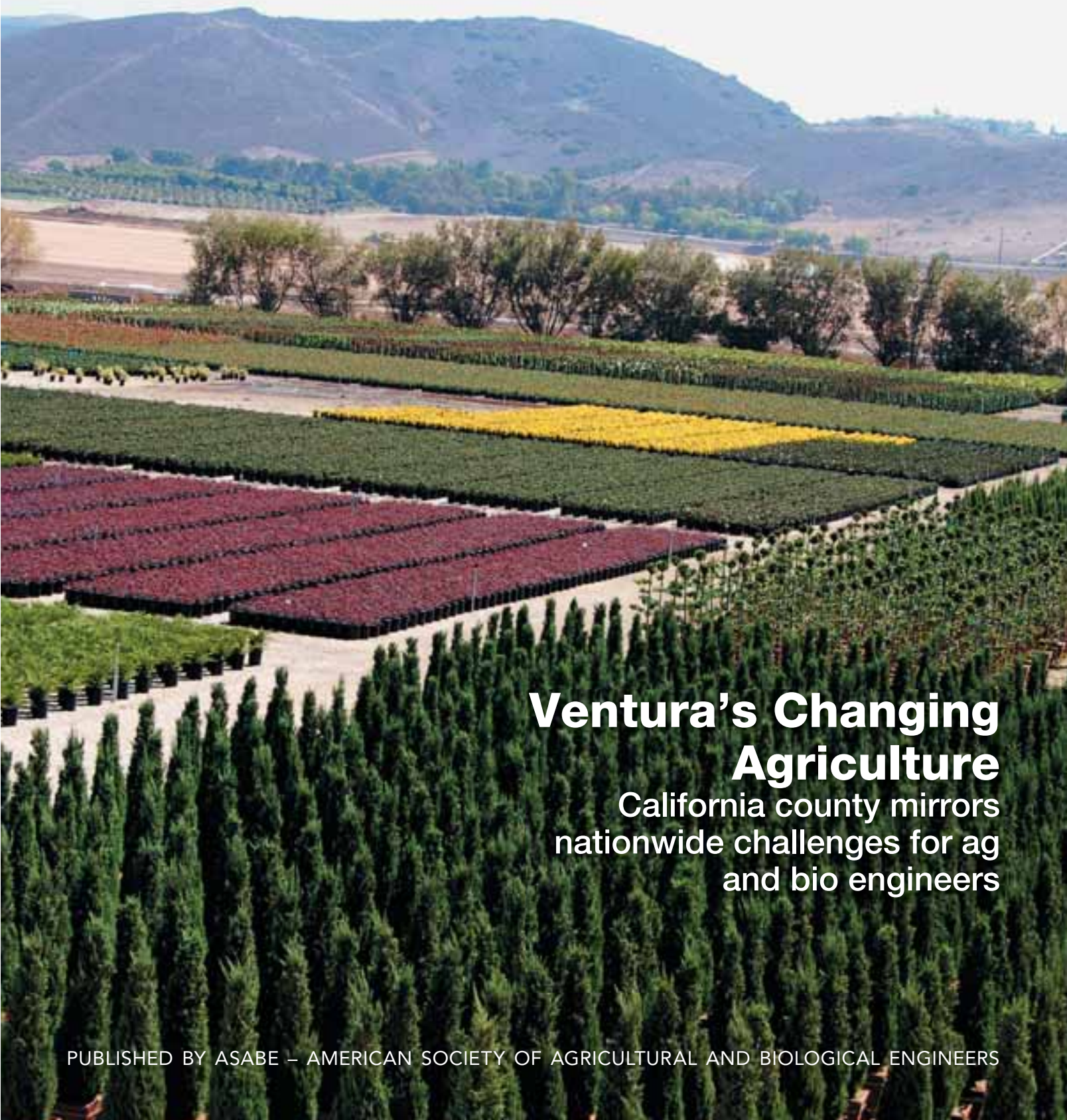


RESOURCE

Engineering & Technology for a Sustainable World

February 2008



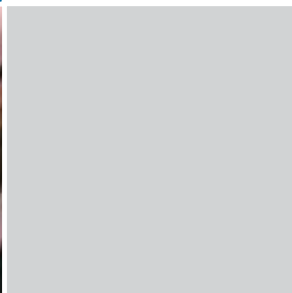
Ventura's Changing Agriculture

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February 2008

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ON THE COVER

A new 100-ha (247-acre) nursery stock facility in Moorpark, Calif., is caught on author Ralph Shirley's camera lens. It is anticipated that nursery stock will replace strawberries as the number one crop in Ventura County in the next few years.

