**Green Team Elementary STEAM Project**

**Design of Experiment**

***Sponsored by the Daniel Boone High School’s***

***Supersonic Hydroponics and First Class Biogas***

***Green Team Divisions.***

This Design of Experiment (DOE) details the activities associated with the Hydroponics and Traditional Gardening experiments/activities. This DOE will detail the responsibilities of the student researchers and the data they should collect in order to draw conclusions pertaining to their research.

For background information on the Hydroponics Project, please see the following webpage:

<http://supersonic-hydroponics.weebly.com/>

**Materials Included**

Seed Starter System

Potting soil – commercial

Potting soil – “Birdsboro Red”

Potting soil – Mix commercial/“Birdsboro Red”

Transplant Pots

Water – Rain

Water – Pipe

pH Kit

Hydroponics Reactors

Hydroponics Pots

Hydroclay

Live Plants

**Experiment 1 - Traditional Gardening Experiment/Activity**

Your research team will begin by planting seeds (tomatoes, pepper, and lettuce) into three different potting soil types: commercially obtained, “Birdsboro Red,” and mix commercial/“Birdsboro Red.”

You will plant twelve (12) total seeds of each plant variety assigned to your research team. Four (4) seeds will be planted in commercial potting soil, four (4) seeds will be planted in “Birdsboro Red” potting soil, and four (4) seeds will be planted in mixed commercial/“Birdsboro Red” potting soil. If a seed fails to germinate, then record this data in the log detailed below and plant an additional seed in its place.

You will water six (6) of these seeds (two (2) in each soil type) using pipe water from your school’s water system. You will water six (6) of these seeds (two (2) in each soil type) using pipe water using the rainwater provided with your research kit. It is also suggested that your students obtain rainwater from their homes for the project. The water may be transported to school in any clean one gallon jug. You will continue watering your seeds and plants as needed with the same type of water throughout the duration of your experiment.

Once your seedlings have reached the appropriate height, you will transplant them into larger pots, using the same soil type, in order to accommodate the expanding root system.

***1.1 - Data Collection: Daily Activity/Event Log***

You will begin by determining and recording the pH of the water (pipe and rainwater) used to water your seeds/plants. You should water your plants from a gallon jug. You will need to take the pH of your water each time you refill the jug. Record this pH in your research log on the date that you refill your jug.

Clearly label each seed/seedling/plant in such a way that the label will travel with the plant throughout the duration of the experiment. Keep a daily log noting significant events in the life cycle of the plant. Significant events could include, but are not limited to, the following:

Watering

Soil type

Seed Planting

Plant emersion

Daily plant height in centimeters

Date transplanted

Death of plant

Plant condition (wilted, normal, spotted leaves, dry appearance, ….)

Plant injury (broken stalk, torn leaf,…)

Other

Record all data in the *Traditional Garden Experiment Log Book* MS Excel spreadsheet.

***1.2 - Data Collection:*** ***Height Measurements***

Record the height of the plants on a daily basis even if there is no apparent change in plant height. If the seed has not sprouted and the plant has not emerged, then record the plant height as “0.00.”

Record this data in the *Traditional Garden Experiment Log Book* MS Excel spreadsheet.

***1.3 - Conclusions:***

Based upon your collected data, make conclusions about your experiment. Your conclusions may include, but are not limited to, the following possible outcomes.

Which soil type was the best soil type? Justify your reasons for selecting this soil type.

Which water source promoted the best plant growth? Explain your answer.

What other conclusion can your team reach about your project?

**Experiment 2 - Hydroponic Gardening Experiment/Activity**

Your research team will receive two four-hole hydroponic bioreactors, eight plastic hydroponics pots, hydroclay, a pH test kit, and eight plants ready to be transplanted into the bioreactors.

Fill the bioreactors with water. One of the bioreactors will be filled with pipe water, and the other reactor will be filled with rain water.

Remove the plants from the dirt and rinse the roots clean removing all soil from the roots. Next, hold the plants’ roots above the bottom of the cup and drop the hydroclay balls around the roots until the plant is completely supported by the hydroclay.

Insert the pots into the large holes on the bioreactors. You will need to change the water in the bioreactors once per week.

***2.1 - Data Collection: Daily Activity/Event Log***

Clearly label each hydroponics pot in such a way that the label will travel with the plant throughout the duration of the experiment.

Keep a log of all activities your team carries out on the plants in your bioreactor. These activities can include, but are not limited to, the following: adding or removing water, pH measurements, significant changes in plant appearance, bioreactor water temperature, plant height, ….

Record all data in the *Hydroponics Experiment Log Book* MS Excel spreadsheet.

***2.2 - Data Collection:*** ***Height Measurements***

Record the height of the plants on a daily basis even if there is no apparent change in plant height. Record this data in the *Hydroponics Experiment Log Book* MS Excel spreadsheet.

***2.3 - pH & Temperature Measurements:***

Record the pH and temperature of the water on a daily basis. Record this data in the *Hydroponics Experiment Log Book* MS Excel spreadsheet.

***2.4 Conclusions:***

Based upon your collected data, make conclusions about your experiment. Your conclusions may include, but are not limited to, the following possible outcomes.

Which water type resulted in the best plant growth? Justify your reasons for selecting this soil type.

Which growth medium, water or soil, produced the best results? Explain your answer.

How did the pH of the water influence your results?

What other conclusion can your team reach about your project?

***Green Team Photographic/Video Consent Form***

Dear Parents,

The purpose of this form is to obtain your consent to photograph or videotape your student in the course of their participation as a special ***Junior Researcher for the DBHS’s Award Winning Green Team***. Please indicate your consent to have your child photographed/videotaped for the purposes indicated below by checking the appropriate box(es). If you wish not to have your child photographed, then please indicate your desire below.

**Please write in pen.**

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Print Student’s Name Print Parent’s Name Parent’s Signature

 Please do not photograph or videotape my student.

 You may photograph my child and place the pictures on Daniel Boone and on the Green Team Webpages.

 You may photograph my child and use the pictures in current and future grant applications that will help support Green Team activities.

In addition to requesting your consent to photograph and to publish your child’s picture as indicated above, this form also requests your permission to have your student interviewed for future press releases relating to the Green Team’s activities. These activities also include grant applications which have provided the funding for this current project and which will help document the activities for future grant applications. Students’ full names will be included in any interviews.

 Please do not photograph or interview my student for publication in any newspaper or news program.

 My Student may be photographed and interviewed as indicated above for publication in the newspaper.

 You may videotape my student for publication on news reports or for grant application purposes.

Thank you,

Mr. Shannon W. Helzer Mr. Sid Harwood