Texas Rice

Texas A&M University System
Agricultural Research and Extension Center
Beaumont, Texas

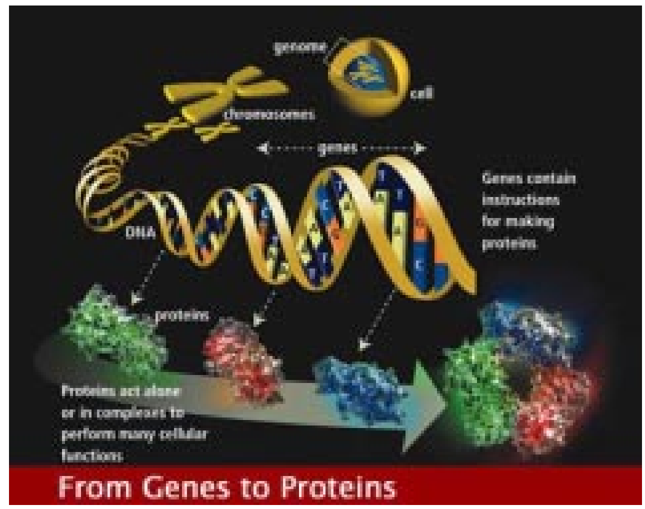
March 2006 Volume VI Number 1

Genetic Engineering in Agriculture

There has been a tremendous amount of attention in the press recently on the use of biotechnology to produce novel organisms for crop production. While these issues are far from being decided, there is much known already that can help consumers make decisions based on sound scientific principles.

A genetically modified organism (GMO) is an organism whose genetic material has been altered using a technique that splices together DNA fragments from more than one organism, thus producing a "recombinant" DNA molecule. This is achieved by cutting up DNA molecules with restriction enzymes and splicing these fragments together using DNA ligase. A transgenic organism, then, is one that contains DNA sequences from a foreign organism integrated into its own genome, thus the term *transgenic*, which literally means *across genes*.

The first GMOs were bacteria, created by Stanley N. Cohen and Herbert Boyer in 1973. Soon after this, in 1974, scientists called for a voluntary moratorium on certain recombinant DNA experiments. One goal of the moratorium was to provide time for a conference that would evaluate the state of the new technology and the risks associated with it. That conference concluded that recombinant DNA research should proceed, but under strict guidelines. The guidelines were subsequently disseminated by the National Institutes of Health in the United States and by comparable bodies in other countries.



Scientists have learned how to 'program' DNA to make specific proteins of use in human health and nutrition.

Examples of GMOs are diverse, and include transgenic experimental animals, such as mice, transgenic plants, such as 'golden rice', and various microscopic organisms altered for the purposes of genetic research or for the production of pharmaceuticals. Scientists have been producing insulin through GMO technology since 1982.

Mechanisms of Genetic Modification of Plants

Several techniques are used for the genetic modification of plants. One commonly used is based on a natural ability of the bacterium *Agrobacterium tumefaciens* to infect plants and cause a tumor-like growth, termed a 'crown gall'. *A. tumefaciens* contains a plasmid (a circular piece of DNA) that transfers from the bacteria into the infected plant, which later integrates into the plant's genome. The transferred genes cause the plant to form the gall, which houses the bacteria and produces nutrients that support the bacteria's growth. A number of scientists contributed to this discovery throughout the late 1960s and 1970s, with key discoveries by Jeff Schell, Marc Van Montagu, Georges Morel, Mary-Dell Chilton and Jacques Tempé. By 1983 biotechnology had reached the point where it was possible to insert additional genes of interest into *A. tumefaciens* and thus, transfer those genes into plants. This process is commonly used to create transgenic crop plants for agricultural purposes.

Another process to create transgenic crops is the biolistic method, commonly referred to as the 'gene gun'. As the name implies, genetic material coated over gold or tungsten is shot into target cells.

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From the Editor...

In preparation for a recent meeting with Congressman Allan Ritter, two of our east side rice producers, Mike Doguet and Bill Dishman Jr., asked that I provide an overview of the role that transgenic crops currently play in the U.S. agricultural economy and their potential value to the Texas rice industry. The following summarizes what was presented at that meeting.

Transgenetics refers to the "transfer" of "genes" between species to create genetically modified organisms (GMOs). A range of laboratory methods is used to transfer genes, with one of the oldest commercial GMO species being used to produce insulin. The large majority of insulin used to control diabetes is now produced using transgenics, in the process, greatly reducing costs that were previously required to harvest insulin from animal tissue, while at the same time greatly increasing its supply. This relatively early example of the use of transgenics, whose start dates back to 1978, has saved $ billions and an untold number of lives.

A number of genes of economic importance have now been isolated and transferred into several cultivated crops, including canola, corn, cotton, grapes, potatoes, rice, soybeans, tomatoes, and wheat. These include genes that effect plant size, earliness, yield, fruit and fiber quality, genes that confer resistance to insect and disease, genes that confer tolerance to herbicides, and genes that produce food oils that are less likely to clog arteries.