Change



As we move into 2008, things are hot and heavy on the presidential campaign trail, with change being a major topic. But, ASABE has change underway as well, change far more likely to be substantive than that proclaimed by the candidates.

In a continuing effort to better deliver information, *Resource* magazine has been changed. Beginning with this issue, you'll find more pages of information about recent technology developments and other topics related to our agricultural and biological engineering profession. Beginning in January 2008, most of the member and Society news previously found in the *Inside ASABE* section of the magazine is being delivered via a monthly electronic newsletter. ASABE is now working with Naylor, LCC, a company specializing in association magazines, to improve and more economically produce *e-Resource* and electronic and print versions of *Resource* magazine.

Another positive change has been in the Society's finances. As a result of sufficient growth in our restricted reserve, your board of trustees has approved an initiative fund of \$100,000. This fund supports initiation of change and provides seed money that will result in new products, services, or activities to enhance our profession and the value of ASABE membership. Proposals submitted by members are now being reviewed to select projects to support.

Expansion of ASABE's biological engineering presence continues to be a positive change. I believe, however, that progress has been very small relative to the huge potential. We have a challenge to define what appropriately is our "turf" and to act to capture the potential that biological engineering has for our Society.

These are some of the changes that ASABE is undergoing as we work to provide increased value to members and to become an even better professional society for agricultural and biological engineers.

I welcome your comments; e-mail them to me at don.erbach@mac.com.

Sincerely,
Donald C. Erbach, USDA-ARS (retired)

EVENTS *Calendar*

ASABE CONFERENCES AND INTERNATIONAL MEETINGS

To receive more information about ASABE conferences and meetings, call ASABE at (800) 371-2723 or e-mail mcknight@asabe.org.

2008

- | | |
|------------------|---|
| Feb. 10-13 | Agricultural Equipment Technology Conference. Louisville, Kentucky, USA. |
| March 29-April 3 | 21st Century Watershed Technology: Improving Water Quality and the Environment. Concepcion, Chile. |
| June 27-28 | Food Processing Automation Conference. Providence, Rhode Island, USA. |
| June 29-July 2 | ASABE Annual International Meeting. Rhode Island Convention Center Providence, Rhode Island, USA. |
| Sept. 1-5 | The Eighth International Livestock Environment Symposium (ILES VIII). Igaussu Falls, Brazil. |

2009

- | | |
|----------------|--|
| June 28-July 1 | ASABE Annual International Meeting. Grand Sierra Resort, Reno, Nevada, USA. |
|----------------|--|

ASABE SECTION AND COMMUNITY EVENTS

2008

- | | |
|------------|--|
| Feb. 19 | Quad City Continuing Education Seminar. Contact Eric Windeknecht, WindeknechtEricD@JohnDeere.com . |
| March 25 | Quad City Awards Meeting. Contact Eric Windeknecht, WindeknechtEricD@JohnDeere.com . |
| April 15 | Quad City Section Tour. Contact Eric Windeknecht, WindeknechtEricD@JohnDeere.com . |
| June 12-14 | Florida Annual Section Meeting, Trade Show, and Continuing Education Program. Duck Key, Florida, USA. Contact Lisa Collins, 5gators@gmail.com . www.fl-asabe.org . |

ASABE ENDORSED EVENTS

2008

- | | |
|------------|---|
| Feb. 19-22 | National Frame Building Association Frame Building Expo. Columbus, Ohio, USA. Sponsored by the National Frame Building Association. www.nfba.org . |
|------------|---|

2009

- | | |
|----------|---|
| Jan. 5-9 | Frutic Chile 2009: Eighth International Symposium of Information and Technology for the Sustainable Production of Fruit and Vegetables, Nuts, Wines, and Olives. Concepcion, Chile. www.frutic09.org . |
|----------|---|

Ventura County's Changing Agriculture

California county mirrors nationwide challenges for ag and bio engineers

Ralph Shirley

The rapidly changing face of agriculture in many parts of the world is providing opportunities for agricultural and biological engineers to use their imaginations and apply their skills in shifting environments. Ventura County, Calif., is a good example of the various factors that affect such change and give pause for us to consider how those shifts give rise to many opportunities.

In the January 1952 *Geographical Review*, Howard Gregor wrote, "No student of American agriculture can fail to be impressed by the present intensity of California's farming and the variety of crops produced in the state. But even more impressive has been the rapidly shifting emphasis from one crop to another in the course of the state's agricultural development."

