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In a collaboration between vegetable growers in Australia and New Zealand, a new selective breeding of broccoli holds promise to provide new inroads into fighting cancer.

The research is part of a five-year ‘Vital Vegetables’ project aimed at enhancing the health benefits of vegetables to meet the demand of consumers. VegFed (New Zealand Vegetable and Potato Growers Federation) and Ausveg (Australian Vegetable and Potato Growers Federation) are behind NZ$22 million (US$ 12.5 million) enterprise, along with other project partners in the likes of Crop & Food Research and Australia’s Department of Primary Industries (Victoria).

Broccoli is the first in a new line of super vegetables under development. Broccoli has the glucosinolate, vitamins and antioxidants proven to improve the body’s resistance against cancer. The research project seeks out the broccoli types with the highest amounts of these compounds, before selectively breeding a brand with optimal levels of nutrition. Each broccoli floret would ideally develop up to 40% more cancer fighting properties.

Project leader, Dr. Bruce Tomkins, from the Victorian Industry Department, described the early findings as very promising. The researchers have found broccoli with 40 times more chemicals that can slow or prevent cancers of the alimentary canal, and even potentially lower cholesterol levels that causes cardiovascular diseases. The project is supported by New Zealand’s Foundation for Research Science & Technology (FRST) and Horticulture Australia Ltd.

By boosting the nutrition levels, the scientists are also hopeful that the richly enhanced broccoli can help provide adequate nourishment in smaller servings to people who are reluctant to consume vegetables. Three out of four Australians do not eat enough of the recommended levels of vegetables. In younger adults aged between 18 and 24, only one in six are eating the necessary amounts.
It is expected that people would be willing to pay more for the added nutritional value of the ‘Vital Vegetables’ brand. However, market research has indicated a certain level of public skepticism about scientists’ altering of food products – even when consumers are assured that the enhanced broccoli is not genetically modified.

Some researchers share the consumers’ note of caution. While Prof. Mark Wahlqvist, Director of the Asia Pacific Health and Nutrition Center Making, hailed the project’s findings, he warned that there are limits to how much natural food production can be enhanced. “I think it’s more a question of sustainability of the food supply,” he said. “But we don’t want to lose opportunities either for improving our health, through modifications of the let’s say, vegetable supply, and we’ve always done it.”

About Vital Vegetables

The ‘Vital Vegetables’ project sees Vegfed (New Zealand Vegetable and Potato Growers Federation), and Ausveg (Australian Vegetable and Potato Growers Federation) joining with other project partners; New Zealand’s Foundation for Research Science & Technology (FRST), Crop & Food Research, and Australia’s Department of Primary Industries (Victoria) and Horticulture Australia Ltd. The project aims to meet consumer needs identified in market research, which showed that consumers overwhelmingly seek food products that will deliver a ‘package’ of desired attributes that include: nutrition and health, taste, freshness, convenience and price.

Already available from the Vital Vegetables® project is a book “Antioxidants – a Health Revolution” by Crop & Food Research’s Dr. Carolyn Lister. The book provides a comprehensive and practical guide to the role of antioxidants in foods and the importance of fruit and vegetables in our diets.
New Gene to Combat Leaf Blotch in Wheat Plants

Scientists from the Purdue University have discovered a gene (Stb8, pasta wheat origin) which enables bread wheat plants to resist Septoria tritici (fungus strain) leaf blotch (STB). It is hoped that the latest marker is useful in identifying other plants carrying the Stb8 gene.

According to Assoc. Prof. Stephen Goodwin at Purdue University, the main objective is to learn about the molecular pathways that allow the plants to respond to pathogens. The group plans to extend the study to other fungus-resistant gene in an attempt to prevent the breakdown of resistance in the plants. This is because previously identified genes only conferred resistance on bread wheat plants for a few years.

The latest Stb8 seems to possess genetic characteristics that could prolong the resistance of bread wheat plants to leaf blotch. The specific genomic site of Stb8 allows the gene to be combined with other genes, thus offering increased protection against leaf blotch, and prolonging bread wheat plant’s resistance. Consequently, the amount of grain lost to the pathogen can be greatly reduced.