While several GMO crops have not reached commercial production, GMO canola, corn, cotton, and soybeans are all grown commercially in the U.S., each representing 60% or more of the respective acreage of each crop in the U.S. Collectively, these crops have saved U.S. farmers $ billions by reducing insecticide and herbicide spray costs, reducing crop injury, and increasing crop yields. Furthermore, without the increased profitability GMO crops afford, U.S. agricultural production would be less able to compete on the already uneven world agriculture export market with duties and tariffs, on average, over 4 times greater in other countries.

Almost every family who purchases food at U.S. markets has consumed trans-genetically modified food, most without knowing it. This same argument increasingly applies to many lesser-developed countries. Even GMO cotton, which is largely grown for its fiber, is used to produce margarines and vegetable oils.

During our lifetime, a major increase in food production will be required to prevent the world population from outstripping global food supply. Arguably, GMO crops are the only readily available technology suited to addressing the continually escalating global demand for food.

With the majority of U.S. acreage of canola, corn, cotton, and soybeans already GMO based, why the hullabaloo over growing commercial GMO rice? My guess it that the answer is wrapped up in issues involving perceived problems associated with unfounded fears of transgenic foods, some of which have spawned restrictions involved with exporting transgenic commodities to other countries.

My guess is that once China begins large-scale production of GMO rice, the barriers to the international sale of GMO rice will tumble. But the real problem is timing and, unless GMO rice is commercially grown in the U.S. very soon, other countries will gain an unfair competitive advantage.

As with most "new" technologies, transgenics is not without limitations. For example, broad-scale planting of herbicide-resistant transgenic crops have resulted in local weed populations that can no longer be controlled with particular herbicides. This problem is occurring due to the movement of the herbicide-resistant gene, such as with red rice through out-crossing, and due to the herbicide sprays amplifying resistance genes that first occurred in the weeds via random gene mutations.

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Inside This Issue

Farming Rice

a monthly guide for Texas growers

Providing useful and timely information to Texas rice growers, so they may increase productivity and profitability on their farms.

Using Banded Fluid Fertilizer to Improve The Economics of Rice Production in Texas

In flood-irrigated rice production, nitrogen fertilizer enters a unique environment, which can fluctuate between being aerobic and anaerobic. Losses of fertilizer N and mechanisms of N losses vary greatly from those of upland crops. Whereas upland crops frequently use 40 - 60% of the applied N, flooded rice crops typically use only 20 - 40%. Rice research in Arkansas, though, has shown that N fertilizer use efficiency of granular urea can be as high as 70% when applied under ideal conditions by airplane in multiple applications. However, aerial applications can cost $25 to $35/acre.

Banded fertilizer has proven effective for most crops and has the potential to improve fertilizer efficiency in rice production and reduce fertilizer application cost by as much as 70%. Studies in Asia have shown that band placement of both dry and liquid fertilizer below the soil surface can enhance the efficiency of nitrogen fertilizer.

This photo illustrates how the fluid fertilizer is banded into the soil at the time of planting.

The aim of this research project is to couple all innovations in fertilizer management (banded, fluid fertilizers) with innovations in water management (early flood, and all the benefits associated with early flood) to reduce rice production costs. The package of practices to be evaluated should contribute to lower fertilizer costs, lower application costs, less herbicide, and less irrigation water, thus, creating an earlier and more uniform crop maturity with better milling of rice grain.

Historically, most fertilizer has been aerially applied to drill-seeded rice in the southern U.S. in 2 - 4 applications during the growing season because aerial application is quick, fields are flooded, and multiple applications increase efficiency of topdressed N. Banded fluid fertilizer has the potential to reduce fertilizer application cost by applying 75-100% of total N while planting, and increase N uptake efficiency by reducing ammonia volatilization and denitrification.

Studies were conducted on clay soil near Beaumont, TX in 2003, 2004, and 2005 and on sandy loam soil near Eagle Lake, TX in 2004 and 2005. The fluid treatments received 75 or 100% of the 150 lbs N/A at planting, with the remainder being applied as dry urea at midseason. Fluid fertilizer was banded 2 - 4 inches below the soil surface, between every other drill row, spaced 8 inches apart. Dry fertilizer treatments received 17-100% of the 150 lbs N/A as dry urea broadcast on the soil surface just prior to planting. Remaining N was applied at preflood and midseason.

Fertilizer treatments were superimposed on flood irrigation treatments consisting of establishing the flood at the 4- or 6-leaf growth stage. Fertilizer treatments include: (1) 150 lbs N/A

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fluid during planting, (2) 150 lbs N/A dry urea applied just prior to planting, (3) 2-way split, 100 lbs N/A fluid at planting + 50 lbs N/A dry urea at midseason, (4) 3-way split, all dry urea, 25 lbs N/A preplant, 75 lbs N/A preflood, 50 lbs N/A midseason) and (5) No nitrogen applied. Plant N content and rice yield were measured under each system.