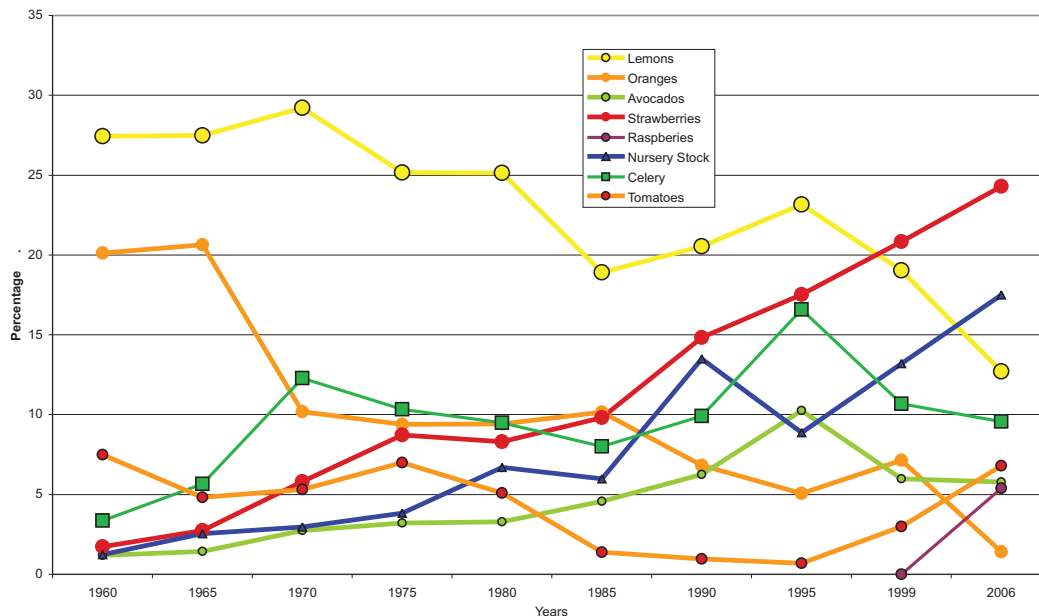
This is no less accurate today than it was half a century ago. Gregor's subject and mine are one and the same: Ventura

County, northwest of Los Angeles, is a unique blend of climate, people, and land that makes agriculture a \$1.5 billion dollar business on less than 42,000 ha (103,784 acres).

In 1900, livestock was number one in the county. In 1920, the top crop was lima beans. The lima beans your mother made you eat have all but disappeared, replaced by other more enticing, gourmet vegetables. Oranges became king, followed by lemons, which reigned from the 1960s into 2005, accounting for approximately 30 percent of the county's agricultural crops. By 2006, strawberries became the number one crop. In the next few years, it is anticipated that berries will lose first place to nursery stock – purchased for decoration rather than eating.

Five critical factors drive agriculture in Ventura County: climate, water, land value, labor availability, and technology.

Major Crops of Ventura County by % of Total County Ag Dollar Volume





Year-round cropping requires planting as soon as crop residue is plowed under. Hillsides have been put into production with orchards using drip irrigation as the flat land became too valuable for other crops. Onions, in the foreground, will be ready for harvest in just a few days.

Climate

Located along the ocean with latitude N34.2°, the temperatures are generally moderate. Average high and low temperatures are 21°C and 10°C (70°F and 50°F), respectively, with little variance from summer to winter. Low temperatures seldom drop to -3°C (27°F) for more than a few hours in an evening. Nearly any crop imaginable can be grown in the county, thanks to the weather, but for farming to be profitable, the crops must yield high value due to the cost of land.

Water

Rainfall is only 39 cm (15 in.) per year and falls mostly in November through April. Primary agricultural land is situated over a very deep, well-replenished aquifer that furnishes most of the water required. However, without irrigation, the land is virtually worthless agriculturally. About 8.5 percent of the county is irrigated, yielding an average crop value of \$36,000 per ha (\$14,600 per acre). Approximately 8.6 percent of the county is used for grazing without irrigation, yielding grazing vegetation worth only \$25 per ha (\$10 per acre). Most of Ventura County is too mountainous to be farmed. Approximately 9 percent of county land has been built up and urbanized.

Land value

The Oxnard plain on the coast and three valley floors to the east are virtually flat and well-suited to traditional irrigation methods. These areas provide excellent opportunity for growing crops year round. Between these flat plains and

further to the north are large sections of land with rolling to rugged hills. Some hills have been put into production with orchards using drip irrigation as the flat land became too valuable for other crops.