Septoria tritici causes wheat crop damage worldwide with yields losses of 50% or more. The disease caused by the fungus is widespread in the Pacific Northwest, the Northern Great Plains and the Eastern Midwest soft wheat region in the US. Experts estimated annual losses at US$275 million.

More about Septoria tritici

- Fungus strain.
- Causes Septoria leaf blotch.
- Septoria leaf blotch
  
  Initial stage
  - Appears as tan to brownish colored oval or irregularly lesions on wheat leaves.

  Later stage
  - Small dark-brown to black specks appear in the lesions.
  - Pycnidia are found in the specks where spores of the fungus are produced.
  - The spread and severity of the disease are favored by cool and moist conditions (59–68°F).
With no significant improvement of rice production in Cambodia in 40 years, efforts have been building up from abroad in an attempt to boost the yield of rice — Southeast Asian countries’ most vital crop. But the social, economic and corporate culture in Cambodia has prevented any of the foreign agricultural or agrochemical corporations from having any significant impact on the country’s state of agriculture.

Involving foreign organizations is part of the Cambodian Government’s efforts to increase rice productivity. Some of the agricultural improvements introduced include:

- Development of more productive crop varieties,
- Improvement of pest and fertilizer inputs, and
- Introduction of better cropping systems.

For instance, Australia has taken the lead and made a contribution to the development of sustainable rice production systems in Cambodia through the Cambodia-IRRI-Australia Project (CIAP). In the last three years, four provincial seed companies have been formed under the initiative of the Australian government, with the aim of providing enhanced quality rice seeds to farmers.

However, 98% of the farmers have the practice of saving their seeds and only changing their varieties once in every 4-5 years. These seeds saved by the local farmers are characterized by inferior physical qualities, with germination being as low as 50%. With rice being the most important staple food of the country, the low levels of production have in effect led to the majority of Cambodia’s arable land being used to cultivate rice. In 2002, a record production of 4.12 million tons of rice was yielded.

Despite statistics showing that food production is not keeping up with the population increase in Cambodia, rice production has been enough for local consumption, and small quantities have been set-aside for export since 1995. In recent times, production and economic factors such as milling deficiencies and high export costs — with Cambodia exporting at US$19/ton against the rate of US$1/ton in Vietnam — have driven large quantities of rice to be smuggled into Thailand and Vietnam for milling. While the sustenance of the local population has not been affected, these smuggled exports of rice have cost the country in terms of national income.
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Rice production has also met with other perennial constraints, with problems related to the lack of infrastructure, unpredictable rainfall, droughts and flooding disasters, and poor soil. But the real obstacles, towards the development of a more sustainable agricultural industry, are the social and economic conditions under which the Cambodian people are living.

High quality agronomic inputs are not attainable to most farmers for various reasons. The latest agricultural advances — improved seed (especially hybrid varieties), agrochemicals, and fertilizers — are simply too costly and out of reach for the impoverished local farmers.

Even if farmers are able to afford the inputs, the choice and quality assurance procedures are in the hands of the unregulated distributors and importers. In the fertilizer industry for instance, distribution is confined to the few companies charging premium rates for products well below optimum product formulation standards. And to boost the country’s chances of becoming a major exporter of fruits and vegetables in the region, much still has to be done to persuade farmers to grow crops for beyond their own consumption.

The Cambodian Government is undertaking several collaborative R&D projects with overseas organizations. The hope is that rice production will eventually increase to a regular export level through measures such as expanding irrigated rice area, increasing the use of fertilizer, and increasing the adoption of high-yielding varieties.

To Asians, rice is what potatoes are to Europeans. Considered the essential staple for the most populous continent in the world, it is no wonder that researchers in Mainland China are focusing on breeding the more productive strains.

