



Texas Rice

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Allelopathy: Potential for Weed Control in Rice

Over time, all species have evolved mechanisms for self-defense, like the well-known ‘fight or flight’ response in mammals. Plants, however, do not have the ability to flee from predators, or pick up and move when competition inhibits growth.

Plants deal with these problems in several ways, by physically discouraging feeding with thorns and hairy surfaces, as well as producing chemical compounds that protect them in other ways.

As far back as 300 BC, Theophrastus referred to ‘phytotoxicity’ among plants in his book, *Enquiry into Plants*, and the Greek philosopher Democritus reported the use of naturally occurring plant products as a practical method of controlling weeds.

It wasn’t until 1937, though, that the German scientist Hans Molisch first coined the term ‘allelopathy’ in a monograph; which described the biological interaction among plants, algae and microorganisms. Although Molisch used the term to describe both positive and negative interactions, common usage of the term generally refers to the antagonistic effect some plants have on their neighbors.

In the early 1960s, this phenomenon caught the interest of Dr. Elroy Rice, an ecologist at the University of Oklahoma. He studied



This photo illustrates the fibrous surface roots in the allelopathic rice line PI 312777, and a lack of these roots in Kaybonnet, a conventional long grain that has no allelopathic activity. Researchers speculate that root proliferation at or near the soil surface could potentially be a mechanism by which phytotoxic chemicals are exuded from suppressive rice roots into the weed seed zone, thus increasing suppression of weed germination and/or growth.

plant succession in abandoned agricultural fields and found there were four stages: the pioneer weed stage (duration 2-3 years), the annual grass stage (duration 9-13 years), the perennial bunch grass stage (duration 30-50 years), and the climax prairie. Through extensive research, he established that chemical interactions between plants were the major factor causing rapid disappearance of the pioneer weed stage and the long duration of the two middle stages. Much of Rice’s book, *Allelopathy*, published in 1974, is based on his research in Oklahoma.

In an effort to reach out beyond the scientific community, Rice published *Pest Control with Nature’s*

Chemicals in 1983, and made allelopathy a household word. On September 5th, 1994, at a meeting in New Delhi, India, the International Allelopathy Society was formed, and although Rice was not present at the meeting, he was instrumental in bringing the scientists together. The Society established the “Rice Award” to recognize the best paper submitted by a student at their biennial symposia.

After the publication of Rice’s books, there was renewed interest among U.S. scientists on the concept of allelopathy. In a paper published in 1986 by Putman and Weston, they reported that the al-

continued on page 9

From the Editor...



Texans take pride in honoring commitments. As such, we expect others in this great country to play by these same rules. It is from this perspective that I am taken aback by proposals from our leaders in Washington D.C. to redirect 2002 Farm Bill funding and thereby place further obstacles on the economic playing field faced by our agricultural producers. I am equally concerned over attempts to reduce Hatch funding to our nation's Land Grant University System, which would put a substantial hole in the middle of U.S. agricultural research.

It would be hard to argue against the majority of decisions made by our government providing for the betterment of our people and our nation. Were this not the case, our country would not be one of the very best places in the world to live. Nor, would immigrants from less fortunate places around the world continue to view the U.S. as a place of opportunity where a person with enough gumption and drive can literally rise to the very top. However, with respect to our leadership's desires to change both Farm Bill and Hatch Act funding, both, if enacted as proposed, would deliver shattering blows to U.S. agriculture.

The push to reopen the 2002 Farm Bill is viewed by many as a bad thing. However, if proposed changes were fully thought out and were they to improve the fairness or efficiency of the Farm Bill at increasing the competitiveness of our farmers in a fair manner, most would rush to be the first to endorse the changes. Instead, what is proposed is a poorly thought out redirection of Farm Bill funding, a redirection that makes sense only were Europe, South America, and Asia to similarly reduce its price supports and/or tariffs. But as things currently stand, were the proposed changes enacted, U.S. agriculture would suffer reduced income and ultimately reduced agricultural infrastructure in our rural communities. Although the average Joe would be impacted more slowly, the ultimate loser would be each and every one of us, through both reduced food security and escalating food prices.

The 2002 Farm Bill is, in many respects, a contractual agreement. When a grower decides to purchase

a \$200,000 combine or to plant a certain mix and acreage of crops, it is done so with the understanding that they can sell their crops at fair and equitable prices, affording a reasonable income. Similarly, when we buy a car or a home, we are doing so with an understanding of what our income and expenses will be. Changing the Farm Bill at this point, and in the manner that is being proposed, is analogous to changing a loan contract in mid-stream. Some things just aren't done.

The push to redirect a significant amount of Hatch funding, as presented, is similarly poorly thought out. On paper, it sounds good for the money to be added to a pool for use in a nationally competitive grants program. However, the problem is in the baking of this new pie. Roughly speaking somewhere near 12% of Experiment Station funding to Land Grant Universities is from Hatch Funds. Were the proposed allocation of these funds changed in the manner proposed, the impact would mean that as many as one in every eight research personnel, who are partially supported through Hatch funding, would be gone. If well thought out, and implemented in a gradual manner, the proposed changes to Hatch funding could work. However, suffice it to say, the result, if implemented as proposed, would be equivalent to trying to lose weight by whacking off one or more appendages with a machete. For some reason, I don't think that will work.

