WHAT IS RiceCAP?

Coordinated Agricultural Project for Rice

A multi-state, multi-institution project, funded by USDA/CSREES that utilizes new information from genomics to help solve two historically difficult rice problems – milling quality stability and sheath blight disease resistance.

WHY DOES RICE LOOK & TASTE LIKE IT DOES?

Living organisms have large numbers of cells containing the genetic information responsible for its traits, like milling quality or susceptibility to diseases, like sheath blight. That information is in long strings of DNA that is made up of individual chemical units that encode genes responsible for the specific traits of the plant.

All genetic information in an organism is like a collection of books on many different topics; the entire collection of books is referred to as a genome. In the books, the various pages contain genes, that specify what features the organism will have. Each different organism has its own set of books and, while many genes are similar, some are different. But the books are all written in the same language.

The genetic information in the cell is made up of individual chemical units. If an alphabetic letter is used to represent each chemical unit, it would require 40 books, each with 1,000 pages to contain all of the information in a rice cell. In 2005, all of the genetic information, contained in the genome of rice, was determined and found to contain ~37,500 genes, a number greater than that in the human genome. Each gene is equivalent to a half page of information.

HOW IS CLASSICAL BREEDING USED TO CREATE NEW RICE VARIETIES?

What happens to the genetic information when two rice plants are bred? Does the next generation have 80 books? No, because genetic rules dictate that progeny have the same amount of genetic information as each parent, 40 books for rice. Half the genes from each parent are kept; half are lost, yielding a plant with new combinations of parental traits.

A breeder simply crosses male cells (pollen) from one plant with female cells (eggs) of another plant, observes the progeny, and chooses plants with the desired traits. Such crosses can also occur in nature due to insects or wind-blown pollen. Classical breeding results in plants with modified genomes containing new mixes of genes.

HOW IS MARKER-ASSISTED SELECTION USED TO IMPROVE CROP VARIETIES?

In a process called marker-assisted selection (MAS), a "table of contents" is developed for the rice genome. It specifies where in the genome the genetic information for certain traits is located and leads to the identification of a chemical tag that recognizes that region. These tags allow breeders to identify plants with a particular trait, based on the presence of the chemical tag.

The process is similar to using the "find" command in a word processing system to identify a particular passage in a book. By finding the passage, you know you are in a particular part of the book. In breeding, the chemical tags help determine whether particular genetic information is in a plant’s genome. If the chemical tags are found, it is likely that the plant has a particular trait. This process enables breeders to develop new varieties more efficiently than with more “observational” classical breeding approaches. MAS allows researchers to observe the natural rearrangement of genes and identify plants with desired traits.

WHAT IS RiceCAP DOING?

RiceCAP researchers are looking at large, diverse rice populations for traits related to milling quality and sheath blight resistance and trying to identify the specific genetic information responsible for those traits. Once they find which "pages" of the genetic information correlate with the presence of the trait, they can develop specific chemical tags that allow them to select plants with the desired traits. This large populational approach to studying the complex traits for sheath blight resistance and milling quality will provide breeders with important tools to speed breeding for improved rice varieties.

FOR MORE INFORMATION, PLEASE VISIT: HTTP://WWW.UARK.EDU/UA/RICECAP/