Since the mid 1960s, there has been a growing awareness of the value of agricultural land as a resource in the county, and efforts have been made to preserve the land for agricultural use rather than build urban sprawl, as seen in neighboring Los Angeles and Orange Counties. In the late 1990s, voters adopted a series of landmark anti-sprawl measures known as Save Our Agricultural Resources (SOAR). Land has been set aside between communities for agricultural purposes only. Expansion of city limits requires voter approval. With these measures restricting land use, the value of agricultural land is based largely on productive capacity. The land is held by a few families, and there is not much turnover in the market; therefore, the average value of the land is difficult to establish. Some prime agricultural land recently sold for \$260,000 per ha (\$105,000 per acre) for raising blueberries. A better estimate of land value comes from the cash rent where ground suitable for strawberries runs about \$8,650 per ha (\$3,500 per acre) per year.

Labor availability

Crops of high value generally require large inputs of labor. Traditionally, labor has been available by hiring immigrants from Mexico and further south. Because the crops can be grown year-round, workers do not have to migrate seasonally in and out of the county. In the



Transplanting celery fingerling saves several weeks in the crop cycle on the land.

1970s and 1980s, Caesar Chavez’s United Farm Workers of America called national attention to the poor working and living conditions and the low wages paid to farm workers. Many changes have been made, including availability of sanitary facilities and elimination of the short-handled hoe for crop thinning. However, the fact remains that the work is extremely demanding physically.

Most farmers now use farm labor contractors to arrange workers for timely planting and harvesting of crops. Most contractors provide honest, reliable services, but abuses still exist. More than 95 percent of the labor is provided by persons born outside of the United States. Farmers readily admit that most of the labor force does not reside in the country legally.

Recently, big warehouse stores have tapped the same labor pool with attractive work environments and pay scales. Lawmakers have been “prattling” about trying to find solutions to the complex issues of undocumented workers. Recent efforts to secure borders with “The Wall” make growers nervous. Elsewhere in the state, recent cooperation of the local authorities and immigration services using the Social Security Administration

database have been making raids on the farm workers in the field. They match names and social security numbers and deport those who have been working with invalid Social Security numbers. All of these factors make farm labor shortages a possibility.

Affordable housing is an issue. Much of the housing for farm laborers is overcrowded and substandard. Desirable

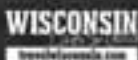


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Strawberries, grown on plastic-covered beds to control weeds and keep fruit clean, are the current number one crop in Ventura County, Calif. Cattle gave way to lima beans, then vegetables, oranges, and lemons as top crops. Now, nursery stock is predicted to soon surpass strawberries.

climate, a reasonable commute to the Los Angeles area, and SOAR-limited growth have driven median home prices to above \$600,000.

Technology

Changes in crop patterns are largely associated with the development of technologies that obsolete one crop and advance another. Beef and hide production in the late 1800s gave way to cropping as the railroad advanced and made shipping produce long distances economical. The advent of the lima bean harvester made limas a viable economic commodity. Port Hueneme Harbor, built by farmers in 1940 without government assistance, allowed economical export of crops like lima beans and lemons. It remains the best deep water port between Los Angeles and San Francisco today.

Advancements in strawberry production have led to its rise as a popular crop, accounting for almost one-fourth of the county's production value. Early production methods allowed plantings to bear for five years. The window for harvest was very narrow and very weather-dependent. New methods and varieties allow transplanting from cold storage and controlled time of harvest. New varieties mature in a few months and allow double-cropping each year. Timing on the fresh market is extended to almost the entire year. Advancements in harvest techniques have included deep furrows reducing the bending required for harvest and plastic covered beds that keep

weeds out and fruit clean. Conveyer machines that traverse the field allow pickers to simply follow the machine, placing the fruit on the conveyer where others pack it into boxes. This method replaces individuals walking back and forth through the furrows with boxes of harvested fruit. Initially, the machines were resisted by the labor union, but the improved field efficiency allowed for higher incentive pay, and use of the method is spreading.

Food safety/traceability issues have given rise to a host of solutions. In some cases the produce can now be tracked to the field location and the laborer who picked it, creating an interesting paradox because most of the laborers are "undocumented workers."

Opportunity knocks for agricultural and biological engineers

Engineers, working in harmony with growers, agronomists, and other professionals, provide a valuable service to an industry that is adapting as the critical factors change. The most critical factor at this time appears to be potential changes in the labor pool. As the labor pool shrinks, opportunities to mechanize harvesting of crops like strawberries, raspberries, peppers, and broccoli, which require in-field selection and grading, will abound.

