

Biotechnology Project Final
Logan Fontenelle Middle School

- Project Title:** Global Warming: Agricultural Dangers
- Problem / Question:** How might global warming affect the mechanics of Nebraskan agricultural goods (such as corn) in the coming years?
- Hypothesis:** Crop yield and plant growth may slow / decrease, leading farmers to consider alternate crops.
- Variables:** Constant variables include 500 ml of water, three times a week; equal amounts of artificial growing light and enriched soils; three seeds of sweet corn per mound, three mounds per environ.
- Independent variable consists of alterations in temperature per corn-growing environ (as per the intent of this experiment).
- Dependent variables relate directly to the eventual growth of corn placed in separate environs, varying by constant temperatures, and measured by an index of total height, width and length of leaves, and (should time permit) actual corn yield.
- Standard:** As mentioned prior, the eventual growth of corn in its respective environs will be measured by an index of total height, width and length of leaves, and corn yield. This information is presented in the form of various graphs later in this report.

MATERIALS:

- | | | |
|-------------------|----------|-------------|
| - Corn seeds | | (2 packets) |
| - Duct tape | | (2 rolls) |
| - Extension cords | | (4) |
| - Grow lamps | | (4) |
| - Planting pots | (1 x 1') | (4) |
| - Plastic wrap | | (2 meters) |
| - Power strip | | (1) |
| - Potting soil | | (2 bags) |
| - Space heaters | | (2) |
| - Styrofoam | (8 x 4') | (15 sheets) |
| - Thermometers | | (4) |
| - Metric ruler | | (2) |
| - Water | | (as needed) |
| - 400mL beakers | | (2) |

PROCEDURE:

- a. Purchase and gather required materials.
- b. Construct four individual environs – one for each temperature variation.
- c. Germinate corn plants (in ideal conditions).
- d. Transfer three plants, a grow lamp, and a thermometer into each environ.
- e. Continue to water and regulate temperatures.
- f. Measure plants twice a week.
- g. Record results; graph average results per variation.
- h. Compare charts of variations.
- i. Finish project and present results.

GRAPHED DATA - CONTROL

	12-12	12-13	12-14	12-15	12-17	1-3	1-13	1-23	1-28	1-30	2-1
Shortest	0	0	1	6	8	16	20	24	30	32	34
Tallest	1.5	3	6	9	14	28	37	42	47	50	52

GRAPHED DATA - BETA

	12-12	12-13	12-14	12-15	12-17	1-3	1-13	1-23	1-28	1-30	2-1
Shortest	0	0	1	6	10	12	17	23	26	30	36
Tallest	1.5	3	6	9	14	19	30	41	45	50	52

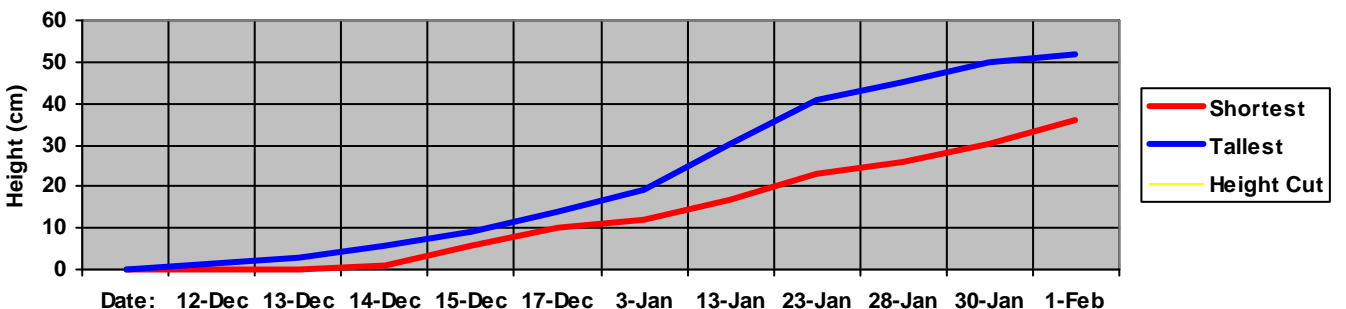
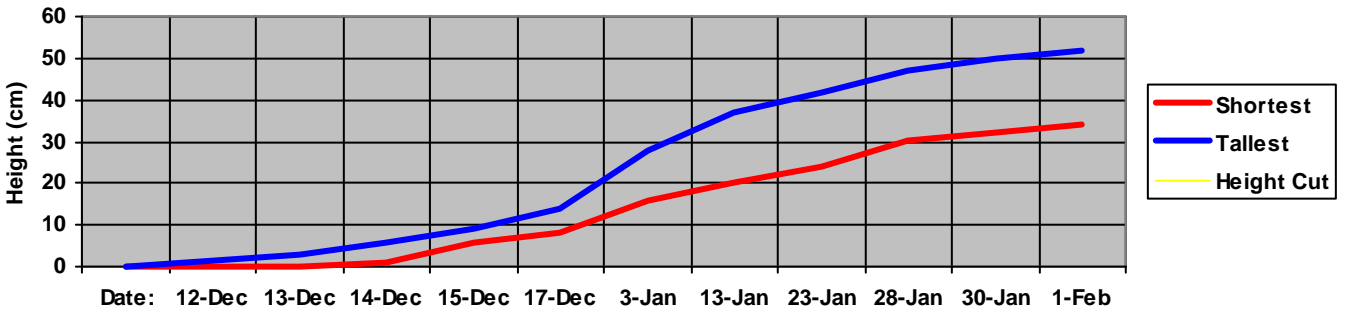
GRAPHED DATA - GAMMA

