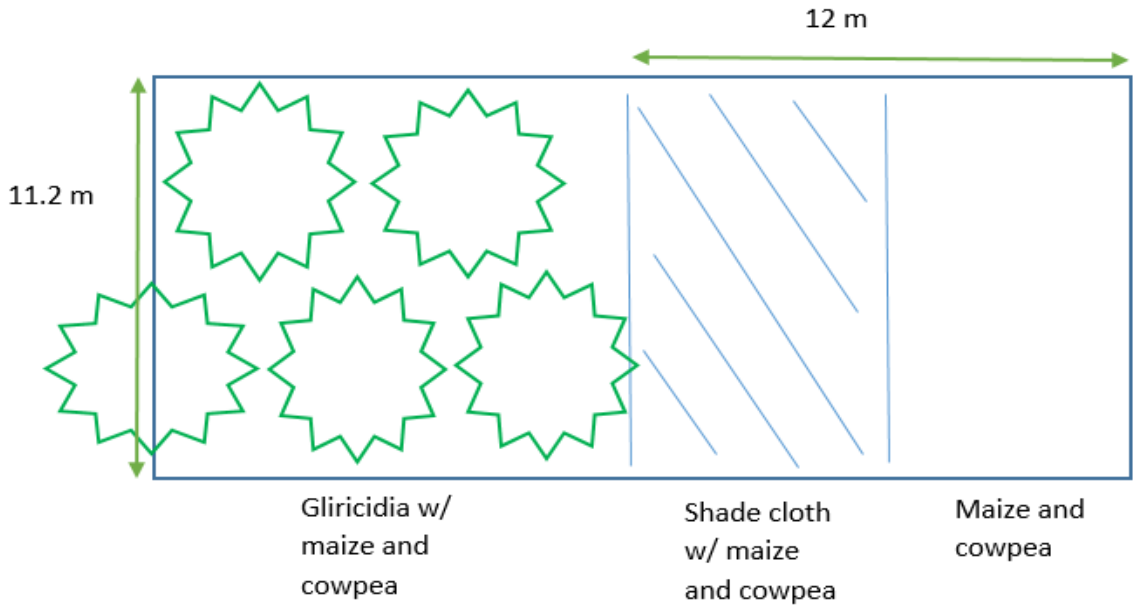
Designing Experiments



Ideas for ECHO Post-Field Trip Activities

Thank you for visiting ECHO Global Farm with your students. This document contains an "Idea Bank" from which you may feel free to "copy and paste" into your own worksheet format, Smart Board page, or digital document to be projected on a classroom screen. A worksheet and answer key are included. We hope that these materials will support your curriculum and continue the ECHO learning experience in your classroom.

Science – Designing Experiments -Activity 1

(Overview)

(Source: Inside Echo Newsletter, June 2019)

ECHO-Florida initiated a multi-year gliricidia intercropping trial. Researchers are trying to determine if the shade produced by gliricidia trees, spaced six meters apart, will affect the yield of maize and cowpea crops over time. Alternating rows of maize and cowpea were planted. The experimental design included the following: maize and cowpea planted under widely-spaced gliricidia trees, maize and cowpea planted under 30% shade cloth, and maize and cowpea alone. *(The description of the study has been modified for middle school classroom use.)*

What is intercropping? (See photos of plantings in other countries, below).

What are legumes?

Which plants in this study are legumes?

Why are legumes frequently used for intercropping?

Why is 30% shade cloth being used in one plot with maize and cowpea?

Why are only maize and cowpea planted in the third plot?

Discuss the experimental design: investigative question, variables

Using the description of the study, design an experimental plot map. Compare your completed map with the actual field trial (photos and map below).

In a spacious area on your school campus, measure out a distance of six meters, the spacing of the gliricidia trees. A research plot includes two rows of trees (5 total) and an additional 12 meters for the shade cloth with maize/cowpea and maize/cowpea alone. Try measuring out this area.

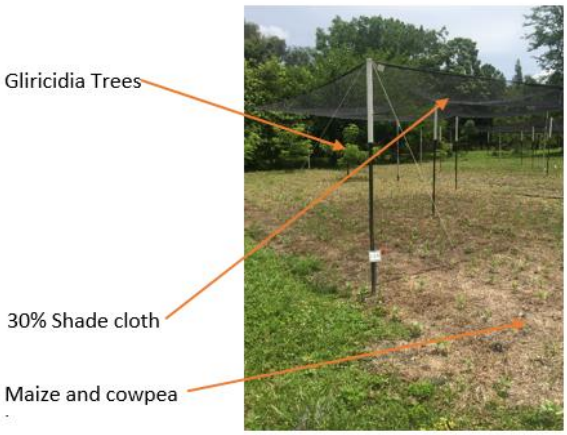
Research other uses for cowpea and gliricidia.