Nitrogen Uptake

In 2003, on clay soil, when N uptake was measured at midseason, fluid fertilizer applied all at planting increased N uptake over that of dry urea applied preplant under both the 4- and 6-leaf flood. When N uptake was determined at late boot in 2004, the N content (152 lbs/A) of above ground biomass in the fluid fertilizer treatment, where all of the N was applied at planting, was similar for both the 4- and 6-leaf floods, possibly due to early season rain on clay soil. N uptake for fluid fertilizer applied at planting was about 50 lbs/A greater than N uptake for dry urea applied at planting and 3-way split treatments under both 4- and 6-leaf floods. On silt loam soil, N uptake for the fluid treatment applied at planting (148 lbs/A) was similar to the 3-way split (150 lbs/A) and greater than dry urea applied preplant (130 lbs/A) in 2004. Data from 2005 continues to show an N uptake advantage of 36 lbs/A for 4-leaf flood when fluid fertilizer was applied preplant is compared to dry urea fertilizer applied preplant on clay soil. However, N in rice plants for the 3-way split was similar to that found in the fluid fertilizer only treatment for both irrigation treatments. On silt loam soil in 2005, N uptake was similar for all fertilizer treatments (135 lbs/A) due to the ability of these soils to supply large amounts of residual N.

When averaged across the two years where N uptake was determined at late boot, fluid fertilizer compared to dry urea, applied all preplant, increased N uptake by 42 and 27 lbs/A for the 4- and 6-leaf flood on clay soil. When compared to the 3-way split, fluid fertilizer also increased N uptake by 28 and 21 lbs/A for the 4- and 6-leaf flood. The average of two year's data from sandy loam soil indicates that fluid fertilizer has less of an advantage on these soils, with fluid having only 10 lbs/A more N in plants compared to dry urea treatments.

Effects on Rice Yield

Figure 1 shows improved yield for the zero fertil-

Figure 1. Rice yield from each of the three years of fluid fertilizer evaluation for Texas rice production when irrigation flood was established at the 4- or 6-leaf growth stage. Total N applied was 150 lbs/A.

Rice Yield when Grown on Clay Soil Near Beaumont, TX.

Fertilizer Treatment	Fertilizer Source	Nitrogen Rate lbs/A			2003 Yield lbs/A		2004 Yield lbs/A		2005 Yield lbs/A	
		AP[1]	PF[2]	MS[3]	4-leaf	6-leaf	4-leaf	6-leaf	4-leaf	6-leaf
1) Fluid all during planting	Fluid	150	0	0	6939	6223	6498	6359	8350	8851
2) Dry urea just prior to planting	Dry	150	0	0	6869	5223	5867	5993	8080	7324
3) 2-way split	Fluid+Dry	100	0	50	6213	5213	6099	6210	8650	8546
4) 3-way split	Dry	25	75	50	6554	6104	6249	6058	8580	8008
5) No nitrogen	None	0	0	0	2103	1540	2495	1678	2918	2645

[1]AP = at planting; [2]PF = preflood, [3]MS = midseason.

Rice Yield when Grown on Silt Loam Soil Near Eagle Lake, TX.

Fertilizer Treatment	Fertilizer Source	Nitrogen Rate lbs/A			2003 Yield lbs/A		2004 Yield lbs/A		2-Yr Avg lbs/A	
		AP[1]	PF[2]	MS[3]	4-leaf	6-leaf	4-leaf	6-leaf	4-leaf	6-leaf
1) Fluid all during planting	Fluid	150	0	0	8426	8248	-	7343	8426	7796
2) Dry urea just prior to planting	Dry	150	0	0	7498	7676	-	7176	7498	7426
3) 2-way split	Fluid+Dry	100	0	50	8439	8198	-	7256	8439	7727
4) 3-way split	Dry	25	75	50	8384	7754	-	7000	8384	7377
5) No nitrogen	None	0	0	0	5545	4873	-	4932	5545	4903

[1]AP = at planting; [2]PF = preflood, [3]MS = midseason.

Banded Fluid Fertilizer continued...

izer treatment when flooded at the 4-leaf growth stage. The approximately 600 lb/A higher yield at both locations suggests establishing the flood at the 4-leaf growth stage improved conditions for maximizing rice yield and/or increasing soil N uptake efficiency. The 4-leaf flood also maximized yields across all fertilizer treatments. When 150 lbs N/A were applied under the 4-leaf flood on clay soil, the 3-way split of dry urea yielded 7077 lbs/A, while dry urea and fluid fertilizer applied all preplant yielded 6939 and 7262 lbs/A, respectively, when averaged across the three years of this study. Under the 6-leaf flood, on clay soil, the 3-way split of dry fertilizer yielded 6622, while the preplant urea and preplant fluid yielded 6179 and 7144 lbs/A, respectively.

