling

Procedure:

Outline:

The general procedures of this experiment can be described in 2 main stages. In the first stage, seeds were obtained from the strawberry fruit and the germination of the seeds was ensured by obtaining the right environment. Then, as a continuation of the seedling stage, this stage will be completed when the germinated seeds become seedlings in the fertile and high-nutrient soil environment obtained with mixtures. In this procedure, which includes flowering and fruiting stages in the water and soil environments where the experiment will be compared, after the necessary environment and conditions for water and soil cultivation are prepared, 15 test subjects are prepared for both environments and the flowering and fruiting times are compared and monitored.

Steps of Procedure:

For Seeding:

a. Pre Seeding:

Seeds carefully removed from the strawberry fruit with the help of tweezers are placed inside the cotton medium moistened with drinking water into the cotton and moist environment storage container where the strawberry seeds will be kept for germination. After the top of the container is tightly covered with stretch film, a few small holes are opened on it to allow the seeds to breathe. This partially covered box is then placed on a heating device where the optimal temperature can be achieved and then left to germinate. Moisten the container with drinking water every 3 hours. This process continues until germination occurs, and in my experience this process took about ... days.

b. Post-Seeding:

Germinated seeds are planted in nutrient-rich and aerated soil consisting of mixtures of ..... and while they are irrigated with drinking water 2-3 days a week during the week of planting, in order for them to become seedlings, they are watered with drinking water only 2 days a week during the period it takes for them to become seedlings. . During the seedling formation process, they benefited from sunlight, and since the planting time was summer, the seeds were exposed to approximately 11 hours of sunlight per day. Another factor was temperature. Efforts have been made to keep the seeds at optimal temperature values by taking advantage of open air. An average of 50 germinated seeds were used to form seedlings, and only 37 of them successfully became seedlings.

Hydrophonic Agriculture:

The first step in order to do hydroponics was to obtain the materials completely. Afterwards, I will place the strawberry plants that have become seedlings in mesh pots, and I used styrofoam to place the pots on a border where only their roots will touch. I prepared this shelf system by cutting circles with the diameters of the mesh pots so that the styrofoam shelf could fit neatly inside the box. Then, I added drinking water into this light-proof box. After cutting the Styrofoam, the next step was to add the required nutrients A and B to the water at slightly less than optimal levels of 1.0-2.5 (After the first week, EC values were gradually increased with A and B nutrients). After adding these nutrients, I measured the nutritional value with an EC meter and made the necessary changes. After this stage, I measured the pH values of the water and made the necessary checks again. Finally, after adjusting the air pump that will provide constant oxygen to the plant roots, I also put the air stone into the box. As the last step, I put the strawberry seedlings in mesh pots and placed them on the styrofoam shelf. After these steps, I placed the boxes containing the strawberry

seedlings in places that would receive sunlight and followed the flowering and fruiting times of the seedlings by measuring both pH and EC values every 3 days.

Soil Agriculture:

The pots in which the seedlings will be placed are placed in 5-liter pots, with half of the normal and trophic soil. In this type of agriculture, unlike hydroponics, fertilizer that replaces nutrients A and B is prepared by mixing it with water. For this mixture, approximately 2.5 grams of fertilizer is added to 1 liter of water and mixed; The EC values (1.6) of this mixed water are measured when it is prepared and necessary changes are made to ensure that it is at optimal rates. This water is used during the first week of irrigation 2-3 times a day. As the last stage, the seedlings are planted in the mixed soil we have prepared and after the first water is given, the pots are placed in a place with optimal temperature and sunlight. Furthermore, the flowering and fruiting times of the seedlings are followed.

3.RESULTS

3.1 Raw Data Table:

Table 7: Raw Data Table Showing the Results of The Flowering and Fruiting Time

Independent Variable	Trial Number	Flowering Time (days)	Fruiting Time (days)
Soil Agriculture	1	15	29
	2	14	20
	3	17	28
	4	19	25
	5	16	29
	6	17	23
	7	17	21
	8	18	29
	9	20	27
	10	14	19
	11	17	24
	12	16	26

	13	22	30
	14	16	29
	15	18	29
Hydrophoic Agriculture	1	17	20
	2	24	25
	3	20	22
	4	17	18
	5	22	21
	6	19	24
	7	22	18
	8	19	22
	9	21	17
	10	25	21
	11	20	19
	12	18	21
	13	20	20
	14	19	23
	15	18	21

3.2 Data Processing

Sample Calculation for The Mean Amount of Days for Flowering:

$$\frac{The\ sum\ of\ Flowering\ time\ in\ days\ for\ Soil\ Agriculture}{The\ number\ of\ trials}$$

$$= The\ mean\ of\ flowering\ time\ for\ soil\ agriculture$$

$$= 17\ days$$

$$\frac{The\ sum\ of\ Flowering\ time\ in\ days\ for\ Hydrophobic\ Agriculture}{The\ number\ of\ trials}$$

$$= The\ mean\ of\ flowering\ time\ for\ hydrophobic\ agriculture$$

$$= 19\ days$$

*Graph Calculation for The Mean Amount of Days for Flowering (Soil Agriculture):

$$\frac{\frac{1}{15}+\frac{1}{14}+\frac{1}{17}\ldots+\frac{1}{22}+\frac{1}{16}+\frac{1}{18}}{15}=0.05943..$$