The latest success story is that of Dr. Wang Huaqi, of the Department of Plant Genetics and Breeding, College of Crop Science, China Agricultural University (CAU). He has developed a new strain of aerobic rice, known as “Han Dao” in Chinese (translated means “dry land rice”), through many years of plant hybridization. The seeds of the new strains need no more than 50% of the average level water consumption in conventional rice growing practice.

To cultivate rice properly, it is planted in some 50–60 cm of water for a period of 3–6 months. Rice planting uses up to three times as much water as other crops (e.g. wheat and maize), “Han Dao” would be regarded as a major breakthrough because this invention could potentially help China to save a substantial amount of water, and allow for better water resource management.

China Develops Han Dao Rice Strain

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During the period of 2000 to 2002, some 190,000 hectares and 120,000 hectares of the new aerobic rice have been grown in Northeastern China and Mato Grosso (Brazil), respectively. According to Dr. Bas Bouman, a water scientist at the International Rice Research Institute (based in the Philippines), test fields in Luzon Province in the Philippines and in Uttar Pradesh in Northern India have also been sowed with the new seeds.

In addition, new initiatives were undertaken to address the integrated management of aerobic rice systems, such as a joint project with China’s Wageningen University, on micro-nutrients and grain quality. Other new techniques to improve cultivation of rice include the plant’s tolerance to high salt concentration, drought or diseases.

About China Agricultural University

The China Agricultural University (CAU) is a leading agricultural education and research institution in China. It is a merger of the former Beijing Agricultural University (BAU) and Beijing Agricultural Engineering University (BAEU) in 1995. The history of the University traces back to 1905 as the College of Agriculture in the Capital University (the present Peking University), the oldest university in China. The University is under the jurisdiction of the Ministry of Education P.R.C. The University has six academicians of the Chinese Academy of Sciences, five academicians of the Chinese Academy of Engineering Sciences, 235 professors, and 488 associate professors.

Contact Details

China Agricultural University
Address: No.2 West Yuan Ming Yuan Road, Beijing 100094, China PRC
Tel: +86 10 6289 2615
Email: cauc@public.cau.edu.cn
URL: http://www.cau.edu.cn/en/hpen.htm

About Dr. Wang Huaqi

Wang Huaqi, Associate Professor of the Department of Plant Genetics and Breeding, College of Crop Science, China Agricultural University (CAU), was recently appointed as Chairman of the Water Saving Workgroup. An active member of the Water Saving Workgroup, Wang Huaqi’s appointment came at an exciting time when the workgroup is actively pursuing the aerobic rice study in China as one of the promising water-saving technologies.
Controversy continues to dog the country’s first genetically modified (GM) crop — Bt (Bacillus thuringiensis) cotton. A Gene Campaign field study on Bt cotton has found that Monsanto’s promised solution to the dreaded bollworm (moth) is not working as well as it should. Pink bollworm is emerging a major pest in the fields of Andhra Pradesh and Gujarat, as the Bt toxin is effectively killing only green bollworm.

According to Dr. Suman Sahai, director, Gene Campaign, who has gathered feedback from Hyderabad scientists, farmers, seed industry representatives, cotton traders and NGOs, substantial savings in pesticide use cannot be expected as farmers would still have to spray to control the pink bollworm. The field study by Gene Campaign has revealed that farmers have been spraying heavily for 60–70 days to control the pest. Dr. Sahai commented that the surge is due to the spread of illegal strain of Nabhatarat 151 variety. The constant exposure to Bt toxin without implementation of refuges has put the green bollworm under pressure, but created a “favorable space” for pink bollworm to multiply.

Another alarming revelation is that farmers and breeders have created their own Bt cotton varieties by crossing the Navbharat 151 with locally-adapted cotton varieties, which have spread to many states through an informal sales network.

Field populations of pink bollworm harbor three genetic mutations that confer resistance to Bt toxin. Consequently, bollworm carrying any two mutant genes can become resistant. Such resistant bollworm moths mate with each other producing fully-resistant bollworm. This unexpected development is posing a serious challenge to cotton scientists and their strategy of Bt pest management.