This data shows the more efficient banded fluid fertilizer produced higher rice yields than dry fertilizer under the 6-leaf flood where conditions were more favorable for N denitrification. A similar trend was observed for the sandy loam soil at Eagle Lake

Economic Advantages

Fertilizer and application cost, and gross returns minus fertilizer and application cost, were estimated for each treatment. Fertilizer application cost are based on $4/A for subsurface banding of fluid fertilizer and $8/A for aerial applications of less than 110 lbs/A urea. The economic advantage of fluid fertilizer applied at planting when compared to the traditional 3-way split on clay soil was $26 and $53/A for the 4- and 6-leaf flood, respectively. On sandy loam soil, fluid fertilizer's economic advantage was less than that for the clay soil, having a $35 advantage over the 3-way split when flooding at the 6-leaf growth stage.

This study illustrates the pronounced effect of N fertilizer placement and timely flood establishment on N uptake efficiency and rice yield, especially on clay soil. In the future, additional research is needed to determine if the application of liquid fertilizer is sufficiently fast to be applied economically to large commercial fields. *

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Pharmaceutical Crop Production

Beginning in the early 1980s, private companies and university researchers have engineered crops to produce pharmaceutical and industrial chemicals (referred to as "pharma" crops). Since 1991, USDA has approved more than 200 applications to grow pharma crops in 34 states, including Texas. The developers of pharma crops hope to reduce the cost of producing drugs and industrial chemicals, and in some cases produce drugs that cannot be made by other means.

Food and feed crops, particularly corn, are the crops of choice for pharma crop companies. There has been much public debate over the possibility that these engineered crops might find their way into the food supply and cause potential harm to the consumer.

Ventria Bioscience, a California-based company specializing in plant-made pharmaceuticals, made the news recently when they attempted to shift production to Missouri. They patented a technology to remove proteins from genetically modified rice, proteins normally found in human milk, saliva and tears, which could then be refined for use in medicines to fight diarrhea, dehydration and other illnesses. Initially, Anheiser-Busch said they would not continue to purchase Missouri rice if Ventria grew its pharm rice in the state. They later retracted and said if the pharm rice was grown in Northern Missouri, away from the bootheel production sites, they *would* continue to purchase Missouri rice.

Ventria then began negotiations with Northwest Missouri State University to anchor the Missouri Center of Excellence for Plant Biologics at the campus in Maryville. When the university Board of Regents voted to shrink the project by half, Ventria announced it would look for another partner to continue the business endeavor.

Other such companies have had difficulties as well. The Texas-based company, ProdiGene Inc., was found liable in 2002 of mismanaging field trials of genetically modified crops in Iowa and Nebraska. They were forced to pay $3 M in penalties and clean-up cost. According to the Union of Concerned Scientist website, (http://go.ucsusa.org/food_and_environment/pharm/index.php?s_keyword=XX) ProdiGene is one of the companies growing pharmaceutical corn in Texas. Other pharma crops currently in Texas trials include soybeans and tomatoes. *

Currently, high-pressure helium is used to propel the material into the cells, but when the method was first developed, researchers actually used gunpowder. The biolistic method was used for the creation of two of the most common transgenic crops - RoundUp Ready soybeans and Bt-corn.

Golden Rice, pictured on the right, is a genetically engineered variety whose grains contain the yellow-orange pigment beta-carotene, a plant-based source of vitamin A.

Pros and Cons of Transgenic Technology

Genetic modification is the subject of intense controversy. Some see the science as intolerable meddling with "natural" order, despite known examples of natural genetic breeding occurring throughout history. While some would like to see it banned, others push for required labeling of genetically modified food. Other controversies include the definition of patent and property pertaining to products of genetic engineering, and the possibility of unforeseen global side effects as a result of the proliferation of modified organisms.

Individual genetically modified crops (such as soybeans) are subject to intense study before being brought to market, and are common in the United States. Some countries in Europe have taken the opposite position, stating that genetic modification has not been proven safe, and therefore will not accept genetically modified food from the United States or any other country. This issue was brought before the World Trade Organization, which recently determined that the European Union (EU) created an unnecessary obstacle to international trade by not allowing modified food to be imported. The ruling stated that similar bans imposed separately by France, Germany, Italy, Luxembourg and Greece, also violated WTO rules.

The EU first began barring the sale of genetically modified crops and foods in 1998, mainly due to health concerns. It continued to do so up until 2004, when the European Commission allowed U.S. firms to begin shipping a modified strain of sweet corn into EU member countries. EU officials have allowed the import of nine biotech crops since 2004, but the American Soybean Association (ASA) believes the U.S. needs to continue to push the Europeans to base import decisions on scientifically sound principles. They believe this favorable WTO ruling should only be seen as a starting point in the actions against Europe's unjustified and unscientific policies toward biotechnology, and what must follow is a challenge of the EU's unfair traceability and labeling laws. ASA officials maintain that the EU labeling requirements for all foods and feeds that contain or consist of biotech products are costing U.S. soybean growers hundreds of millions of dollars in lost sales each year.

Besides health issues, some GMO critics have raised the concern that conventionally bred crop plants can be cross-pollinated with modified plants. Plant pollen and seeds from some plant species can be dispersed over large areas by wind, animals, and insects. Recent research has lent support to the concern, particularly since modified genes were found in conventional crops, and also within wild relatives of these crops. GM proponents point out that out-crossing, where plant pollen travels from a crop plant source to wild relatives that can produce hybrid offspring, is not new. The same thing happens with any new crop variety - newly introduced traits can potentially cross out into neighboring crop plants of the same species and to closely related wild relatives of crop plants.