*Graph Calculation for The Mean Amount of Days for Flowering (Hydrophobic Agriculture):

$$\frac{\frac{1}{17}+\frac{1}{24}+\frac{1}{20}\ldots+\frac{1}{20}+\frac{1}{19}+\frac{1}{18}}{15}=0.05045..$$

Sample Calculation for The Mean Amount of Days for Fruiting:

$$\frac{The\ sum\ of\ Fruiting\ time\ in\ days\ for\ Soil\ Agriculture}{The\ number\ of\ trials}$$
$$=The\ mean\ of\ fruiting\ time\ for\ soil\ agriculture$$
$$=29\ days$$

$$\frac{The\ sum\ of\ Fruiting\ time\ in\ days\ for\ Hydrophobic\ Agriculture}{The\ number\ of\ trials}$$
$$=The\ mean\ of\ fruiting\ time\ for\ Hydrophobic\ agriculture$$
$$=21\ days$$

*Graph Calculation for The Mean Amount of Days for Fruiting (Soil Agriculture):

$$\frac{\frac{1}{29}+\frac{1}{20}+\frac{1}{28}\ldots+\frac{1}{30}+\frac{1}{29}+\frac{1}{29}}{15}=0.03949..$$

*Graph Calculation for The Mean Amount of Days for Fruiting (Hydrophobic Agriculture):

$$\frac{\frac{1}{17}+\frac{1}{24}+\frac{1}{20}\ldots+\frac{1}{20}+\frac{1}{19}+\frac{1}{18}}{15}=0.04860..$$

Standard Deviation Calculation for the flowering time of soil agriculture and hydrophobic:

$$s=\sqrt{\frac{1}{N-1}}\sum_{i=1}^{N}(x_i-\bar{x})^2$$

For Soil Agriculture:

$$=\frac{(15-17.066)^2+\ldots+(18-17.0666)^2}{15-1}$$
$$=\frac{64.9333}{14}$$

$$= \sqrt{4.6380952380952}$$
$$= 2.1536237457122$$

For Hydrophonic Agriculture:

$$= \frac{(17 - 20.066666666667)^2 + \ldots + (18 - 20.066666666667)^2}{15 - 1}$$
$$= \frac{78.933333333333}{14}$$
$$= \sqrt{5.6380952380952}$$
$$= 2.3744673588187$$

Standard Deviation Calculation for the fruiting time of soil agriculture and hydrophobic:

For Soil Agriculture:

$$= 3.6813558578846$$

For Hydrophonic Agriculture:

$$= 2.2424476423256$$

Processed Data Table 1: The Means of Flowering and Fruiting Time for Soil and Hydrophobic Agriculture

Independent Variable	Mean for Flowering (days)	Mean For Fruiting (days)
Soil Agriculture	17	29
Hydrophobic Agriculture	19	21

* Processed Data Table 2: The Means of Flowering and Fruiting Time for Soil and Hydrophobic Agriculture Graphs

Independent Variable	Mean for Flowering (days)	Mean For Fruiting (days)
Soil Agriculture	0.05943	0.03949
Hydrophobic Agriculture	0.05045	0.04860