Images are from plantings in other countries.

Cowpea-Maize Intercropping

https://www.google.com/search?q=images+cowpea+intercropping&tbm=isch&source=iu&ictx=1&fir=Avqn73Y3l8tF6M%253A%252C0IoZLZqV3fePxM%252C_&vet=1&usg=AI4_-kQTbDKXeftbBnFoz-76SNBkBMkotw&sa=X&ved=2ahUKEwie0fmd3eHiAhVH1VkKHTOoDR0Q9QEwA3oECAcQCg#imgrc=Avqn73Y3l8tF6M: (Image source)

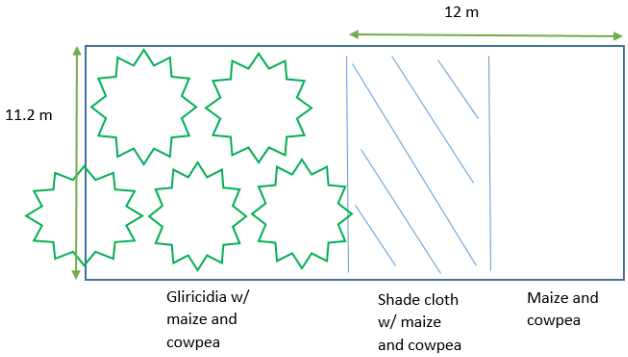
Newly planted research plots at ECHO FL June 2019



Gliricidia Trees (planted October, 2018)

Gliricidia Field Trial 07-11-2019

Gliricidia Field Trial 08-06-2019

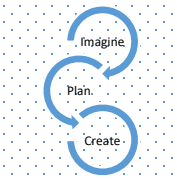


Science – Designing Experiments -Activity 2

(Overview)

ECHO-Asia Regional Impact Center would like to set up a study comparing the growth performance of pigs fed with fermented banana stalk silage and pigs fed with commercial pig food as a supplement to their regular forage (farm harvested plants) diet.

(Source: Inside Echo Newsletter, July 2019)



Design an experimental study comparing the effect of these two diets on pig growth. Include a description of the study, investigative question, variables, charts for recording data, etc.

https://www.echonet.org/the-echo-update-blog/raising-hogs-on-banana-silage-in-myanmar

Design your own experimental study to evaluate the effectiveness of two farming techniques which ECHO uses on the Global Farm.

Student pages and teacher answer key follow…

_____ _____

ECHO

_____ _____

Science – Designing Experiments -Activity 1

ECHO-Florida initiated a multi-year gliricidia intercropping trial. Researchers are trying to determine if the shade produced by gliricidia trees, spaced six meters apart, will affect the yield of maize and cowpea crops over time. Alternating rows of maize and cowpea were planted. The experimental design included the following: maize and cowpea planted under widely-spaced gliricidia trees, maize and cowpea planted under 30% shade cloth, and maize and cowpea alone.

1. What is intercropping?

   _____
   _____
   _____
   _____

2. What are legumes?

_____
_____
_____
_____

3. Which plants in this study are legumes?

_____
_____
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_____

4. Why are legumes frequently used for intercropping?

_____
_____
_____
_____

5. Why is 30% shade cloth being used in one plot with maize and cowpea?

_____
_____
_____
_____

6. Why are only maize and cowpea planted in the third plot?

_____
_____
_____
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7. Discuss the experimental design: investigative question, variables