Defenders of GM technology point out that each GM crop is assessed on a case-by-case basis to determine if there are any risk associated with the out-crossing of the GM trait into wild plant populations. The fact that a GM plant may outcross with a related wild relative is not, in itself, a risk unless such an occurrence has consequences. If a herbicide resistance trait was to cross into a wild relative, the farmer can manage this risk by rotating herbicides.

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Another hot issue is the potential for patented genes to be transferred through out-crossing, even accidentally, with conventional crops in a neighboring field. If this happens, the patent holder has the right to control the use of those crops. This was supported by Canadian law in the widely publicized case of Monsanto vs. Percy Schmeiser.

Monsanto also made headlines when they submitted a patent for a technology protection tool, dubbed the 'terminator gene', to produce first generation crops that would not result in viable seeds in the second generation. In addition to the commercial protection of proprietary technology, a generally contentious issue, another purpose of the terminator gene was to prevent the escape of genetically modified traits into wild-type species by sterilizing any resultant hybrids. Use of the terminator technology would also prevent 'volunteers', or plants that grow from unharvested seed, a major concern that arose during the Starlink debacle.

In spite of the potential benefits, the terminator gene technology created a backlash amongst those who felt the technology would prevent re-use of seed by farmers in the developing world, and was ostensibly a means to protect intellectual property rights. Opponents also argued that if such technology was not closely regulated, it could escape into the environment, causing widespread devastation of commercialized crops.

Due, in part, to intense public concern regarding GMOs, the USDA's Office of the Inspector General (OIG) launched a review of the USDA Animal and Plant Health Inspection Service (APHIS), the agency responsible for oversight of GM research. According to the report released in December of 2005, the OIG found several shortcomings in the protocols APHIS had in place to monitor transgenic research.

According to the report, the number of approved applications to field test genetically engineered crops in the U.S. has increased significantly since 1986, when the Department began regulating experimental GE plants. Since that time, the USDA has approved over 10,600 applications for more than 49,300 field sites. Biotechnology companies are investing millions of dollars to develop new GE plants, with the goal of commercializing them for use as food, feed, fiber, industrial compounds, and medicines. The report emphasized that it is the USDA's responsibility to ensure that GE plants, including their pollen and seeds, do not persist in the environment, yet the Department's efforts to regulate those crops have not kept pace.

As part of the evaluation, OIG inspected the sites for compliance with APHIS requirements for the growing or postharvest season. They found that APHIS "needs to strengthen its accountability for field tests of GE crops. In fact, at various stages of the field test process, from approval of applications to inspection of fields, weaknesses in APHIS regulations and internal management controls increase the risk that regulated, genetically engineered organisms will inadvertently persist in the environment before they are deemed safe to grow without regulation."

APHIS responded by revising and/or enhancing many aspects of their regulatory program. Changes will continue to be implemented that will better insure that GMO research proceeds in a manner that is safe for the public and the environment.

Those in favor of GMO technology point out the many benefits it offers farmers and the general public. Farmers can save money on costly herbicides, pesticides and fertilizers, while the public can benefit from a consistent and affordable food supply. In addition, people in developing countries that face possible starvation as populations continue to rise, have a chance to use existing farmland to feed themselves in the challenging years that lie ahead. *

Researchers in China are actively pursuing the development of genetically engineered rice to meet the demands of their growing population.

Genetically Engineered vs Genetically Modified

Often times, there is confusion among the public about exactly what constitutes a genetically modified organism. As the term is commonly used, it indicates when foreign genes are artificially inserted into a host genome. Some scientists now suggest it would be more accurate to use the term genetically *engineered* organism, as plants can be genetically modified without the insertion of foreign DNA.

In fact, plant breeders have been creating novel varieties for over a century using basic Mendelian genetics. And even before the genetic mechanisms were understood, botanist were making crosses of different biotypes within the same species.

In the early 1900s, plant breeders began utilizing mutagenic techniques to come up with improved varieties. For example, tomato seeds would be exposed to chemicals or radiation that would alter their genetic structure. The seeds would then be grown out, and those that survived were evaluated for improved properties. This technique does not result in GEOs.

An example of this technique led to the development of the Clearfield rice varieties, which are tolerant of the imidazolinones class of herbicides. Research at the LSU AgCenter's Rice Research Station, initiated by Dr. Tim Croughan, lead to the development of an herbicide resistant rice now known as Clearfield technology.

After 10 years of work, Croughan went back to a methodology he had tried early on, and began soaking seeds in a chemical called ethyl-methane sulfonate (EMS) to induce mutations. EMS has been used for decades by plant breeders to cause point mutations, also known as base-pair mutations, in an effort to develop improved varieties. In fact, over 1000 different varieties of grain and vegetable crops are available today as a direct result of this methodology.