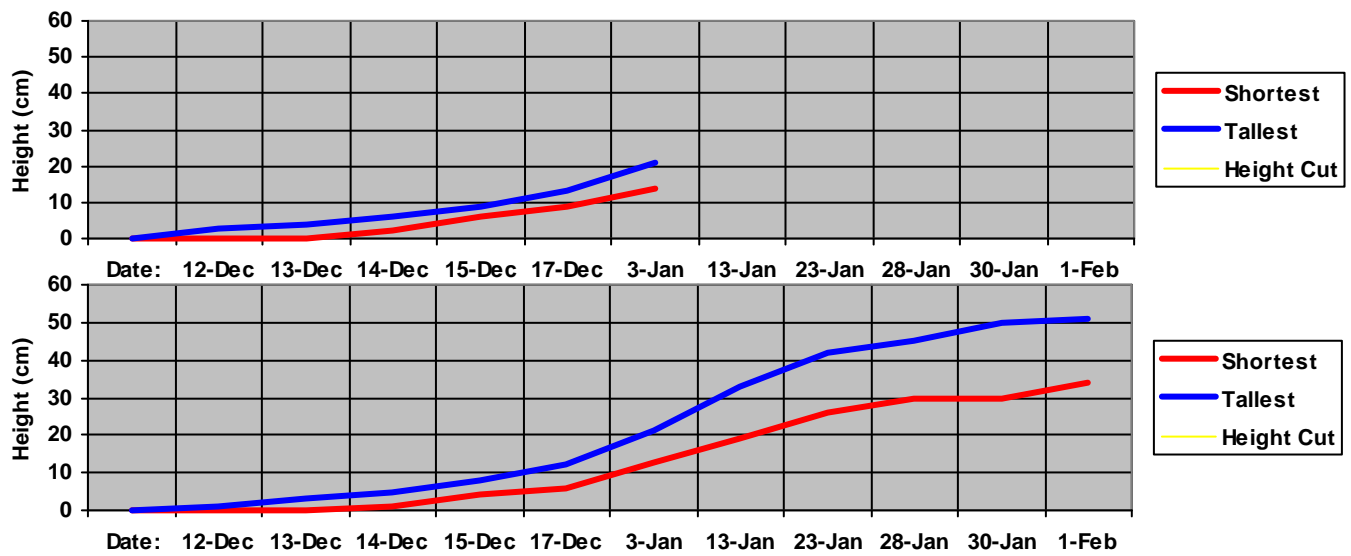
	12-12	12-13	12-14	12-15	12-17	1-3	1-13	1-23	1-28	1-30	2-1
Shortest	0	0	2	6	9	14	-	-	-	-	-
Tallest	2.5	4	6	9	13	21	-	-	-	-	-

GRAPHED DATA - DELTA

	12-12	12-13	12-14	12-15	12-17	1-3	1-13	1-23	1-28	1-30	2-1
Shortest	0	0	1	4	6	13	19	26	30	30	34
Tallest	1	3	5	8	12	21	33	42	45	50	51

PLANT GROWTH DATA: ALPHA / BETA / GAMMA / DELTA (ORDERED THUS)





- Concluding Measurements: (Alpha) - Length of plant: 45 cm
 (regarding mature plants) 4 leaves: 17 cm, 27 cm, 33 cm, 36 cm
 Mass: 2.25 grams (thin stalk)
- (Beta) - Length of plant: 60 cm
 6 leaves: 9 cm, 12 cm, 24 cm, 31 cm, 36 cm, 43 cm
 Mass: 3.06 grams (thick stalk)
- (Delta) - Length of plant: 54 cm
 6 leaves: 11 cm, 16 cm, 29 cm, 33 cm, 36 cm, 37 cm
 Mass: 3.30 grams (thick stalk)

Additional Statistics: Temperature per environ:

Alpha (Control)	~72°F / 22°C
Beta (Environ)	~79°F / 26°C
Gamma	~86°F / 30°C
Delta	~93°F / 34°C

Refer to watering and other miscellaneous records stapled to this report for further time-based details.

