Study shows genetic rice breeding goes back 10,000 years

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Cambodia, Kratie: A worker is removing the rice seedlings. Image: Wikipedia

(PhysOrg.com) -- In a paper published in the *Proceedings of the National Academy of Sciences*, Masanori Yamasaki and colleagues from Kobe University in Japan, describe how they analyzed the genomes of several types of rice and discovered that the lengths of the stems on the plants grew shorter over time as rice was first being domesticated, resulting in sturdier plants and increased grain output. They conclude that due to the type of mutant genes seen in the early plants that caused the shorter stems, intentional breeding of rice must have occurred as far back as 10,000 years ago.

The two mutations, occurring in the SD1 gene, suggest human beings were breeding rice in ways very similar to that which resulted in the green revolution in modern times; namely, separating out those plants

with the shortest stalks for replanting, eventually resulting in the mutation of genes as the plants adapted to domesticated farming environments. The result then, as in recent years, has been increased production and the ability to feed more people from the same amount of land.

Rice, second only to corn in worldwide production, has been a staple in the diets of more people the world over than any other food, and current efforts to increase productivity continue; from simple breeding techniques to transferring DNA in the lab. The oldest known sample of domesticated rice was found in Korea in 2003, and is believed, by some, to date back 15,000 years, meaning that the cross-breeding of plants or selective farming techniques that led to the results in the new gene study, didn't appear for another five thousand years. Despite the Korean find, most modern agricultural geneticists believe domestication of rice first occurred in China, likely in the Yangtze Valley.

As the world faces an ever growing population, rice has become ever more important, especially in light of the fact that the heaviest growth has occurred in Asia, which not coincidently, is where the most rice is grown. New studies that show humans have been breeding rice for 10,000 years serve to underscore the importance of rice throughout history, and highlight the fact that it will likely serve as the food of the future, if only today's scientists can find a way to increase yields yet again.

More information: Artificial selection for a green revolution gene during japonica rice domestication, *PNAS*, Published online before print June 6, 2011, doi: 10.1073/pnas.1019490108

Abstract
The semidwarf phenotype has been extensively selected during modern crop breeding as an agronomically important trait. Introduction of the

semidwarf gene, semi-dwarf1 (sd1), which encodes a gibberellin biosynthesis enzyme, made significant contributions to the “green revolution” in rice (Oryza sativa L.). Here we report that SD1 was involved not only in modern breeding including the green revolution, but also in early steps of rice domestication. We identified two SNPs in O. sativa subspecies (ssp.) japonica SD1 as functional nucleotide polymorphisms (FNPs) responsible for shorter culm length and low gibberellin biosynthetic activity. Genetic diversity analysis among O. sativa ssp. japonica and indica, along with their wild ancestor O. rufipogon Griff, revealed that these FNPs clearly differentiate the japonica landrace and O. rufipogon. We also found a dramatic reduction in nucleotide diversity around SD1 only in the japonica landrace, not in the indica landrace or O. rufipogon. These findings indicate that SD1 has been subjected to artificial selection in rice evolution and that the FNPs participated in japonica domestication, suggesting that ancient humans already used the green revolution gene.

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