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Cowpea-Maize Intercropping

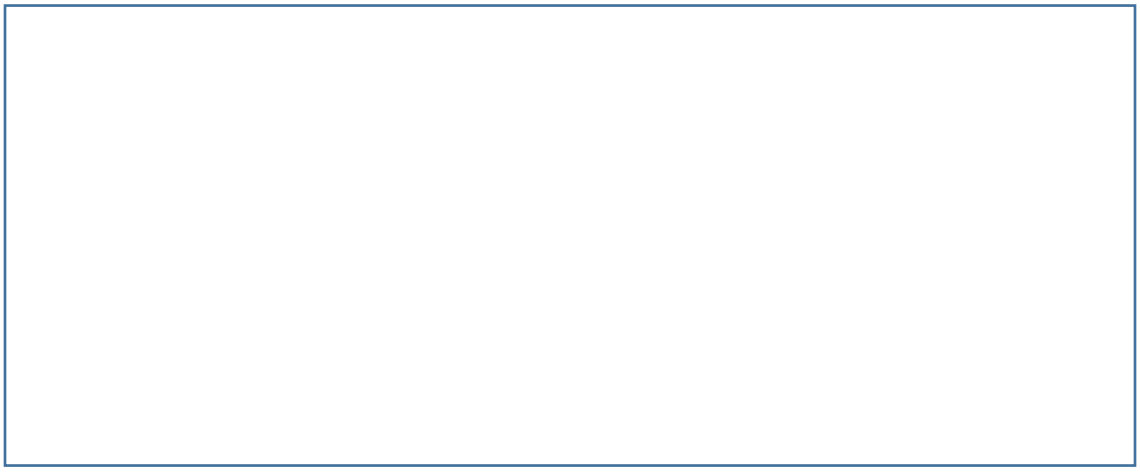
Newly planted research plots at ECHO FL June 2019

Gliricidia Trees (planted October, 2018)

Gliricidia Field Trial
07-11-2019

Gliricidia Field Trial
08-06-2019

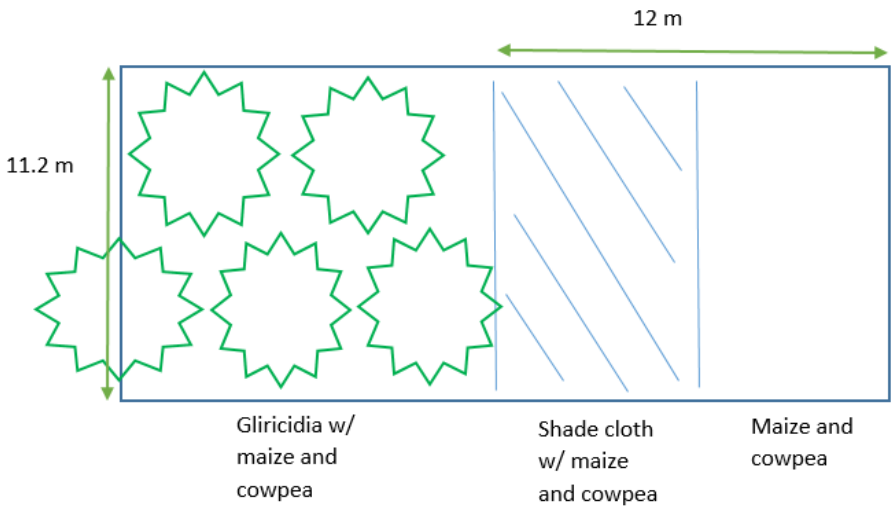
8. Using the description of the study, design an experimental plot map. Compare your completed map with the actual field trial map on the next page.



9. In a spacious area on your school campus, measure out a distance of six meters, the spacing of the gliricidia trees. A research plot includes two rows of trees (5 total) and an additional 12 meters for the shade cloth with maize/cowpea and maize/cowpea alone. Try measuring out this area.

10. Research other uses for cowpea and gliricidia.

_____
_____
_____
_____



Science – Designing Experiments -Activity 2

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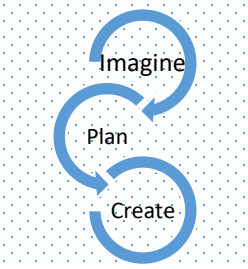

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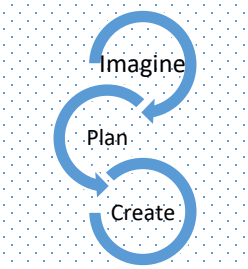

Design your own experimental study to evaluate the effectiveness of two farming techniques which ECHO uses on the Global Farm.

Answer Key

Experiment Design Activities

Science – Designing Experiments -Activity 1

(Adapted from Inside Echo Newsletter, June 2019)

ECHO-Florida initiated a multi-year gliricidia intercropping trial. Researchers are trying to determine if the shade produced by gliricidia trees, spaced six meters apart, will affect the yield of maize and cowpea crops over time. Alternating rows of maize and cowpea were planted. The experimental design included the following: maize and cowpea planted under widely-spaced gliricidia trees, maize and cowpea planted under 30% shade cloth, and maize and cowpea alone. *(The description of the study has been modified for middle school classroom use.)*

1. **What is intercropping? (See photos of plantings in other countries, below).**

   Intercropping is a farming method that involves planting or growing more than one crop at the same time and on the same piece of land. Usually the crops are in close proximity to each other.