Ultimately, I am trusting that the checks and balances in our government will result in the right decisions being reached.

Sincerely,

A handwritten signature in black ink that reads "L. T. Wilson".

L.T. Wilson
Professor and Center Director
Jack B. Wendt Endowed Chair
in Rice Research

Inside This Issue

Cover Story:
Allelopathy in Rice

Researcher in the News: Dr. James Stansel	3
Special Guest Editorial	5
Rice Farmers Travel to Washington	8
State, National and International News	11

Researcher in the News...

Spanning over four decades, Jim Stansel has dedicated his entire career to the advancement of rice production.

Born in Angleton, Texas, the oldest of three children, Stansel grew up in the rice industry. His grandfather started farming rice in southern Louisiana in the 1890's, and Stansel's father, Roy, put in his first rice crop at the age of 14. Roy acquired his BS in Agronomy at Louisiana State University, and his MS from Texas A&M University in 1928.

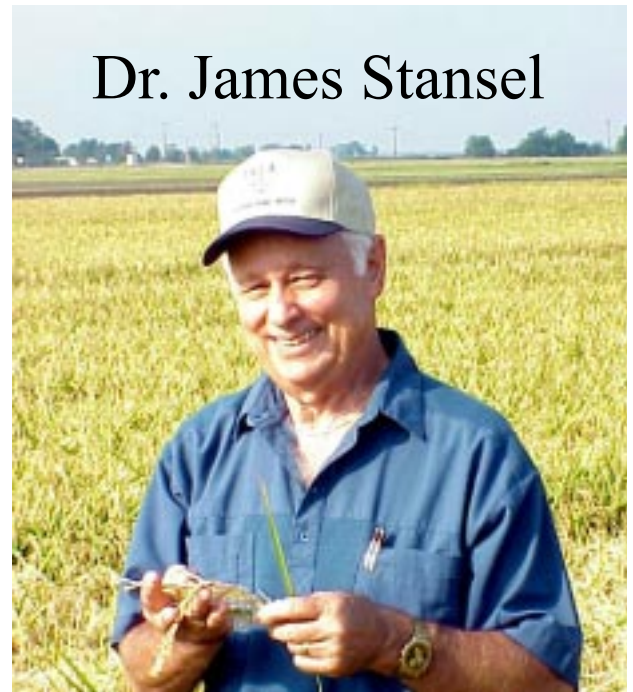
Immediately after graduation from Texas A&M, Roy accepted the position as superintendent of the Angleton substation, where he served for the next 18 years. Jim and his dad are the only father-son combination which both held positions equivalent to Resident Director of Texas A&M Research Centers.

From his earliest years, Stansel knew he would work in rice. When he left to begin his college education at Texas A&M, Stansel had every intention of returning home to Angleton to farm rice. The government intervened in his plans, though, when the rice allotment program was initiated in 1955. The following year, Stansel completed his BS in Agronomy, and then went on to serve in the Army Reserve, which is where he met Bill Dishman, Sr. They became good friends, and Stansel credits Dishman with being a very positive influence throughout his life.

After his initial duty in the Reserves, Stansel was hired on by the Texas Rice Improvement Association (TRIA) and worked at the Beaumont Center in the Rice Quality Lab. During this time, Stansel completed his thesis under Dr. Hank Beachell, and acquired his MS in Field Crop Science, also at Texas A&M.

One of the things Stansel was most interested in was the genetics of amylose content and gelatinization of rice starch. At the time, Dr. Herb Kramer was doing similar work in corn at Purdue University, so Stansel decided to go there and pursue his doctorate. In 1960, he returned to Beaumont to continue his doctorate work under the Boyt Memorial Scholarship administered by TRIA.

Through carefully controlled tests in the greenhouse and growth chamber, he determined the genetic patterns and influence of environmental temperatures on amylose content and gelatinization temperature of rice. As these are the two predominant factors influencing the cooking and processing quality of rice, all



Dr. James Stansel

variety releases in the U.S. now meet industry standards for these traits. This research culminated in 1965, with Stansel acquiring his PhD in Plant Breeding and Genetics, Plant Biochemistry and Statistics.

Next, Stansel looked at the relationships between nitrogen fertility and climatic conditions, as they influence grain yields. He showed that planting date influenced yield potential and nitrogen response, which led to the adoption of earlier planting dates, and increased ratoon production along the Gulf Coast.

In 1967, Stansel carried this research further and developed the concept of splitting nitrogen applications to reduce lodging and disease risk, while at the same time, maximizing yields. This technology, with minor modifications, is still used by over 90% of the Texas rice acreage.

During that time, he also developed the procedures for identifying stages of crop development that are important for many cultural management inputs. Working with agricultural meteorologists in Arkansas, Stansel integrated the heat unit approach to predict these stages of crop development, which became known as the DD50 Program (Degree Days above 50). At first the data was presented as graphs and charts, then Jack Vawter, at the Eagle Lake Station, wrote a computer program that would make DD50 more useful to farmers. Recently, scientists at the Beaumont Center expanded and refined the program to create the web-based Rice Development Advisory Program.