Croughan began with 10 varieties of rice, including the old release Alexandria Seed 3510 (known as AS3510). In 1993, Croughan found a single plant from the mutated AS3510 seed that could survive elevated levels of the *imi* herbicide Newpath. The plant was grown out, its progeny planted in the field, then sprayed with Newpath. All the plants survived. After that, a team of researchers spent a great deal of time and effort moving the gene from the AS3510 mutant into genotypes that were commercially viable. The first two varieties that resulted from this were CL121 and CL141. The newest Clearfield varieties, CL161 and CL131, have a different resistance gene. This gene is from a second mutant (in a Cypress line) that has a much higher level of resistance than that found in the original AS3510 mutant.

Today, Clearfield varieties are now grown extensively on acreage in Texas, Louisiana, Arkansas, Mississippi and Missouri in areas where red rice is a persistent problem.

In 2000, a similar technique called 'Tilling' was devised using the *Arabidopsis*-genome. Traditional mutagenesis screens, like the EMS mutagenesis, can cause point mutations, but the identification of these point mutations is much more difficult. Tilling (Targeting Induced Local Lesions in Genomes) is a method in molecular biology that allows a directed identification of mutations in a specific gene. The method combines a standard technique, the mutagenesis with Ethyl methanesulfonate (EMS), with a new screening-technique that enables the possibility to identify Mismatch-Hybridization with High Performance Liquid Chromatography.

This new technology is capable of achieving results similar to those in genetically engineered crops , yet it relies solely on genes already in the plant. Scientists at the USDA Agricultural Research Service's Crop Production and Pest Control research unit on the campus of Purdue University, have launched a tilling project with the goal of making hypoallergenic soybeans. Soybeans are one of the top eight allergenic foods, along with peanuts.

The researchers are creating as many mutations as they can in soybeans, then mining that information. They believe it may be possible to identify mutants in the Tilling population that do not produce specific allergens. They are also using Tilling to develop healthier soybean oil and higher-protein soybeans. They estimate that trans-fat-free nonhydrogenated soybean oil will be available in one year, while soybean oil that will rival olive oil for its monounsaturated fats is three years away.

These new techniques and methodologies will give plant breeders more tools to work with in their quest to produce higher-yielding, low-input varieties that may have definite health benefits for consumers. *

Sorting Out The Ag Policy Situation for 2006

For the last nine months there has been considerable discussion about the future direction of agricultural policy in the United States. Congress has indicated a strong desire to keep the major provisions of the current farm bill (Food Security and Rural Improvement Act of 2002) intact until it expires in 2007. However, most observers point to two primary reasons that changes are coming for U.S. policy as the 2007 farm bill debate begins in earnest in 2006.

First, a year ago, all the talk in Washington was about getting control of the federal budget deficit and the adverse impact war spending was going to have on the amount of government borrowing and the general economy. In this regard, the President asked Congress to reduce spending through budget reconciliation, and as of November 2005, both the Senate and House had plans for accomplishing around a $3 billion reduction in mandatory spending over the 2006-2010 period. While this was definitely a modest cut, rumors in Washington are that the next reconciliation amount will be much larger. A larger cut would require the Agricultural Committees of Congress, producers, and their associations to take stock as to whether the current set of programs and corresponding payments (counter-cyclical payments, direct payments, and marketing loan payments/loan deficiency payments) are still what they want, given less money is behind them. We may have to wait until 2007 to find out about a future reconciliation bill, as years divisible by 2 aren't normally years subject to budget reductions.

The second reason for program change is the loss in the Brazil World Trade Organization (WTO) case against the U.S. cotton program. Thus far, the U.S. has made minimal changes to comply with the WTO ruling with the intention of dealing with the major changes in the 2007 farm bill. While the loss in the cotton case is important, when you couple it with the ongoing Doha Round discussions of the WTO, something has to change. With the loss in the cotton case, the U.S. will not be able to stay under our existing amber box spending limit without changes in commodity programs. If the U.S. Trade Representatives' proposed lower spending limits are approved, without an accommodation of our request to change how certain program payments are categorized, then real changes, beyond most farmers' wildest imagination, will have to be made in commodity programs. If you wonder why the U.S. negotiators would consider making significant concessions in the current trade round, think about this. Many believe the only options are to make significant changes in the trade negotiations or face more cases against other program commodities such as rice and soybeans.

On their own, neither of the two reasons provided for change are likely to be strong enough to create a major change in agricultural policy; however, in combination they appear to be moving U.S. agricultural policy toward significant changes. While the prospects for change appear pretty good, it should be noted that the amount of financial support for agriculture is not expected to decline appreciably – it may be provided by an alternative form of safety net. *

Article by Dr. Joe L. Outlaw and Dr. Larry Falconer, Professors and Extension Economists

Proposed USDA Budget Cuts

The President's proposed budget for 2007 was unveiled last month. If the President's proposal were to become law, the Department of Agriculture would be hit with the third largest cut of any agency, specifically the Agricultural Research Service was asked to reduce their budget by $34.5 million. If Congress approves this proposal, the USDA-ARS Rice Research Unit at Beaumont would be eliminated, and the Stuttgart program downsized, on October 1st, 2007.