2. **What are legumes?**

   Legumes are plants which have bacteria in nodules on the roots of the plant. The bacteria in the nodules take nitrogen from the air and fix it into the soil, so that other plants that require nitrogen can use it as well.

3. **Which plants in this study are legumes?**

   Gliricidia and cowpea

4. **Why are legumes frequently used for intercropping**?

   Legumes help keep usable nitrogen in the soil, even after they're harvested. This process reduces the need for nitrogen-rich fertilizers, and helps sustain usable nitrogen concentrations in soils for future crops.

5. **Why is 30% shade cloth being used in one plot with maize and cowpea?**

   Gliricidia trees produce shade and nitrogen. The shade cloth provides shade but no nitrogen. The shade cloth plot acts as a comparison or control to see if just shade, alone, produces a better yield. (In a developing, country it would be less expensive and easier to plant gliricidia trees than to grow crops under shade cloth.)

6. **Why are only maize and cowpea planted in the third plot?**

   They are also a control group – not receiving shade treatment.

7. **Discuss the experimental design: investigative question, variables**

   An Investigative Question is a scientific question for which you are trying to find an answer: Does intercropping gliricidia trees with maize and cowpea increase the yield of maize and cowpea plants?

Independent Variable	Dependent Variable	Controlled Variables	Control
-what is being tested or the one thing you change	-result or changes because of the independent variable	-things we keep the same, constant	-group(s) receiving no treatment
Shade from gliricidia trees	**yield** of maize and cowpea	-soil type	-shade cloth (comparison to gliricidia shade)
		-amount of water	-maize and cowpea only (comparison to both groups- gliricidia and shade cloth)
		-date planted	
		…etc.	

Using the description of the study, design an experimental plot. Compare your completed map with the actual field trial (photos and map below).

In a spacious area on your school campus, measure out a distance of six meters, the spacing of the gliricidia trees. A research plot includes two rows of trees (5 total) and an additional 12 meters for the shade cloth with maize/cowpea and maize/cowpea alone. Try measuring out this area.

Research other uses for cowpea and gliricidia.

Uses for cowpeas:

- The leaves and growth points can be picked and used as a vegetable dish.
- The leaves can be dried and used as a meat substitute. About one kilogram (2.2 pounds) of cowpeas is a full meal.
- The green seeds are sometimes roasted like peanuts, and these are ground and used as a substitute for coffee.
- Ground dried seeds mixed with onions and spices can be fried in oil.

- The seeds can also be cooked.
- It can be planted for green hay production. Silage *(grass or other green fodder compacted and stored in airtight conditions, without first being dried, and used as animal feed in the winter)* can be made by mixing the green leaves with sorghum or maize.
- Cowpeas can be planted for dried hay production, and the hay can be sold.
- Source: http://www.arc.agric.za/arc-gci/Pages/Cowpeas.aspx

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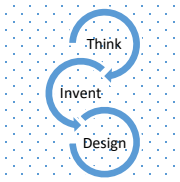
Science – Designing Experiments -Activity 2



ECHO-Asia Regional Impact Center would like to set up a study comparing the growth performance of pigs fed with fermented banana stalk silage and pigs fed with commercial pig food as a supplement to their regular forage (farm harvested plants) diet. (Source: Inside Echo Newsletter, July 2019)

Design an experimental study comparing the effect of these two diets on pig growth. Include a description of the study, investigative question, variables, charts for recording data, etc.

Description of study (example): Six pigs from the same litter will be fed different diets for ___weeks, and the weight of each pig will be recorded, weekly. Total weight gains will be compared to see which food caused the most growth.

An Investigative Question is a scientific question for which you are trying to find an answer. Example, does feeding pigs banana stalk silage or commercial pig food, in addition to their regular diet, increase weight gain?

Independent Variable	Dependent Variable	Controlled Variables	Control
-what is being tested or the one thing you change	-result or changes because of the independent variable	-things we keep the same, constant	-group receiving no treatment
Type of food	**Weight gain of piglet**	-age of piglets -breed (These two variables could be controlled by using siblings from the same litter.)	**-pigs fed only forage – no supplement**
		-same sex	
		-same amount of forage -same amount of silage or commercial food -same amount of fresh water	
		-same amount of exercise, …etc.	

Example of data table for pig food study

Treatment	Initial weight	Week 1 Weight	Week 2 Weight	Week 3 Weight	…..final Week # ___ Weight	Total weight gain
Banana Stalk Silage Supplement						
Pig #1						
Pig #2						
Commercial food Supplement						
Pig #3						
Pig #4						
No Supplement- forage only						
Pig #5						
Pig #6						


echo
Hope Against Hunger