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action group on erosion, technology and concentration

## *Jazzing up Jasmine:*
# Atomically Modified Rice in Asia?

***A nanotech research initiative in Thailand aims to atomically modify the characteristics of local rice varieties – including the country's famous jasmine rice – and to circumvent the controversy over Genetically Modified Organisms (GMOs). Nanobiotech takes agriculture from the battleground of GMOs to the brave new world of Atomically Modified Organisms (AMOs).***

In January, *Bangkok Post* reported on a three-year research project at Chiang Mai University's nuclear physics laboratory,[1] funded by the National Research Council of Thailand, to atomically-modify rice. The research involves drilling a nano-sized hole (a nanometer is one-billionth of a meter) through the wall and membrane of a rice cell in order to insert a nitrogen atom. The hole is drilled using a particle beam (a stream of fast-moving particles, not unlike a lightening bolt) and the nitrogen atom is shot through the hole to stimulate rearrangement of the rice's DNA.

**Pipe Dreams from Particle Beams?** One of the attractions of this technique, according to the director of the Fast Neutron Research Facility in Chiang Mai where the research is being conducted, is that it does not require the usual (and controversial) technique of genetic modification, where genes are transferred between unrelated organisms or are removed or rearranged within a species. "At least we can avoid it," Thiraphat Vilaithong, the Facility director said.[2]

"We don't consider atomically modified rice any safer or more socially acceptable than genetically modified rice," explained Witoon Lianchamroon of Biodiversity Action Thailand (BIOTHAI), a civil society organization based in Bangkok. "It sounds like the same high-tech approach that does not address our needs and could cause severe hardships for Thai rice farmers."

According to BIOTHAI, scientists at Chaing Mai University have already used nanotechnology to modify the colour of a local rice variety, "Khao Kam."[3] The word "Kam" means deep purple, and the rice variety is known for its purple stem, leaves and grains. Using nanotechnology, the scientists changed the colour of the leaves and stems of Khao Kam from purple to green. In a telephone interview, Dr. Thirapat Vilaithong told BIOTHAI that their next target is Jasmine rice. The goal of their research is to develop Jasmine varieties that can be grown all year long, with shorter stems and improved grain colour.

The research at Chiang Mai is related to other types of "mutation breeding" in that the cell's DNA is manipulated to cause a change in gene function. The difficulty lies in finding safe passage through a plant cell's wall and membrane without compromising the cell's ability to survive or allowing essential cellular contents to leak out. Mutation breeding and nuclear physics have a long history, with most work coming out of a joint United Nations Food and Agriculture Organisation/International Atomic

Energy Agency programme in Vienna beginning in the mid-1960s. Over the last 40 years, researchers there have bombarded plant cells with x-rays, beta and gamma rays, among other particles, to induce alterations in the genomes of crop plants.[4]

**The Bigger Picture:** The project being undertaken at Chiang Mai's nuclear physics lab is a testament to Thailand's commitment to nanotechnology. In January, the Prime Minister, Thaksin Shinawatra, ordered the establishment of a nanotechnology center to be headed by the government's National Science and Technology Development Agency (NSTDA).[5] In addition to the rice project, researchers in Chiang Mai are working to alter the surface of silk at the nanometer level to make it water- and dirt-resistant, hoping to give Thailand a competitive advantage over the world's other major silk exporters, which include India and China. Industry analysts predict that the nanotech revolution will someday allow researchers to engineer new materials and modify existing ones so that they exhibit whatever property is most desirable for a given application – strength, weight, electrical conductivity, colour could all be manipulated at the molecular level. In theory, production, including agricultural production, would no longer be dependent on geography, labour or raw materials, rendering some natural resources obsolete – with especially serious disruptions for Third World economies.

**"Oops, There Goes Another Rubber Tree Plant:"** For example, consider the potential of nano-scale innovations to affect the market for rubber: researchers in the US are designing nanoparticles to strengthen and extend the life of automobile tyres as well as new nanomaterials that could be used as a substitute for natural rubber, especially in medical gloves. "If nano-designed tyres and other products require little or no rubber in the future, it will mean less demand for natural rubber with potentially devastating impacts for the livelihoods of rubber tappers and plantation workers worldwide," explains Jim Thomas, ETC Group researcher from Oxford UK. Malaysia and Thailand are currently the world's top producers of natural rubber.

