# MUTANT MILLETS

## Project Information for Students
## Spring 2015

This project is real-life science brought into your classroom! Scientists at the Donald Danforth Plant Science Center research food crops and biofuels. In this project, we will use *Setaria viridis* as a model plant for studying important food grasses and potential biofuel sources, as well as for the development of new plant photosynthesis technologies. *Setaria* is a popular plant studied by scientists because of its small size, low chromosome number, recently sequenced genome and the availability of new genetic resources. We need you to help us grow and study this important model organism.

In this project we want to see what happens to this plant's phenotype (the observable characteristics or traits of an organism) when its genetic material is altered. This semester you have the opportunity to grow and screen a population of *Setaria* plants for mutant (a variation from the normal phenotype of the plant) phenotypes, and then report this data back to researchers at the Donald Danforth Plant Science Center and share it with other classrooms participating in the project. We have approximately 2,000 mutant families to screen, and we need your help! This semester, we will give you seeds from a mutant family that has already been through a primary screen at the DDPSC, and we hope you have the chance to observe the same mutations that we have observed.

In the lab at the Donald Danforth Plant Science Center, *Setaria* seeds were treated with the mutagenic chemical NMU. N-nitroso-N-methylurea (NMU) is an alkylating agent that transfers its methyl group to nucleobases in nucleic acids, which can lead to GC:GT transitions or mutations in the genome. Where this mutation occurs in the genome of the treated seed is random, and may occur anywhere in the 423+ million base pairs of the *Setaria* genome. The mutation may occur in non-essential genes, in redundant genes or a gene that works with other genes (e.g. part of a multigenic trait) and result in a silent mutation (no observable change in phenotype). Alternately, the mutation could result in a new phenotype by occurring in an important place in a gene.

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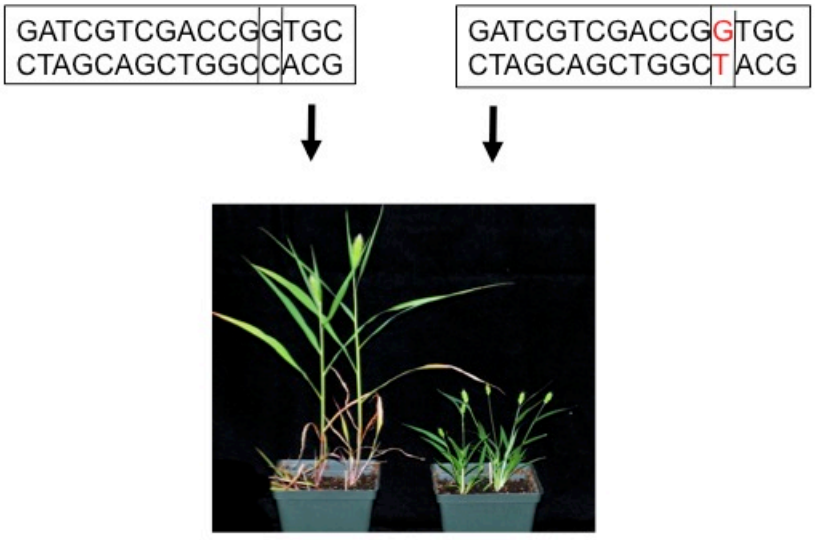


Figure 2. A single base pair mutation caused by NMU in an important gene can cause a mutant phenotype.

Many different mutant phenotypes can be interesting to scientists. Changes in pigmentation (light green or albino plants) may relate to photosynthetic pathways, and these mutants may be used to understand photosynthetic development and $C_4$ photosynthesis. A mutant that has increased number of tillers ("heavy tillering") may result in increase biomass of the plant, which has potential applications to biofuel development.

Once the mutant plants have been identified, researchers will try to further understand what gene (a segment of DNA that might determine a phenotype), or genes, might be important to this mutant phenotype. To do this, scientists will examine how the genotype of the mutant plant differs from the genotype of the wild type plant. They will conduct experiments on the plants to determine what roles those gene(s) may play. Eventually it is hoped that better food crops and biofuel sources will be developed from what we learn from this plant!

Here are a few facts about *Setaria viridis:*

- *Setaria's* common name is foxtail.
- *Setaria* is native to Eurasia, but can be found growing right here in St. Louis.
- *Setaria* is a monocot, which means it is more closely related to other grasses than to dicots, such as tomatoes and sunflowers.

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**Why is *Setaria* a good model grass species for plant research?**

- It is very easy to grow and study in the lab. You can help us learn how to best grow it in a classroom!
- *Setaria* can grow from a seed to an adult plant that produces seeds in as little as 6-8 weeks. You can help us learn how long it will take in your classroom!
- It is a small grass that grows no taller than 6 inches.
- It does not require a pollinator to produce seeds- it can self fertilize. (Would you want a pollinator such as a bee in your lab or classroom?)
- Understanding the genes and cell walls of *Setaria* will help scientists develop better biofuels.

The words highlighted in yellow on the previous page are terms that you should be familiar with. Check in your textbook, on the computer or in the vocabulary sheets included with this project for definitions.

Your goal this spring will be to learn to identify mutant phenotypes of *Setaria*. By making periodic observations of your plants, you will learn a great deal about the life cycle of *Setaria* and its characteristics and how these can change due to a mutation. You will practice data collection skills that will help the scientists at the Donald Danforth Plant Science Center identify possibly beneficial mutations found in *Setaria*. One day your research contributions may help discover ways to better our food crops and biofuel sources.

You will also be learning to use some new vocabulary that plant scientists use when they describe and work with grasses. Welcome to the world of plant science!