Avocado trees can grow 20 m (65 ft) tall, but if they are allowed to grow to maximum productive height, they present obstacles and hazards for workers. Automated machines

(continued on page 11)

Modern Beef/Dairy Production in Morocco

John A. George

Morocco, an emerging society and economy on Africa's northwest corner, is taking forward steps in social, cultural, and economic development. To undergird agriculture, the country's foundational enterprise, the U.S. Grains Council has focused on expanding grain availability and use in the beef/dairy sector and has brought modern agricultural engineering technology to the initiative. This undertaking has resulted in a model dairy calf-rearing facility in the south-central province of Taroudant.

The first of its kind

This is the first custom dairy-calf feedlot in North Africa, and its true impact – economic and otherwise – is still being measured. The feedlot serves the members of a regional

dairy/citrus processing cooperative (COPAG). COPAG has approximately 12,000 members, and the average herd is less than 10 cows.

The business model for the custom lot is to take the calf-raising feed, labor, and resource burden off the farmer. The young calves are placed in a facility specifically designed and managed for efficiently meeting their needs to grow and produce as near their genetic potential as practical. A farmer is able to utilize the resources, which would have gone into calf rearing, to increase milk production and significantly expand his milking herd. Thus, each farmer receives a much larger milk check.

The heifer calves are given excellent care and returned to the farm as bred heifers ready to calve and produce milk at a higher production level than could have been achieved by



Calf hutches dot the sweeping landscape with Atlas Mountains as their backdrop.



In foreground, young stock pens; left background, heifer and bull feeding pens, all owned by COPAG.

the farmer alone. The bull calves are managed, also utilizing top-notch nutrition and health care, to grow more efficiently and sell at a premium.

In the beginning ...

Agricultural Engineering Associates, a firm with nearly four decades of experience in many climates and regions, was selected by the U.S. Grains Council to travel to Morocco and provide design and construction support services.

The feedlot facility is located on approximately 24 ha (60 acres). The vision was for two construction phases, with the first phase providing housing for about 300 baby calves for their first two months, then one month of transition group housing, three additional months of growing pens for young stock, and finishing pens for the bull calves and growing pens for the heifers. The Phase I total capacity is approximately 3,000 head. At the completion of Phase II, the total facility capacity will be approximately 7,000 head.

All the bells and whistles

The project features the latest in agricultural engineering technologies providing well-controlled animal flow and housing meeting the needs of the calves at each stage. The climate in Taroudant is dry, mild to hot, with freezing a rarity, but summer extremes exceed 52°C (125°F) for a few days to a few weeks. The facility is well drained and provides sprinkler dust control and cooling sprinklers under feedline shades. While there are not currently feedlot environmental controls in place in Morocco, the designers specified runoff containment and utilization parameters comparable to those required in most similar feedlot facilities around the world. An efficient cattle receiving, shipping, handling, sorting, and processing facility is provided, as well as a finished cattle sales and

show pen area. Dry manure is efficiently harvested as a valuable resource that is often sold in truckload lots in the local market. Concrete bunker silos and commodity bunkers provide on-site feed storage and preparation support to the manufactured feed delivered from the cooperative's own feedmill.

In addition to providing modern agricultural engineering capabilities for the design and construction of this project, the consulting technical team also included experienced veterinary and management consultants with dairy calf facility ownership and management credentials.

This team worked in concert to provide complete facility design, construction guidance and oversight, nutritional guidance, health protocols, and management guidance, as well as management training for the incoming resident management staff at the facility. Management trainees were brought to the United States for several weeks to experience all aspects of dairy calf rearing and feedlot management tasks in a "hands-on" scenario involving a range of working calf and feedlot production facilities. The management team provided on-site management and training support to the resident staff for over a year during initial facility start-up.

From Phase I to Phase II

The facility construction was initiated in the fall of 2003, and the inaugural ceremonies were held in April 2005. Facility stocking approached full utilization of the Phase I calf facilities, and the animal flow progressively occupied the finishing and growing pens. By the spring of 2006, the Phase I facility operated efficiently at capacity and the decision was made to proceed with Phase II construction. By spring 2007, the facility produced a full generation of fully-grown bred heifers, and a similar number of finished bulls for beef.