In 1971, the Texas House passed legislation to establish a substation in Eagle Lake, to conduct rice re-

Researcher continued...

search on the unique soils of the western rice belt. To establish the new site, Stansel worked closely with David Wintermann, a conservationist, hunting enthusiast and key figure in the Texas Rice industry. Once they decided on a site, Wintermann went to the landowner and negotiated a long-term lease, and supplied funding for the construction of the roads and canals.

As President of the Eagle Lake Division of the American Rice Growers, Wintermann helped Stansel implement a check-off fund that paid for the land, the offices and research facilities at the new western site. This was the first check-off program in the state that supported rice research.

From 1971 to 1982, Stansel was the Scientist in Charge at the Eagle Lake site. He was also responsible for establishing and managing the sites at Katy, Bay City, El Campo and Ganado.

During his time at the Eagle Lake site, Stansel helped implement a water management and water quality research program in cooperation with the USDA Soil Conservation Service, with Dr. Garry McCauley as the lead scientist. The research led to a 25% reduction in water use, and also showed that rice production could be used to improve water quality. Using the recommended management practices, water released from the main crop was shown to be of higher quality than the water that went into the field.

On the weed front, Stansel was co-scientist responsible for the development and use of molinate and propanil herbicides as a tank mix. He collaborated with Dr. Wayne Flinchum, who was the weed specialist at Beaumont, following up on a concept presented by



Stansel attending the Beaumont Rice Field Day with Chuck Onstatt, USDA-ARS-SPA Area Director, and Bob Whitson, Deputy Director of TAES.

Russell Raun, a veteran rice farmer from El Campo. Raun conducted small trials along the edge of one of his fields, and alerted Stansel to his findings. Stansel and Flinchum conducted numerous studies, looking at different rate combinations and soil types, to come up with a proven recommendation. This was one of the first instances of synergistic action of two unrelated herbicides, which broadened the species control spectrum beyond either herbicide. This herbicide combination was the basic weed management program on 85% of Texas rice acreage for over 25 years.

The team also identified the cultural techniques for using pre-emergent herbicides for rice production. They developed the technique for using pre-emergent herbicides in combination with propanil for more effect and longer residual control.

In 1981, Stansel was approached by Dale Hunt, president of American Rice, Inc., and Bill Leher, past president of ARI and owner of Garwood Irrigation Company, to discuss the possibility of initiating a statewide check-off program that would support research and marketing. They developed the Econo-Rice program as a way to market this concept, and went on a statewide tour to gain support from the farmers. The referendum passed in the winter of 1982, the rice belt was organized into 12 districts, and the Texas Rice Research Foundation board was established. ARI supplied funding for the first year of operation.

The Econo-Rice research program was a new approach in research management. Specific industry-wide goals were established by consultation with producers, scientists and Extension personnel. The program received state and national recognition and honors as a model for integrating state, producer and industry resources into a goal-oriented, coordinated program of research and technology transfer. State yields were increased by 38% and the unit cost of production was reduced by 41%, surpassing the original goals set out by the program.

Just before the Econo-Rice program was implemented, Neville Clarke was the director of TAES, and he requested that Stansel return to Beaumont to replace Jullian Craigmiles as Resident Director. Soon after accepting the position, Stansel developed the plan for a \$3.2 million renovation of the Beaumont Center, which included expansion and improvement of existing facilities, making it one of the premier Research

and Extension Centers in the state.

Also, as manager of TAES, Stansel was responsible for oversight of the Texas Rice Improvement Association foundation seed program. He initiated the adoption of 'zero tolerance' for red rice in registered and certified seed rice. This had a major impact on the seed industry, and has significantly improved the quality of seed rice in Texas.

During his tenure as Resident Director in Beaumont, Stansel was actively involved in the varietal improvement program, led by USDA rice breeder Dr. Charlie Bollich. His team introduced the semi-dwarf varieties which revolutionized southern U.S. rice production, and developed the biotechnology tools used in the development of disease resistant varieties.

In 1999, Stansel stepped down from his leadership position in Beaumont, and was awarded Resident Director/Professor Emeritus status by the Texas A&M University System. Far from being ready to retire, though, Stansel continued to work with the Beaumont Center Rice Crop Survey program, which monitors statewide crop development. Yield and quality data is collected on about 20% of the rice acreage, and helps producers evaluate varietal performance under farmer field conditions. The program also monitors water sources, conservation practices, ratoon cropping and season end rice stocks.

Stansel was elected president of the Texas Rice Improvement Association in 2002, and continues to oversee the organization's seed rice program. Throughout his career, Stansel has experienced rice culture under a wide variety of management systems in 18 countries on 4 continents. Twenty-nine graduate students from 10 countries have conducted their research under his leadership, including the Beaumont Center's state breeder, Dr. Rodante Tabien. Stansel has received numerous awards and honors including the Rice Technical Working Group Distinguished Service Award in 2000 and the Vice Chancellor's Award in Excellence in 1994. He was named Fellow by the American Society of Agronomy in 1992 and the Crop Science Society of America in 1994.