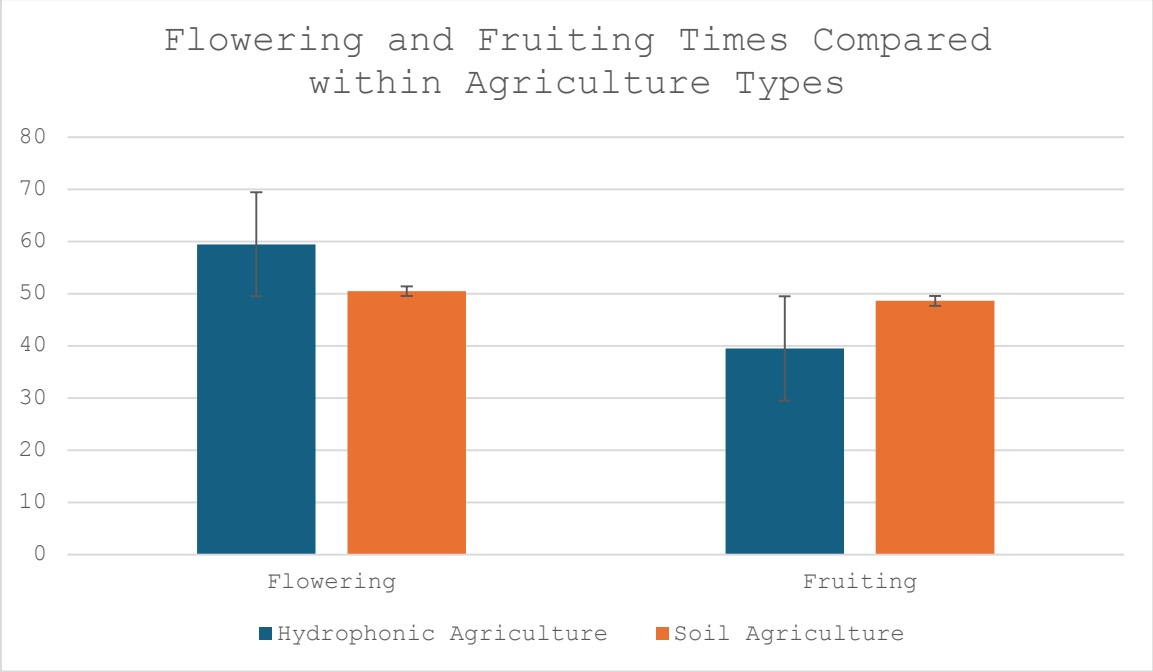
*In order to be proportional to the day calculation graphics, the average is inverted and included in the averaging process. The underlying reason for doing this is that a variable with a value of 17 on the chart looks more effective than one with a value of 15. But in reality, the data with a lower average is more effective because the plant has reached this stage in a much shorter time.

Processed Data Table 3: The Standard Deviations of Flowering and Fruiting Time for Soil and Hydrophonic Agriculture

Independent Variable	Mean for Flowering (days)	Mean For Fruiting (days)
Soil Agriculture	2.15	3.69
Hydrophobic Agriculture	2.37	2.24

3.3 Graphs

* Since the values were very small, all values were multiplied by 1000 when making the graph.



4 DISCUSSION, EVALUATION and CONCLUSION

4.1 Discussion and Evaluation

4.1.1 Strengths:

There are many strengths in this research. These aspects both made the experiment stronger and made my job much easier during the construction and writing phase of the research. The first strength of the experiment was that the plants used in the experiment were obtained from seeds and even the germination stage was done by me. The reason why this was a strength was that each plant was grown equally and under the same conditions in the first stage. This equality affected the absence of any biased or more advantageous features. Another strength of this research is that the season in which this

experiment was conducted is the most suitable time for the cultivation of strawberry plants. At this point, timing and planning have been adjusted to be most suitable for this experiment. Choosing a period with such a suitable season and optimal levels caused me to have no problems during the experiment, especially regarding heat and light.

4.1.2 Limitation

The most prominent element of the limitations in this experiment was that the comparison of fruiting and flowering rates between hydroponics and soil cultivation was done with only one plant species. Although hydroponics showed a faster effect in the experiment, especially in terms of harvest, this speed comparison was made only on strawberry plants. As a result, it has created a partial obstacle to generalization. This situation can be overcome by applying the experimental setup to different plant species.

Another limitation in the experiment is that these types of agriculture were performed with a small number of subjects. An experiment conducted with more subjects will provide a clearer answer to this research question. The reason for the low number of subjects is the plants that were not fully grown when the seedlings were created. Difficulties at this point can be overcome by preparing more and more carefully seedlings.

4.2 Conclusion

The study examined the relative impacts of water and soil cultivation techniques on the growth patterns of strawberry plants, with a particular emphasis on flowering and fruiting periods. The results provided information on the various effects of these cultivation methods. Interestingly, soil cultivation was the most effective way to speed up the fruiting process, even if hydroponic cultivation showed a tendency to speed up the flowering phase of the strawberry plant.

Interestingly, out of time of seeding to harvest, soil agriculture has been faster over hydroponics and brought an quick growth rate. The result shows that this process supports plants growth and stimulates crop yield by the performance and the rate of soil systems. Moreover, it specified the wider limits which these grows have, and not the only question of the time. History has documented that soil-based intensive agriculture has been the conventional practice, but hydroponics is emerging as a disruptor of this traditional norm. In contrast to conventional farming, hydroponics systems decrease the probability of

adverse circumstances like deficiencies in vital nutrients and soil-borne diseases by giving plants a more regulated and optimal environment for growth.

Furthermore, the resource efficiency of hydroponics, which uses less water and chemical fertilizers, reduces the ecological imprint of conventional soil-based agriculture. Because of this, it is important to consider how hydroponics affects the ecosystem. This demonstrates the second facet of sustainability, which indicates how hydroponics is set to transform food production and significantly contribute to environmental preservation.

In conclusion, soil cultivation may hasten strawberry plants' flowering period; nonetheless, hydroponics would be a far better choice in terms of overall growth progress and environmental sustainability. The findings of this study highlight the significance of taking into account different agricultural practices, regardless of whether environmental circumstances are changing or increased food resource output is required.

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