At the Moroccan National Agricultural Show in April 2007, Holstein heifers from the COPAG feedlot won the national competition for "Best Developing Heifer," "Best Pregnant Heifer," and "Best Freshening Heifer." The project has received significant attention from within Morocco, across the continent of Africa, southern Europe, and the Middle East, directing emphasis on the value of well designed and managed large-scale livestock production facilities with good nutrition and genetics. The project has catalyzed the development of numerous additional projects, including a large-scale dairy (4,000 cows) and several other smaller (1,000 cows) dairies and dairy calf feedlots. It has



Hands-on management training for calf care and treatment remains critical to the success of the COPAG feedlot.

Final analysis pending but pointing positive

Since October 2006, heifer calves bred and raised in this feedlot have returned to their owners' milking sheds, and their calves stock the feedlot. COPAG has been monitoring a portion of the existing heifers to measure milk yields, so the animals can be compared against heifers which were raised on-farm. Body condition, good health, and fast growth rates for these heifers, in addition to overall milk yield, are some of the benefits that Moroccan farmers realize from placing their animals at the feedlot. While much of the evaluation is ongoing and feedlot operations and management are being refined, it is obvious that there are significant positive impacts being created by this facility.

also spurred the inauguration of a project focusing on the development of design guidance for 500-head model beef feedlots in Morocco.

ASABE Member **John A. George** is Agricultural Engineering Associates president, Uniontown, Kan., USA; johng@agengineering.com.

Changing Agriculture *continued from page 8*



Note the driverless tractor working with a cabbage-harvesting crew of 20. Tractors may operate up to 3.2 kph (2 mph) without a driver if the throttle, brakes, and clutch pedal are remotely controlled.

could overcome these obstacles and improve yields. Imagine the opportunities and challenges of an automated hillside tree-pruning machine that selects individual limbs to be pruned by size, location, height, and surrounding limb density. The same machine could be outfitted to pick, grade, and pack fruit as well.

Opportunities exist for nursery stock equipment that mixes potting soil, peat, and nutrients, then fills varying

sizes of containers on pallets prepared for planting slips or seeds. Transport of pallets to and from the growing areas could be done with autonomous vehicles similar to those used in warehouse distribution centers.

California law allows tractors in furrows traveling less than 3.2 kph (2 mph) to travel without a driver, provided the throttle, clutch, and brakes can be controlled remotely. This practice is widespread with harvest crews. After-market suppliers provide radio-controlled units and electro-hydraulic valves, but crude linkage and cables are used to connect cylinders to the tractor-operating controls. New tractors with electronically controlled engines and infinitely variable transmissions have the opportunity to provide remote-controlled features with very little added cost and no added hardware. So far, no tractor manufacturer has stepped up to this opportunity. The list of potential technological challenges and opportunities goes on and on.

Ventura's unique blend of climate, land value, water, and labor makes county agriculture an ever-changing mix of diverse crops. Opportunities for agricultural and biological engineers abound as technologies develop to cope with changing factors that affect the needs of the growers.

After 30-plus years designing agricultural machines with Deere & Company, ASABE member **Ralph Shirley** moved to Ventura County, Calif., USA, where he is currently a consulting engineer in accident and fire investigations; ralphshirley@sbcglobal.net.



Independent Study and Human Ingenuity

Amanda Valentine

I am a self-proclaimed mad scientist. My independent study experiences, related to sustainable technological systems, were intriguing, challenging, and sent me around the globe like a Marco Polo in pursuit of the holy grail of new horizons. My independent study as an outlet for human ingenuity in a structured academic environment might encourage others to create such opportunities for themselves.

What it is

Human ingenuity can be defined as creativity, skill, resourcefulness, initiative, inventiveness, originality, and much more. Human ingenuity is constantly being applied. I emphasized its application in the structured learning environment by means of independent study. Independent study is one avenue for a college student to simultaneously pursue curiosities and receive elective credit to complete graduation requirements. A student generally proposes a “project of interest” and obtains permission from a faculty member.

While studying technical systems management within the Agricultural and Biological Engineering Department of the University of Illinois at Urbana-Champaign, I attended a class instructed by ASABE member Tony Grift, assistant professor and research engineer. Grift’s class emphasized the use of “creative” imagination in a fab-



In the late 1700s, Duke Karl Eugen built a country house in Hohenheim, Stuttgart, Germany. It is now well-known for the University of Hohenheim located there and its well-visited botanical garden, where Valentine captured a postcard-perfect photo.

rication project, and it opened my eyes to the complexities concerning various engineering technologies in agricultural production. After the class ended, I took the initiative and received permission from Grift to learn more about sustainable technological systems via independent study for academic credit.