So, one could argue that the initiation of the allotment program for rice in 1955 was the best thing that could have happened for our farmers, because it led Jim Stansel on a path that has resulted in nearly 50 years of service to the U.S. rice industry. ✱

Special Guest Editorial

The following letter by Mr. Jack Wendt was sent to President Bush, a number of Congressmen and the Secretary of Agriculture. It provides an overview of the Farm Bill dating back to the 1950s.

The Honorable George W. Bush
President
United States of America
100 Independence Ave. S.W.
Washington, D.C. 20250

President Bush:

I am a 3rd generation rice producer and have spent my entire life (except for three years in the service during World War II) being involved in agriculture (rice, cattle, cotton and grain). I will be 83 years old this year, so I have seen a lot of changes; changes from horses and mules, to 400 HP tractors and threshing machines to combines. This statement is coming from a farmer who has and is still actively engaged in the production of agricultural products.

All of us who are engaged in the production of agricultural commodities that are subsidized by the USDA are very concerned about the proposed cuts that the administration is considering in the new budget for 2006. Some commodities will not survive if these cuts become a reality. The subsidies that we get now for our crops are just enough to keep us in business. Other developed countries are supporting their rice production 3 to 10 times more than we are here. The reason for this (I'm told) is that they don't ever want to be without an adequate food supply.

I can remember not too many years ago when we had free trade, then supply and demand dictated the price of our commodity. We in the rice business started our own market development program in 1952 called The Texas Rice Promotion Association. Later in 1957, we became a national organization known as the USA Rice Council for Market Development. We, with the help of the USDA, created and developed rice markets in most countries in the world. Three of our most lucrative markets we have ever had were Iraq, Iran, and Cuba. The seed money to develop these markets came from our check-off funds. Now our government has curtailed sales to these countries by putting sanctions on them. Other rice producing countries are now

supplying most of their needs. When and if sanctions are ever lifted it will be very hard to re-establish these markets.

I can remember back in the 1970's when Gerald Ford was our President. He put an embargo on the exportation of certain commodities, mainly wheat, corn and soybeans. The American housewife was probably responsible for this action because they were afraid the American consumers were going to run out of food. They felt so strongly about this that they would demonstrate by picketing in some states. During this time Russia was buying all their extra needs for wheat and corn from us. While visiting in Chicago, by chance, I met and visited with a grain broker for the Russian government who told me that since they could no longer depend on their wheat and corn supplies coming from the U.S. they were making arrangements to buy elsewhere; we lost most of this market. Japan was the biggest market for our soybeans, which we also stopped exporting. Since their supplies were cut off they have invested money in Brazil to produce soybeans. Now Brazil is the largest producer in the world; we lost most of this market too. Beans were \$10.00 a bushel then; now they are \$4.50.

So you can see part of the dilemma that agriculture is in today is caused by our own government controls. Some of us can also remember in the sixties under the Johnson administration, they wanted us to plant from turn-row to turn-row so we could feed the world. Lots of money was invested to expand by most farmers buying land, equipment and storage facilities. This lasted several years until the price for these commodities became too low to survive. Some farmers during the Carter administration in the late seventies went broke and had to auction off their land, cattle and machinery.

American agriculture is known by some to be the envy of the world because of the quality and high production per acre. Since we are losing prime farm land to urban development it is very important that we maintain and support American **agriculture** and **research** so we can continue to produce our needs on less acreage. You know and I know we don't want to depend on our food supply coming from foreign countries. Although we in American agriculture represent less than 2% of the population we play a vital role in the balance of trade with other countries. Agriculture is

America's number one export, which totaled \$53 billion in 2002.

Keeping a strong agriculture system in our country is as important as keeping an updated strong army. The old saying goes, "you can't fight or work on an empty stomach." Once you lose the desire of the American farmer to produce and he is forced to leave the farm it will be hard to replace him or get him back in the farming business. American agriculture was built on individual initiative, private investment and incentives to produce. Once destroyed, agriculture won't be restored overnight by some government program.

If there is one thing Americans don't worry about these days, it is running out of food. We worry a lot more about crime, health care, jobs, and the environment. Food miraculously shows up on our supermarket shelves. There's plenty of it, it isn't priced too bad and it tastes good. The truth of the matter is, our food supply is the best and safest in the world. Let's face it, Americans are complacent about food and where it comes, not realizing that most of it is home grown.

Restrictions and regulations are putting a noose around farmers' necks and tightening it. Most farmers are top notch stewards of the land and care about the environment and want to do the right thing, but some regulations being talked about in Washington, D.C. are punitive and would drastically curtail farming. Here are a few facts that should be considered:

- Today, each U.S. farmer produces food and fiber for 144 people.
- American farmers produce 18 percent of the world's food on just 10 percent of the world's land.
- American farmers account for 25 percent of the world's beef and veal production and 39 percent of the world's corn production.
- Food is most affordable in the U.S., where consumers spend less than 10 percent of their income.
- Thanks to constantly improving technology and farming technicians American farmers are the most efficient in the world.
- Farm programs that we now have represent only 4/10 of 1 % of our national budget.