Prime Minister Thaksin is placing special emphasis on research in nanobiotechnology, such as the atomically modified rice project, in an effort to distinguish Thailand from other regional nanotech research. Because living and non-living material are indistinguishable at the nano-scale – at this fundamental level, they are both simply atoms and molecules of chemical elements – physicists, genetic engineers and material scientists are exploiting this "material unity at the nano-scale" to combine biological and non-biological material in unprecedented ways. While global investment in nanotechnology – both private and public – is estimated between five and six billion dollars (US) *per annum*, the focus on nanobiotechnology is significant. Since 1999, venture capitalists alone have devoted over $450 million to nanobiotechnology.

The rice research in Thailand is just one small piece of the nanobio picture related to food and agriculture. According to Helmut Kaiser Consultancy, some 200 transnational food companies are currently investing in nanotech and are on their way to commercializing products. The list includes many of the world's largest companies: Ajinomoto, Campbell Soup, ConAgra, General Mills, H. J. Heinz, Kraft Foods, McCain Foods, Nestlé, PepsiCo, Sara Lee, Unilever, and more.

**Miracle Rice Re-visited?** The United Nations has designated 2004 the Second International Year of Rice. Neth Daño, executive director of SEARICE in the Philippines, recalls that the first International Year of Rice was thirty-eight years ago in 1966, the year that the International Rice Research Institute (IRRI) launched the Green Revolution in Asia with the release of IR8, the first semi-dwarf rice variety. "The so-called 'miracle rice' required irrigation and a costly package of chemical fertilizers and pesticides that drove poor farmers deeper into debt," said Daño. "IR8 was not only highly susceptible

to pests and diseases, it also introduced massive genetic uniformity, displaced poor farmers and their traditional rice varieties."

"Will 2004 bring us full circle?" asks Kathy Jo Wetter, ETC researcher. "At what cost to farmers, food security and the environment are researchers now tinkering with atomically-modified rice? Will 2004 be remembered as the year that launched atomically-modified rice and the Nano-Rice Revolution?"

Both ETC Group and SEARICE are members of the CBDC Programme (see box, below).

Later this year **ETC Group** plans to release an in-depth report on impacts of nanobiotechnology for food and agriculture, especially in the developing world. The report will also consider food industry applications, such as nanosensors embedded in food packaging and in food itself, "interactive" food and beverages – products that would change colour, flavour or nutrients to accommodate the individual consumer's tastes or health condition, and ultrasound-activated animal vaccines using nanoparticles, among many others.

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[1] Ranjana Wangvipula, "Thailand embarks on the nano path to better rice and silk," *Bangkok Post*, Jan. 21, 2004. Available on the Internet: http://www.smalltimes.com/document_display.cfm?document_id=7266
[2] *Ibid.*
[3] Personal communication from Witoon Lianchamroon of BIOTHAI, 25 March 2004. Witoon spoke to Dr. Thirapat Vilaithong and other scientists at the Fast Neutron Research Facility in Chaing Mai by telephone.
[4] http://www.plantmutations.com/mutation_breeding.htm. According to the FAO/IAEA Mutant Varieties database over, well over 2000 varieties have been released in 52 countries. See http://www-infocris.iaea.org/MVD/
[5] Anonymous, "Prime Minister orders establishment of nanotechnology center," *Pattaya Mail*, Vol. XII No. 2, Friday January 9 - January 15, 2004. Available on the Internet: http://www.pattayamail.com/545/business.shtml. See also, Jen Lin-Liu, "Thailand's leader plants the seeds for a future in nanobiotech, *Small Times*, Feb. 28, 2003. Available on the Internet: http://www.smalltimes.com/document_display.cfm?document_id=5588

**The Action Group on Erosion, Technology and Concentration, formerly RAFI, is an international civil society organization headquartered in Canada. The ETC group is dedicated to the advancement of cultural and ecological diversity and human rights. www.etcgroup.org. The ETC group is also a member of the Community Biodiversity Development and Conservation Programme (CBDC). The CBDC is a collaborative experimental initiative involving civil society organizations and public research institutions in 14 countries. The CBDC is dedicated to the exploration of community-directed programmes to strengthen the conservation and enhancement of agricultural biodiversity. The CBDC website is www.cbdcprogram.org.**