I read scholarly journals, performed electronic searches, gave individual interviews, and maintained continuous in-depth discussions with Grift. I was able to enhance my research skills and resourcefulness and gain a greater understanding of the concept of sustainability as a fundamental component of agricultural policy, commonly referred to as socially supportive, economically competitive, environmentally sound, or natural resource conserving.

I learned more about the unique regional differences and the potential solutions for water scarcity, soil degradation, human nutritional requirements, population growth, and the changing climate by various methods of precision agriculture, biotechnologies, and alternative crop production systems (hydroponics). In some aspects, Grift gave me permission to become accountable for my own efforts in a learning environment and helped me lay the foundation for further independent study endeavors, which makes him my academic mentor.



Valentine's "PV demonstration project" in Germany not only caught the attention of her instructors and colleagues, but also passing-by students.

Building blocks for study and travel

Those enhanced research skills came in handy when I accepted an independent study-abroad opportunity from Andrea Bohn, College of Agriculture, Consumer, and Environmental Sciences. Joachim Müller, professor and department head of the agricultural engineering tropics and subtropics department at the Universität Hohenheim, Stuttgart, Germany, introduced me to a new technological scenario based upon renewable energies. Müller gave permission to think outside the box and to develop applied research techniques in learning about photovoltaic (solar panel) efficiencies. He also gave me the opportunity to work with and learn from some very talented technicians and staff members.

My efforts directed toward understanding photovoltaic efficiencies led me to spend many hours up on the roof of the experiment station. I was primarily interested in cooling the panels with water and collecting specific zone temperatures. The panel's temperatures were adequate to fry an egg. However, an egg would have simulated the soiling effect, which creates irradiation reflection losses, thus reducing transmittance and decreasing the panel's output power, relevant to technological efficiency research. During that period, I was more concerned with the effect water had on the panel's temperatures. I learned it can be difficult to do experiments outside, especially when it rains! The data collection process, in general, is easier than explaining all the possible



Amanda Valentine's independent-study project crossed oceans and brought together various international players with a variety of expertise: (from left) ASABE member Valentine, Simon Valentine, ASABE member Tony Grift, Ahmed Hegazi, Gerald Frank, and Joachim Müller.

variations in the data, but this is what makes research interesting and absorbing.

Before I returned to Illinois, Müller agreed to continue his support toward my learning efforts by providing an outlet to demonstrate my progress. I obtained the necessary gizmos, gadgets, and instruments to continue my efforts at home. After I satisfied my curiosity with the effect water had on the panel's temperature, it was time to take my new skills and invent something original; this was an opportunity for me to contribute to the study of photovoltaic efficiency research.

Independent study leads to more independence

Typically, technological efficiencies and economic considerations are the norm in determining if a device is appropriate. I wanted to "get a handle" on complete sustainable technological systems, so I developed a three-part independent study program that allowed me to ponder development of a technology improvement based on a region (site-specific) that could be considered a potential worst-case scenario.

I discussed the advantages and disadvantages of following standardized research practices with Simon Valentine, an independent consultant specializing in analytical thinking. By applying more originality to my work, I finally created a looping consequential impact analysis concept that can be used in determining if a technological system in its entirety meets sustainable criteria for photovoltaic powered agricultural irrigation techniques in the Eastern Oweinat area in Egypt.

The goal was to create a technological improvement that took the guesswork out of determining when to clean a photovoltaics panel front surface. Also, I wanted to justify any quantity of water used in the cleaning process, because fresh water isn't an abundant resource, especially in the Eastern Oweinat area. Gerald Frank, the electronics shop supervisor from the department of life sciences at the University of Illinois at Urbana-Champaign, took my

project concept and turned it into a reality. He invented a relevant comparative circuit that functioned well with my existing devices.

Grift got involved in my project, too, which allowed me to further develop the circuit. He shared his skills and allowed access to his lab and equipment. I learned how to program a microprocessor to convert analog to digital, which allowed the circuit to display messages according to my logic flowchart. Now Frank's circuit displays a few different messages relevant to my experimental needs.

Success takes flight

After several favorable indoor laboratory experiments, I returned to Germany and presented the circuit as a technological improvement first-stage prototype to Müller and Ahmed Hegazi, a visiting agriculture engineer from Egypt focusing on field-based research application tests. While in Germany, Hegazi discussed his own inventions with photovoltaic efficiencies, and we "think-tank" the potential the prototype could have with his existing research.