However, as with most federal legislation, the cost of our farm programs is somewhat misleading. Our farmers will not receive all of the money earmarked for the Farm Bill. In fact, they will receive only about 29% of the funds. The remaining 71% provides sup-

Guest Editorial continued...

port for the Food Stamp Program, the Children Nutrition Programs, the Women, Infant, and Children Care Program, and range of other USDA Programs. The bottom line is that funding provided to producers through the Farm Bill costs the average US family \$5.21 per month or \$62.53 per year in 2003. This cost represents 0.15% of the average annual income of an American family. Or looking at it a little differently, that's about \$0.17 per family per day.

America's food and fiber industry employs more than 25 million people and is responsible for 15 percent of the U.S. economy—larger than the construction, transportation and utilities industries combined. Agriculture's \$53 billion in exports means jobs and business for America (2002). USDA economists estimate that each dollar in exports stimulates another \$1.47 in U.S. business. It takes 444,000 people to process, package, market, finance and ship out agricultural exports. Thanks to our farming families, the United States is one of the few countries in the world that has never known widespread hunger. Not relying on other countries for our food is key to national security. The vast majority of the food America eats is grown by U.S. farmers.

The last report I have, the average Canadian family spent 12.4% of their disposable income on food. Food cost statistics for Great Britain (17.5%), Germany (17.7%) and Japan (17.8%) were all considerably higher than food costs in the U.S. Many other countries spend an even greater amount of their income on food. An average family in Mexico spends 33.2% of their income on food. Further down the ladder, India (52%) and Uganda (53.7%) spend five times as much of their income on food that we do in the U.S.

Why do families in other countries pay more for food? Part of the increased cost can be explained by lower production efficiencies. The modest price support provided by the U.S. government and the greater efficiency of U.S. agriculture production are not sufficient to provide a level international playing field and prevent the erosion of U.S. agricultural infrastructure. During the past decade alone, U.S. farm acreage decreased by 3%. The number of farmers that have been forced to choose other ways to make a living has increased by an even greater amount. Without equitable price supports and tariffs it is likely that the decrease in agricultural land will continue.

Is the U.S., as a nation, willing to put measures in place to maintain agricultural production as an important part of our economy? Or is our nation willing to become dependent upon agricultural production from other countries?

The question is not whether food price support is necessary, but one of determining how much price support is needed to protect our food producers and our food supply from unfair competition brought about by unequal agricultural trade restrictions. Like other business in our country, U.S. agricultural producers have shown they can compete with the very best from any country, sometimes even when the playing field is leveled against them.

We must keep our agricultural system strong so Americans may never be dependant on foreign food imports to feed our own people. If the American consumers want to keep adequate food supplies, the safest and the cheapest cost per capita of food in the world, then I think our government should maintain a support level on agriculture commodities that is necessary to keep us in business until free trade, supply and demand will some day return as it was in the past.

In the words of our past presidents;

"Our farmers are the most efficient in the world. In no other country do so few people produce so much food, to feed so many, at such reasonable prices."

-President Dwight D. Eisenhower

"Our nation owes a debt of gratitude to our farmers and ranchers for helping to ensure stability in our economy, for providing food products that amply meet our citizens' needs and for representing what is best about America." -President George W. Bush

Therefore, I urge you to oppose these proposals to re-open the farm bill and single out farming families in rice country and elsewhere for drastic and disproportionate program cuts. As an independent Commission of the Department of Agriculture recently concluded, it would be unwise and unfair to those who depend on these programs to make such fundamental changes in the farm safety net until the expiration of the current farm bill in 2007.

Sincerely,

Jack Wendt

Rice Farmers Travel to Washington

In two separate trips, rice farmers from Texas traveled to Washington D.C. this month to voice concern over proposed budget cuts to agriculture, and the new restrictions announced by the Treasury Department's Office of Foreign Assets Control (OFAC) regarding cash sales to Cuba.

The first delegation included Steve Balas, Dan Gertson, Ray Stoesser, Bill Hefner and Danny Gertson. In meetings with congressmen, the group stressed that the present farm bill is working, and any changes in funding or structure would significantly impair the present bill. They also pointed out that proposed cuts to agriculture are almost 6%, while in other areas cuts are less than 1%.

During their stay, the US Rice Producers Association hosted a dinner that was attended by several congressmen, including U.S. Representative Ted Poe. According to Danny Gertson, visits with the congressmen were well received, but future legislation will determine their level of success. "Rice producers must continue to promote our industry," said Gertson, "our survival is in peril."

Later in the month, Dennis DeLaughter, a rice farmer from Edna, Texas presented testimony jointly approved by the USRPA and the USA Rice Federation, in which the industry called upon the U.S. Congress to prevent the loss of a new \$100 million Cuban rice market.

The testimony noted that Congress passed the Trade Sanctions Reform and Export Enhancement Act of 2000 to achieve its goal of enhancing U.S. agricultural export opportunities by explicitly exempting sales of food and medicine from any economic embargo. As a result, since December 2001, Cuba has purchased approximately \$1.25 billion worth of U.S. agricultural goods. In 2004, Cuba imported \$64 million worth of U.S. rice, making it the fastest growing U.S. rice market and one of the top five long grain rice destinations for the year.