The USDA has been a partner at the Texas A&M Agricultural Research and Extension Center in Beaumont since 1914. Since that time, 33 varieties of rice have been released from the Center, each with improved yield potential, disease resistance, and cooking quality. Recently, ARS added a Molecular Biology lab, which utilizes DNA marker technology to aid in the efficient and effective incorporation of valuable traits into improved rice cultivars.

Ray Stoesser, President of the Texas Rice Council from Dayton, noted that "All the USDA scientists and technicians work closely with the Texas A&M personnel to insure the greatest benefit for the Texas rice industry." Given that the rice industry contributes $1 billion annually to the Texas economy, it seems that it is a partnership worth saving. *

Geothermal springs in central Tibet are home to a diverse collection of extremophiles, organisms that live in the most extreme environments on Earth.

Out Of This World: Nasa Funds Revolutionary Ideas

Bouncing robots capable of exploring planets, a giant pinhole camera in space, and genetically engineered crops that could grow on other worlds are just three of the ideas proposed by scientists funded by NASA's forward-thinking Institute for Advanced Concepts.

"NIAC was created to identify new and revolutionary concepts for NASA that go well beyond what NASA is currently doing," said Robert Cassanova, director of NIAC, set up in 1998 as an independent brainstorming institute.

At a recent meeting in Colorado, scientists heard about the projects funded after last year's NIAC call. One microbiologist, Amy Grunden, at North Carolina State University, reported that she had been working on a way to grow food in harsh conditions on other planets. Her inspiration came from extremophiles, microscopic organisms that live in the most extreme environments on Earth.

"We can actually pinpoint particular genes that are responsible for providing adaptations for these organisms that are living in extreme environments," said Professor Grunden. "Given our current biochemical and physiological knowledge of some of these adaptive pathways, can we put them in other plant systems to help them deal with extremes?"

Her idea is to put "extreme survival" genes into crops such as rye; astronauts on long missions would take the seeds with them, saving on the cost of taking food supplies into space. *

For more information go to http://www.niac.usra.edu/

Plant Derived Vaccine

The announcement recently that Dow AgroSciences was granted the world's first regulatory approval for a plant-made vaccine marks another step toward the commercialization, and legitimizing, of a technology that holds much promise for new ways of treating a myriad of human and animal diseases.

And it may allow the production of more effective medicines at a lower cost than present methods that are based on expensive animal component research/ manufacturing systems. Down the road, researchers envision plant-derived human vaccines that wouldn't require refrigerated storage, would have fewer side effects, and could be given in pill, inhalant, or patch.

Dow's Concert Plant-Cell-Produced System, developed in a short five years, represents a new category of plant-made vaccines that are expected to be both safe and effective for horses, dogs,cats, poultry, swine, and cattle.

Conventional vaccine production, using animal components, entails the risk of contamination by pathogens. The Dow process instead inserts a protein from a virus or bacteria into a plant cell and reproduces it in a bioreactor. And because it uses a specific protein, animals don't have the temporary infections that can result with conventional vaccines.

Because the process uses only plant cells instead of whole plants, and it takes place in a contained environment, there is no possibility of pollen cross-contamination, which has been one of the bugaboos of those who oppose genetically modified crops. *

From an article by Hembree Brandon, Delta Farm Press

Tobacco has been the crop of choice for developers of plant derived pharmaceuticals.

State, National and International News...

GMO Rice in Costa Rica

USRPA - The University of Costa Rica, working with the Ministry of Agriculture, has announced that its GMO rice project is getting close to commercialization. Modified for both herbicide tolerance and disease resistance, the new variety still needs to pass tests on its safety for human consumption and low impact on the environment. No release date is predicted. The announcement was made at an international forum in Costa Rica titled "Genetically Improved Crops and Bio-Security: Opportunities for Developing Countries".

Rice Leadership Graduates

USA Rice Federation - Future rice industry leaders graduated from their two-year program during the 2006 Rice Industry Government Affairs Conference. The 2004-2006 leadership class participated in the conference's extensive leadership meetings with government, regulatory and rice industry officials. The class' participation in the Government Affairs Conference and other meetings marked the fourth and final session of the two-year leadership program. The graduating class includes producer Michael Skalicky from Ganado, TX and Dr. Brain Ottis, who did much of his doctorate work at the Beaumont Center.

Rice Farmers Travel to D.C.

