BrachyBio! Mutant Plants
Student Pre-Lab

Name_____

The following is an excerpt that appeared in the Jacksonville Daily Progress Newspaper on August 2, 2011:

Drought 2011: The ripple effect

Janet Gregg Jacksonville Daily Progress

JACKSONVILLE — The impact of the current drought on the state's agriculture industry has been devastating already and is likely to worsen if the drought continues through next year as some experts predict.

"It does look like the drought of 2011 will be the costliest drought in Texas history," said Mark Welch, Extension economist for grain marketing with the Texas Agrilife Extension Service. "It's a three, four, five billion dollar impact right now, just in Texas. This is a big deal."

The state's five main field crops: wheat, corn, hay, sorghum and cotton have been devastated. The wheat yield was half that of a normal year. That means half the income for wheat farmers, and half the amount of wheat available for ranchers to feed their livestock.

There's a global impact as well. Texas exports most of its wheat crop for world trade.

"We've seen relatively high wheat prices in recent years, and those prices will go up with the shortage on a global scale if other wheat producing nations can't make up the deficiencies of the U.S.," Welch said….

Climate change may be to blame for the current problems in Texas; as well as for the historic floods experienced in the Mid-West and the record setting snowfall in the North East in 2011. These extreme conditions will only complicate an already large problem: The Earth's population is growing faster than its ability to increase crop yield.

I: Population Growth vs. Wheat Production:

Using a different color for each of the two data sets, plot the points for the following data on the graph below:

Year	Global Wheat Production[1] (Millions of Tons)	Global Human Population[2] (Billions)
2000	583	6.15
2005	620	6.52
2010	633	6.90
2015	650*	7.30*
2020	680*	7.87*

1-Food and Agriculture Organization of the United Nations: FAO STAT Databases

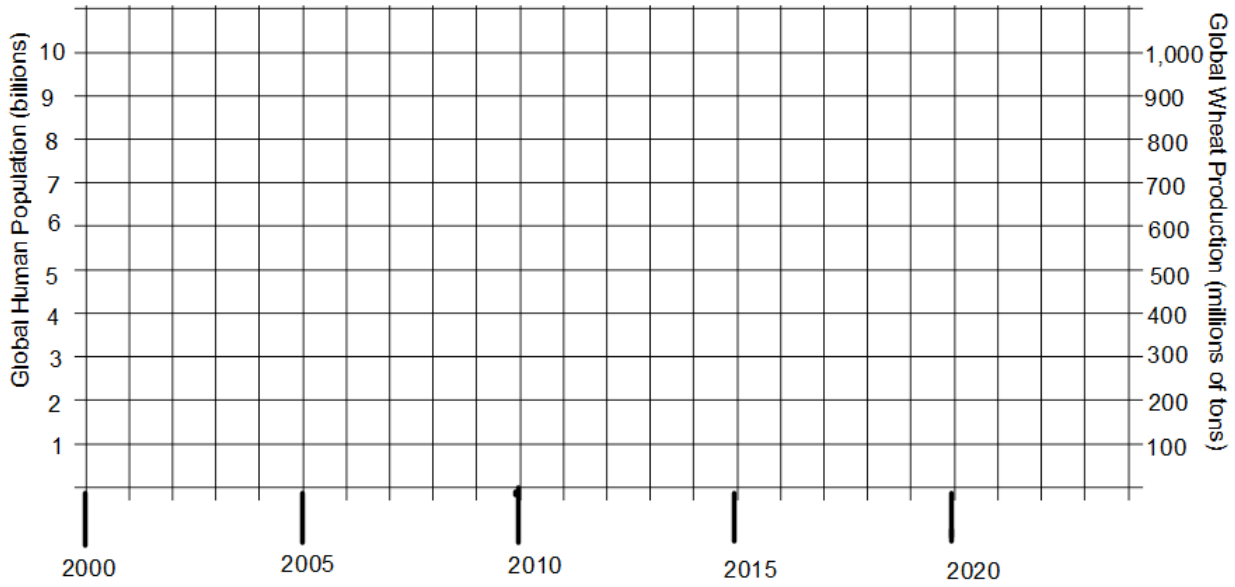
2- United Nations 2008 estimates, World Population Database

*Projected

Color used for Population:

Color used for Wheat

Global Population Growth and Wheat Production:



1. What is the general trend for Global Human Population growth?

2. What is the general trend for the Global Wheat Production for the same period?

3. Food production will have to rise 70 percent by 2050 as the world population expands to about 9.3 billion people from about 6.8 billion people in 2010, according to the UN's Food and Agriculture Organization. Given the changes in climate, and the increasing population, the UN FAO believes these new gains will have to come from increased yields, not farming more land[2]. What are some ways this increase in crop production can be achieved?