According to Dwight Roberts, President & CEO of the USRPA, OFAC's actions not only threaten to disrupt trade, but degrade our reputation as a reliable supplier of grain to the world markets. "The Treasury Department's unnecessary rule ignores the sanctity of

\$250 million in open contracts, a move that would be detrimental to U.S. agriculture as a reliable international supplier for years to come, as it was after the 1980 Soviet embargo ordered by Jimmy Carter" stated Roberts. "What is even more disturbing is that this ruling comes at precisely the wrong time, as Cuba is suffering from its worst drought in 100 years, a potential humanitarian disaster", according to Roberts.

"Simply put, OFAC's ruling makes it more difficult for Cuba to buy from U.S. farmers to feed its population. We strongly urge Congress to take the necessary steps to permit the Export Enhancement Act of 2000 to operate as intended and give us an opportunity to compete without undue restriction from our own government," added Roberts.

At the hearing, DeLaughter recommended four actions to forestall the Rule's undesirable consequences:

1. The most efficient, effective method to protect and enhance the Cuban market is for OFAC to reverse its Final Rule.
2. If the Final Rule is not reversed, OFAC should approve the industry petition submitted yesterday by more than 30 farm and trade groups, and modify the Rule to allow contracts that were in place as of February 22 to be honored under their original payment and other terms.
3. We urge the swift enactment of legislation to reiterate the intent of Congress that exports financed by the payment of cash in advance be allowed to continue on the same basis that has been successfully used for \$1 billion in exports during the past 4 years.
4. Congress should insist that OFAC and future Administrations respect the requirement in section 903 of the 2000 Export Enhancement Act that prohibits the imposition of new trade restrictions or conditions unless approved in advance by Congress. Absent compliance with the law, rice producers are concerned that there will be nothing to stop the total shut down of exports to Cuba by a similar restrictive "interpretation" in the future.

Chris Williams, a rice farmer from Poplar Bluff, Missouri and the Chairman of the Board of the USRPA said, "Farmers cannot afford losing export markets so vital to their livelihood, especially when pending federal budget proposals would reduce the farm safety net. This is not smart agricultural policy."*

A copy of the testimony can be found at www.usriceproducers.com

Allelopathy continued...

Allelopathic potential of plants resulted from the release of toxic substances, either through root exudation or from decaying plant material. They also concluded that allelopathy had been demonstrated in about 90 crops including beets, lupine, maize, wheat, oats, barley, rye, cucumbers and rice.

Dr. Bob Dilday, with the USDA/ARS Dale Bumpers National Rice Research Center in Stuttgart (DBNRRC), Arkansas, paved the way for much of the work conducted in the U.S.

on allelopathy in rice. Dilday received his PhD in Breeding and Genetics at Texas A&M University in 1971. In the early 1980s, he was conducting research on the growth characteristics of single rice plants. Towards the end of the season, he noticed that some of the plants had ducksalad growing right up to their base, while other specimens had a uniform 'weed free zone' around their perimeter. Curious as to whether the phenomenon was just an aberration, Dilday collected seed from the plants and did row studies the following season. Sure enough, the selected lines continued to show allelopathic effects on surrounding vegetation.

Dilday then began extensive screening of U.S. and foreign germplasm to determine which lines had antagonistic effects on ducksalad. He conducted trials in the greenhouse and growth chambers, and always followed up with field studies. As a result, Dilday and co-workers identified over 400 accessions that expressed a significant allelopathic response to ducksalad.

In continuing this work, Dilday collaborated with Dr. David Gealy, also with USDA-ARS at DBNRRC, to determine varieties that showed an allelopathic response to barnyardgrass (BYG), another major weed in rice fields. In the University of Arkansas Bulletin #485, Gealy and Dilday reported the results of a trial that tested 57 foreign and domestic varieties. They found that as a group, foreign lines generally suppressed BYG better and maintained higher yields in

the presence of the weed. The report concluded, "Because some commercial cultivars and advanced breeding lines were as suppressive to BYG as the most suppressive foreign lines, existing commercial rice germplasm may be a valuable genetic source for natural weed suppression activity that could be helpful to breeders and farmers as part of a complete crop improvement program for rice. These commercial lines produce plant types and grain of a quality that is already acceptable to the U.S.

rice industry and thus will not require the additional 'quality' improvements that will be necessary for commercialization of the BYG-suppressive foreign rice lines and cultivars."

A paper entitled, "Allelopathic Potential in Rice Germplasm Against Ducksalad, Redstem and Barnyard Grass" by Dilday, et al. was published in the 2001 *Journal of Crop Production*. They reported that of the 17,279 rice accessions

or varieties from 110 countries in the USDA/ARS rice collection, about 12,000 had been evaluated for allelopathy to ducksalad, and 5000 for allelopathy to redstem and barnyardgrass. In the field tests conducted between 1988 and 1990, accessions with allelopathic activity were reported for ducksalad (412), redstem (145), and barnyardgrass (94). As an interesting side note, the researchers also found that accessions that showed allelopathic activity in the field had 2-3 times more root biomass than those that did not. This brings up the point that some weed suppression may be due to competition as well as chemical interactions between plants.