Interpretation: Temperature and the accompanying lack of moisture proves detrimental to corn, though most of the environs fared well in their conditions. However, considering the **average** daily temperatures would rise and fall (and thus reach past these numbers throughout the warmer seasons), our results are not entirely conclusive due to restraints on the scope of this project. We believe that in time, advances will be made to improve corn yield and perhaps counter the effects of global warming – to some extent. Also, it is our regret we could not continue the experiment to investigate eventual corn yield and other calculations.

Experimental Errors: Despite our best attempts, there are certain standards and objectives that elude our grasp. Due to the restraints of a working schedule and additional programs, the number of potential errors is relatively high (again to our regret).

Among these are the failure to keep day-by-day records, a malfunction in one space heater, slight differences in actual amounts of water, 'wear-and-tear' on the separate environs (thus creating minor temperature fluxuations), and general inability to maintain absolute temperatures due to a variety of structural configurations (such as central heating).

Recommendations: Should this experiment (or something of the same scale) be replicated again, there are some definite recommendations that can be made on our part. Ensure constant temperatures and functionality of space heaters a few weeks prior; check through most of the day (and perhaps even night) in case of any structural safeguards in the use of electricity. Environs must be constructed thoroughly and with relative similarity. Keep precise day-by-day records of plant growth in regard to height, number of leaves, width of leaves, and so on. In addition, extending the length of the experiment should be considered (perhaps granting an index of corn yield data).

THINGS OF NOTE: As this experiment is a recreation (or precreation) of global warming, moisture lost to heat is considered a natural occurrence and was not countered in any intentional way.

Precipitation: Disregarding a recent drought (2000-2004), average growing season precipitation measured 2.7 inches a month supplemented by an average 2-3 inches irrigation.

OPTIMAL CONDITIONS

Relative humidity of 80%
An average temperature of 16-28°C
Moist soil and fertilized ground
Nitrogen and phosphorus supplements

We extend our sincerest thanks to these two men who proved integral to our research.

Mr. Keith Glewen of the Sarpy Extension Service who so kindly provided information and contacts.		Dr. Don Lee, UNL professor and head of the department of agronomy and horticulture... a man who knew the answers.
---	--	--

They have our deepest respect for bringing this experiment into the realm of possibility.

BIO-TECH RECORDS

12-07-07	8:50am	1000ml	
12-10-07	4:30pm	1000ml	
12-12-07	8:45am	1000ml	Grow lights added 8:45am-all 4 containers Pot #1- 5 sprouts: about 1½ cm Pot #2- 2 sprouts: about 1 - 2 cm Pot #3- 3 sprouts: about ¼ - 2 cm Pot #4- 2 sprouts: just breaking surface – 1cm
12-13-07	8:05am	No Water	Grow light introduced 8:05am- all containers Pot #1- 15: just breaking surface - 3cm Pot #2- 4: 1 - 4cm Pot #3- 15: 1 - 5 cm Pot #4- 15: just breaking surface - 4cm
12-14-07	8:45am	1000ml	Pot #1- 20: 1 - 6cm Pot #2- 14: just breaking surface - 5cm Pot #3- 16: 1 - 6cm Pot #4- 22: 1 - 5cm
12-15-07		No Water	Removing crippled plants - Pot #1- Thinned to 8 plants: 6 - 9cm Pot #2- Thinned to 6 plants: 5 - 7cm Pot #3- Thinned to 8 plants: 6 - 9 cm Pot #4- Thinned to 9 plants: 4 - 8cm
12-17-07	1:00pm	1000ml	
12-17-07	2:45pm		Moved medium temperature box from room #206 to #209; lack of electricity to supply each environment with a grow lamp and heater.
12-17-07	2:45pm		Pot #1- 8 plants: 8 - 14cm Pot #2- 6 plants: 10 - 14cm Pot #3- 8 plants: 9 - 13cm Pot #4- 4 plants: 9 - 12cm
12-19-07	8:53am	1000ml	Two leaves per plant.
12-21-07	8:45am	1000ml	
12-23-07	9:00am	1000ml	
12-25-07	8:30am		Water gathering in lower end of pots, decided to hold until next watering day.
12-27-07	12:20pm	700ml	