II: Brachypodium: A Model Plant for Grain Crops:

Scientists often work with so-called "Model Organisms": like mice being used to test various procedures or medicines before using them in humans. Brachypodium is an easy to grow and study plant that is closely related to both wheat and rice; making it a perfect plant to study when scientists are looking for new advances in those crop yields.

Using the picture of Triticum turgidum (Wheat) as a guide, label the parts of a Brachypodium plant:

Triticum turgidum (Wheat)

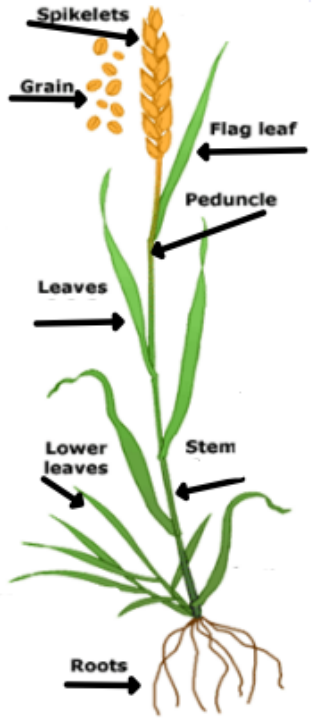


Photo Courtesy of the University of Alberta

Brachypodium distachyon

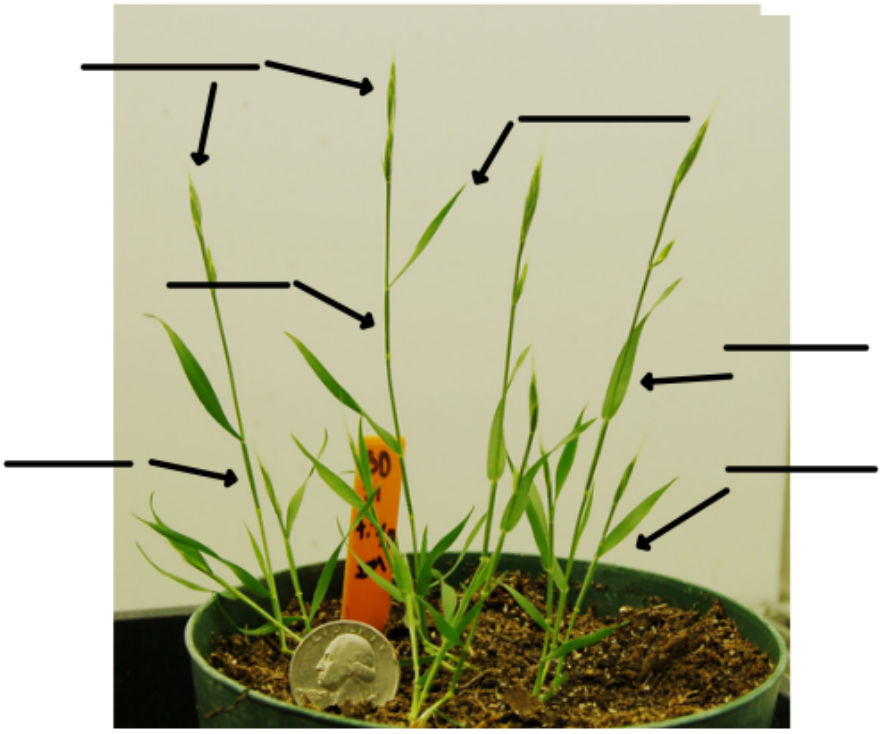


Photo Courtesy of the Boyce Tompson Insitutue

When scientists use model organisms like *Brachypodium distachyon*, (Brachy), they are often looking for new or unusual traits that may provide a deeper understanding of gene function and help develop new varieties of crops. Using your knowledge of biology and the diagram of Brachy, propose a new trait that might be useful to scientists looking to develop crops that can tolerate each of the recently experienced climate conditions:

Drought:

Flood:

Snow Cover/ Late thaw:

By studying new traits that arise (through random mutation) in Brachy, scientists hope to be able to develop new varieties of crops that can not only tolerate, but thrive under unusual conditions. This may increase the yields of crops like wheat, and help feed our growing population.