With Dilday's retirement in 2001, Gealy and other researchers in Arkansas have continued the work in allelopathy. Dr. Karen Moldenhauer, rice breeder and professor with the University of Arkansas Rice Research and Extension Center, co-authored a paper with Gealy entitled "Progress in Developing Weed Suppressive Rice Cultivars in the Southern U.S." The paper is a comprehensive work on the subject and discusses



Plot of allelopathic rice variety PI 312777 surrounded by non-allelopathic varieties infested with barnyardgrass. PI 312777 has been rated as one of the most allelopathic rice varieties in independent studies in the U.S. and China.

Allelopathy continued...

the concept of weed suppressive rice, through both competition and allelopathy; the optimum period for maximum weed suppression; the dynamics of rice-barnyardgrass interference; rice breeding efforts in Arkansas, including potential screening methods; and integrating suppressive cultivars with reduced herbicide rates.

The authors point out that annual losses due to all weeds in rice fields in the southern U.S. have been estimated at \$45 million when growers use current 'best management practices'. However, if herbicides were omitted entirely, the estimated loss skyrockets to a staggering \$640 million, which is 35% of the average total annual farmgate value of the southern U.S. rice crop.

They suggest that if this large benefit from herbicides could be partially substituted with low-cost alternatives, such as growing weed suppressive cultivars, rice could be produced more economically. There is also major concern over herbicide resistant weed species, and the recent trends in the agricultural chemical industry that have resulted in fewer companies seeking herbicides with novel modes of action. The development of weed suppressive cultivars could go a long way in averting this impending lack of adequate weed management tools in rice.

Even if herbicides cannot be omitted entirely, there is evidence that reduced rates can be realized with allelopathic cultivars, while still maintaining the yield potential. Gealy teamed up with University of Arkansas economist Dr. Eric Wailes, and published a paper in *Weed Science* in 2003 that explored the economics of reduced propanil rates in rice. They evaluated Asian and U.S. cultivars under various propanil applications, and found that growing weed suppressive Asian rice cultivars in conjunction with reduced herbicide rates could be an effective and economical weed manage-

ment strategy for rice in the southern U.S. However, the plant type and grain characteristics must be improved, or the weed suppressive trait must be incorporated into existing high-quality U.S. germplasm. Moldenhauer has made this a priority in the Arkansas varietal development program. Crosses have been made, and are being screened with the lines that have the most allelopathic activity or competitive ability.

As indicated earlier, exudate from rice roots is not the only mechanism attributed to allelopathic effects. In a study led by Dr. I. M. Chung at Konkuk University in South Korea, scientists evaluated various parts of the rice plant for suppressing the growth of BYG. They found the highest inhibition rates for straw in 'Danganeubangji' (76.9%), for leaves in 'Dongobyeo' (74.1%), and for hulls in 'Baek' (31.7%). Overall, the highest inhibition rates were from the straw and leaves (root exudates were not measured in this study.) These results suggest there are many different chemicals at

work, in various parts of the rice plant. In fact, Dilday had found in earlier studies that some highly suppressive cultivars, when tilled under, inhibited weed growth in the following season.

There are several problems associated with identifying allelopathic traits in germplasm lines. First, is the issue of allelopathy vs. competition. To establish a true allelopathic effect, you must first eliminate the possibility that a plant is simply out competing its neighbors for food, water and growing space due to differences in root mass and leaf surface area.

Another issue is determining the most reliable technique to document allelopathic activity. Papers published in the past few years have explored the feasibility of using high-performance liquid chromatography (Mattice et al., *Agronomy Journal*, 93:8-11, 2001); water soluble extracts (Ebana et al., *Agronomy Journal*, 93:12-16, 2001); small volume agar essays (Gealy, UofA Bulletin #476); ¹³C isotope analysis (Gealy, UofA Bulletin #485); and replacement series studies (Estorninos et al., *Weed Technology*, 16:401-406, 2002). This list is not all-encompassing, and perhaps even more techniques will be presented



Photo courtesy of Stephen Duke

Monoculture of *Sorghum sudanese*, grown weed-free, without herbicides.

continued on page 12

State, National and International News...

NRCS ANNOUNCES FUNDING FOR INNOVATION GRANTS

TEMPLE - Natural Resources Conservation Service State Conservationist, Dr. Larry D. Butler, announced today \$500,000 available funding for new technology under the Conservation Innovation Grants. CIG provides farmers and ranchers with the opportunity, through innovation, to address the state's most pressing natural resource conservation needs.

"These grants offer an opportunity to promote public-private partnerships that provide innovative technologies and approaches to environmental enhancement and protection on working agriculture lands," Butler stated.

Project proposals should demonstrate the use of innovative technologies or approaches to address a natural resource concern. Project results are expected to improve and create the transfer of conservation technologies, management systems, and innovative approaches (such as market-based systems) into NRCS technical manuals or guides, or to the private sector.

Applications are due in the Texas NRCS State Office by April 22, 2005. Selected applicants may receive grants up to 50 percent of the total project cost, not to exceed \$75,000. Applicants must provide non-federal matching funds for at least 50 percent of the project cost, of which 50 percent may be from in-kind contributions. Projects may be single or multi year, not to exceed three years.