12-29-07	12:35pm	400ml	
12-31-07	11:30am	400ml	
1-2-07	10:00am		Pot #1- Remained in room #130 (control temp.) Pot #2- Moved to designated box(79 °F / 26° C) Pot #3- Moved to designated box(86°F / 30° C) Pot #4- Moved to designated box(93 °F / 34° C)
1-3-08	8:47am	400ml	Pot #1- 16 - 28cm 74 °F / 23 °C Pot #2- 12 - 19cm 77 °F / 25 °C Pot #3- 14 - 21cm 77 °F / 25 °C Pot #4- 13 - 21cm 86 °F / 30 °C
	1:03pm		Pot #1- N/A Pot #2- N/A Pot #3- 133 °F / 56 °C – Heater malfunction; failure to shut down resulted in temp. rise thus proving ultimately fatal to the environ. Pot #4- N/A
	3:45pm		Pot #1- N/A Pot #2- 80 °F / 27 °C Pot #3- 80 °F / 27 °C Pot #4- 86 °F / 30 °C
1-4-08	12:45pm		Pot #1- 72 °F / 22 °C Pot #2- 78 °F / 25 °C Pot #3- 84 °F / 29 °C Pot #4- 88 °F / 31 °C
	4:10pm		Pot #1- N/A Pot #2- 80 °F / 27 °C Pot #3- 80 °F / 27 °C Pot #4- 93 °F / 34 °C
1-5-08	9:15pm	1000ml	Pot #1- Soil seemed dry, increased watering. Pot #2- Soil appeared moister than control. Pot #3- Soil arid, plants nearing death. Pot #4- Soil seemed dry, plants drooping.
1-7-08	8:40am	500ml	Pot #1- Soil moderately moist: 70 °F / 21 °C Pot #2- Soil moderately moist: 78 °F / 25 °C Pot #3- Last two plants near death:72 °F / 22 °C Pot #4- Soil moderately moist: 88 °F / 31 °C

1-8-08	8:50am	500ml	Pot #1- N/A Pot #2- N/A Pot #3- 84 °F / 29 °C Pot #4- 93 °F / 34 °C
	10:30pm		Pot #1- N/A Pot #2- 78 °F / 25 °C Pot #3- N/A Pot #4- 92 °F / 33 °C
1-10-08	1:00pm		Pot #1- N/A Pot #2- 78 °F / 25 °C Pot #3- 86 °F / 30 °C Pot #4- 90 °F / 32 °C
1-13-08	8:50am	500 ml	Pot #1- 20 - 37cm Pot #2- 17 - 30cm Pot #3- N/A Pot #4- 19 - 33cm
1-16-08	8:15am	500ml	Pot #1- 22 - 36cm; 3 plants: 4 leaves, 2 plants: 3 leaves, 70 °F / 21 °C Pot #2- 22 - 33cm; 2 plants: 3 leaves, 3 plants: 4 leaves, 1 plants: 5 leaves, 78°F / 25°C Pot #3- Soil extremely dry: heater malfunction, door removed from hinges, 82 °F / 27 °C Pot #4- 21 - 38cm; 4 - 5 leaves, 92 °F / 33 °C
1-18-08	8:41 am	500 ml	Pot #1- 22 - 37cm; 5 plants: 4 leaves 70 °F / 21 °C Pot #2- 27 - 35cm; 4 plants: 3 leaves, 2 plants: 4 leaves, 80 °F / 27 °C Pot #3- N/A Pot #4- 21 - 40cm; 3 leaves, 4 leaves 90 °F / 32 °C
1-21-08	9:20 am	500 ml	Pot #1- 24 - 40cm; 3 plants: 4 leaves, 2 plants: 3 leaves Pot #2- 29 - 32cm; 5 plants: 4 leaves Pot #3- N/A Pot #4- 27 - 42cm; 4 leaves, 5 leaves
1-23-08	8:42 am	500 ml	Pot #1- 24 - 46cm; 1 plant: 5 leaves, 3 plants: 4 leaves, 1 plant: 3 leaves Pot #2- 25 - 38cm; 1 plant: 5 leaves, 4 plants: 4 leaves, 1 plant: 3 leaves, 78 °F / 25 °C Pot #3- N/A Pot #4- 28 - 44cm; 1 plant: 4 leaves, 1 plant: 3 leaves, 92 °F / 33 °C

1-30-08	8:51 am	500ml	<p>Pot #1- 32 - 50cm; 3 plants: 4 leaves, 2 plants: 5 leaves, 74 °F / 23 °C</p> <p>Pot #2- 30 - 52cm; 5 plants: 5 leaves, 1 plant: 6 leaves, 78 °F / 26 °C</p> <p>Pot #3- N/A</p> <p>Pot #4- 30 - 50cm; 4 leaves, 6 leaves 91 °F / 32 °C</p>
2-1-08	12:56 pm	500ml	<p>Pot #1- 32 - 50cm; 2 plants: 5 leaves, 2 plants: 4 leaves, 1 plant: 3 leaves, 65 °F / 18 °C</p> <p>Pot #2- 36 - 50cm; 2 plants: 6 leaves, 3 plants: 5 leaves, 1 plant: 4 leaves, 74 °F / 23 °C</p> <p>Pot #3- N/A</p> <p>Pot #4- 35 - 49cm; 4 leaves, 6 leaves 93 °F / 34 °C</p>