USRPA - In mid-February, a large number of rice industry representatives from all six rice states converged on Washington, DC in an effort to impress upon the federal government that rice production, like all of agriculture, is a vital aspect of the country's national security. The timing was excellent, since the President released his proposed 2007 budget the week before, which again calls for large cuts in the USDA budget. Most of the ideas are the same as proposed last year, and Congress did not agree to implement them in 2006. All concerned hope that Congress will repeat that performance. As the planting season approaches, there continues to be an atmosphere of uncertainty when it comes to the amount of support the farmers will receive in the near future. Key rice industry issues addressed included protecting the agriculture budget from any additional reduction, disaster assistance for losses in 2005 from natural disasters, support of the 2002 Farm Bill and significant market access improvement for U.S. rice overseas. Agriculture is hard-hit in the proposed budget, with the Department absorbing the third largest percentage decline of any agency. In their Congressional visits, members of USRPA and USARF stressed, from a long list of proposed cuts, that a 5% rescission in all payments is a bad idea, that eliminating the three-entity rule and capping payments at $250,000 will severely impact Southern agriculture, and that a $5 user fee on LDP transactions is simply offensive. The group also emphasized that trade sanctions on Cuba are in need of further reform because farmers feel that normal commercial relations with the high per capita rice consuming neighbor is vital to the future of rice production in the United States. With 45% of rice production going to the export market, trade agreements that contain real market access are imperative along with the use of USDA's market development tools to facilitate U.S. rice sales to Iraq and other key markets. The joint meetings of the two rice organizations presented a strong united front, in an effort to convey to Congress and the Administration that the economic health of the entire U.S. rice industry is tied to the maintenance and expansion of foreign markets. The Board of the US Rice Producers Association voted last November to initiate these joint meetings in Washington in an effort to defend the future of the industry at the highest level.

Soybean Rust Found in Weslaco

Asian soybean rust, a potentially serious fungus of soybean crops, has now been found in an area of Texas where prevailing winds could help spread the disease. While scientists are not sure how the disease will behave in this part of the world, some are concerned that fungal spores from South Texas will ride the winds to the Midwest's multi-billion dollar soybean crop. Dr. Marvin Miller, a Texas Agricultural Experiment Station plant pathologist in South Texas, found the fungus on soybean in a research plot at the Texas A&M University System Agricultural Research and Extension Center at Weslaco. A preliminary diagnosis made at the Texas Plant Disease Diagnostic Laboratory in College Station was confirmed by a U.S. Department of Agriculture laboratory in Beltsville, Md., Miller said.

From an article by Rod Santa Ana III

From the Editor continued...

Although less likely, herbicide resistance in weeds may also be occurring due to the movement of genes from the transgenic crops to other plant species via naturally occurring viruses and bacteria capable of supporting such movement. However, to date, this has not been shown to be a major problem.

Transgenic crops will play an increasing role in both U.S. and world agricultural production. Ultimately, we will see commercial transgenic rice. I am hopeful its value to society will far exceed any challenges faced in its implementation.

Changing topics, this past February the Texas Rice Research Foundation board of directors presented an appreciation award to Katy rice farmer Des Woods in recognition of the significant contribution he has made to the rice industry. The following highlights what was conveyed in the award.

Des began his career working on his father's rice farm. He was destined, however, to work faithfully, humbly, and tirelessly in fields whose boundaries stretched far beyond the Katy Prairie of his youth. Now after forty plus years as a farmer, Des' unparalleled insight has enabled the rice industry to manage successfully the unforeseen and unimaginable changes that have beset the industry in recent decades. Deservedly, Des has earned the respect and profound gratitude of his peers.

In 1965, fresh out of college and a stint with the U.S. Army, Des began farming at his father's side. Soon thereafter, however, he was farming on his own, and just five years later, in 1970, he was named "Rice Farmer of the Year" by Rice Farming Magazine. In 1976, he expanded his operations to Louisiana.

Beginning in the 1970s, the pace of change in the rice industry increased dramatically. Demonstrating remarkable foresight, Des recognized that, as a consequence of these changes, the business of rice farming could no longer take place solely in the field. Des knew, well before most, that the successful farmer of the new millennium would spend time in the research laboratory, before the governmental agency, and on the trading floor.

He has served his state and local community through his involvement in his church and in re-developing wildlife habitats in West Texas. Des has generously shared his time and unique insights in service to his industry as well. Among numerous other examples, Des has served as a director, and later President, of American Rice, Inc., as Vice-President and then 22 years as President of the Texas Rice Research Foundation, and as a member of the Texas Rice Producers Legislative Group. He has also served as the Chairman of the Texas Rice Producers Board, as a member, Chairman, and Vice-Chairman of the National Rice Research Board, and a member of the Governor's Agriculture Task Force. In these and other roles, Des has been instrumental in shaping the rice industry's response to the growing challenges of an increasingly international economy. Please join the Center staff in congratulating Des for this prestigious award.

Sincerely,

L.T. Wilson
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Texas Rice is published 9 times a year by The Texas A&M University System Research and Extension Center at Beaumont. Interviews, writing and layout by Jay Cockrell. Editing by Ted Wilson, Jay Cockrell and Brandy Morace, with additional support by Jim Medley. Information is taken from sources believed to be reliable, but we cannot guarantee accuracy or completeness. Suggestions, story ideas and comments are encouraged.

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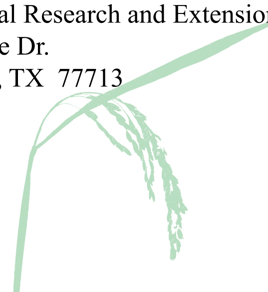

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