For more information contact Claude Ross at (254) 742-9800, or go to <http://www.tx.nrcs.usda.gov/programs/CIG/>

TREASURY RULING ON CUBAN PAYMENTS

WASHINGTON – A Treasury Department ruling that Cuba must pay for shipments of rice, wheat and other commodities before they leave the country has stirred up a hornet's nest in the nation's Capitol.

The Treasury Department's Office of Foreign Assets Control issued a "clarification" on Feb. 22 that the terminology "payment of cash in advance" with regard to shipments to Cuba means payment of cash prior to shipment of goods. The USA Rice Federation said the action would inhibit sales to what was once the largest market for U.S. rice.

"The OFAC 'clarification' is an obvious effort by the administration to further restrict trade with Cuba," USA Rice Federation President and CEO Stuart Proctor said. "Trade sanctions imposed in 1961 have already cost American rice farmers and estimated \$3 billion in lost sales."

Bob Stallman, president of the American Farm Bureau Federation and a rice farmer from Texas, echoed Proctor's comments. "We are greatly disappointed with the regulations announced by the Treasury Department's Office of Foreign Assets Control to require Cuban purchasers of U.S. farm products to pay for those goods prior to shipment," said Stallman.

"The regulations are unwarranted and will have the basic effect of disrupting the shipment of U.S. farm products, and, initially, it will likely cut off all purchases of U.S. farm products to Cuba."

In 2004, Cuba purchased more than \$400 million in U.S. farm prod-

ucts and was expected to increase its purchases significantly this year. Some sources said it could soon become an \$800 million a year market.

Excepted from an article by Forrest Laws in *Farm Press Daily*

CUBA TRADE LEGISLATION

WASHINGTON - Senators Larry Craig (R-ID), Max Baucus (D-MT), and Pat Roberts (R-KS) have introduced S. 328, the "Agricultural Export Facilitation Act of 2005," which clarifies that payments by Cuba for agricultural sales do not have to be made before the shipment of the goods.

This would overrule the Office of Foreign Assets Control's recent decision (see previous story). The legislation would also allow payments to be made directly to U.S. banks and make it easier for U.S. citizens to travel to Cuba to market agricultural products.

RICE ESSAY CONTEST

HOUSTON - A total of \$5,000 in scholarships is being offered in a nationwide essay contest for high school juniors and seniors. The scholarships are being offered through the USRPA's educational website RiceRomp.com.

To participate, the students must write an essay on the topic: "The Importance of Wetlands in the Environment and How the U.S. Rice Industry is Vital to Maintaining Wetlands Habitat in the United States."

For more information go to www.riceromp.com or call the US Rice Producers Association at 713-974-7423.

Allelopathy continued...

when the International Allelopathic Society meets this year in Australia for their 4th world symposium.

Going to the next step, once an allelopathic succession has been positively identified, scientists are using marker-assisted selection to help breeders quickly screen potential germplasm. Dr. Kaworu Ebana at the National Institute of Agrobiological Resources in Japan, led a team of researchers that identified quantitative trait loci (QTL) associated with allelopathic activity in rice. The QTL analysis was carried out using the F² population from the cross between an Indica type line PI 312777 (highly inhibitory) and a Japonica cultivar Rexmont (less inhibitory). Seven QTL were identified on chromosomes 1, 3, 5, 6, 7, 11 and 12; showing conclusively that many genes, and thus secondary metabolites, are responsible for allelopathic activity.

Another paper published in *Plant Breeding* in 2002, presented the results of a collaborative effort between scientists at the Royal Veterinary and Agricultural University in Denmark and the International Rice Research Institute (IRRI) in the Philippines. Olofsdotter et al. concluded that, "it is possible to improve allelopathy in rice using marker assisted selection (and) optimizing allelopathy in combination with breeding for competitive plant types, could result in crop cultivars with superior weed-suppressive ability."

While breeders and geneticists identify allelopathic lines for incorporation into improved varieties, applied plant physiologists and biochemists are working to identify the specific chemicals, or secondary metabolites, that are responsible for allelopathy. Dr. Stephen Duke is leading a team at the USDA/ARS Natural Products Utilization Research Unit on the University

of Mississippi campus to explore the concept of crop allelopathy.

In an extensive review of the subject, Duke concludes, "We still do not know what compounds are primarily responsible for the observed allelopathy in rice. However, the following phytotoxic compounds have been found in root exudates of allelopathic rice varieties: momilactone B (Kato-Noguchi and Ino, 2004); glucosides of two resorcinols, a glucoside of a flavone, and glucosides of two benzoxazinoids (Kong *et al.*, 2002); and a cyclohexenone (Kong *et al.*, 2004a). These results suggest that more than one type of phytotoxin may play a role in fighting weeds in the most allelopathic varieties of rice."

Exploring exactly which chemicals are responsible for allelopathic activity leads to the conclusion that these chemicals could be used for the production of commercial herbicides. Dr. James Vyvyan at Western Washington University published a paper in *Tetrahedron* in 2002 entitled, "Allelochemicals as leads for new herbicides and agrochemicals."

Given the imminent threat of herbicide resistant weeds due to the overuse of herbicides with a single mode of action, Vyvyan's report is promising in that he states, "many allelochemicals operate by mechanisms not possessed by synthetic herbicides, making natural products a promising source of new leads to herbicides." *

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