Through my journeys, I learned that serious studies of the interdependent relationship links between ecological, sociological, economical, and technological criteria must be established in order to justify adding a technological improvement to an existing photovoltaic system. The idea is to save resources and optimize technology efficiency without sacrificing sustainability.

Independent study can be demanding, if not daunting. One must seek and establish all the learning modes. There is no doubt the reward for such efforts are qualitative. However, there is no doubt I've gained greater confidence with all concepts related to sustainable technological systems, especially global awareness. And finally, there is no doubt I was the linking member of a very diverse group of individuals along with the many characteristics of human ingenuity.

ASABE member **Amanda Valentine** is founder and CEO of Valnology, Berment, Ill., USA; valnology@hotmail.com.

Partnering ASABE and ISO Tractor PTO Shaft Standards

Roger D. Mayhew

The need for standards of interchangeability between the tractor PTO shaft and implement drive lines began in the 1920s, when there were many cases of farmers not being able to connect implement drive lines to tractor PTO shafts. Tractors often had different PTO shaft splines or diameters that were not the same as the implement drive line yokes. When this occurred, the farmer would have to trade the implement in or buy another implement that would mate with his tractor. Many times, this forced farmers to buy their tractors and implements from the same company, which limited the farmers' options. When farmers are working out in the field, having the ability to change implements can be critical. This lack of interchangeability between tractors and implements began a movement among agricultural engineers to standardize the PTO shaft.

S203 – a venerable standard

The resulting ASAE standard (S203: Rear power take-off for agricultural tractors) is the Society's oldest standard. The original draft document was developed in 1926 by the Farm Equipment Institute (FEI), now called the Association of Equipment Manufacturers (AEM), and proposed to ASAE, which adopted the standard in 1927. The rotational speed was specified as 536 ± 20 rpm. In 1931, the standard specified the shaft and the hubs. It was not until 1941 that the 6B spline was specified as SAE 6B.

Two become one

The 1,000 rpm rear PTO shaft was proposed by FEI to ASAE in 1958. The 1,000 rpm standard was originally S204, which was combined with S203 in 1976. The ASAE standard was gradually improved over the years to have minimal interchangeability problems between the tractor and the implement. One example was the tighter-fitting spline on the 1,000 rpm shaft to reduce vibration of the drive line. However, there were a number of differences between ASAE S203 and the equivalent ISO tractor PTO shaft standards. Industry manufacturers requested that the two PTO shaft standards be combined into one worldwide PTO shaft standard.

Consolidation

Consolidating the ASAE and ISO standards was difficult due to the different cultures and methods of enforcing the standards. Engineering standards in the United States are voluntary, but the shadow of product liability lawsuits becomes a force. In the European Union (EU), the governments adopt engineering standards, and the standards become almost like federal laws. The Committee for European Normalization (CEN) writes the engineering standards for EU member countries. Usually, CEN adopts the appropriate ISO standard, and it becomes a European Norm (EN) standard if it meets their requirements. The EU governments enforce the standards, which in this case include on-farm inspection of tractors and implements. Farmers can be fined for not adhering to the standards. Some EU countries were reluctant to change any ISO or EN standard because that meant they would have to petition CEN.

Meeting of cultures

One of the biggest problems in the consolidation was the width of the master shield. Some large constant-velocity joints would not fit in the narrow master shields. In addition, one European country uses narrow hitches that do not accept a wider master shield, and those hitches are not used outside of that country. Another area of considerable discussion was the use of the 1-3/8 6B spline at 1,000 rpm in Europe. In North America, that spline is only used on a 540-rpm shaft, and the implements are designed for that speed. Any implement that is designed for 540 rpm will have serious problems when attached to a 1,000 rpm PTO shaft.

The height of the PTO shaft above the ground was another area of long discussions. The height above the ground is affected by the tire diameter, which varies considerably. Nevertheless, after many hours of meetings in Europe, the final balloting of the new ISO 500 was finished, and the standard was approved in 2004. ASABE is in the process of adopting ISO 500 and withdrawing S203. The benefits of adopting one worldwide standard are great.

ASABE member **Roger D. Mayhew**, P.E., consultant, is retired vice president of engineering at Weasler Engineering, Inc, West Bend, Wis., USA; mayhewr7@alexssa.net.

The New Paradigm in Agriculture

Gale A. Buchanan, Joseph A. Dunn, James R. Fischer, Stanley R. Johnson, Janine A. Finnell, and Brian D. Lavoie

Since man first discovered that fire could stave off the cold of winter, provide light, and cook victuals, energy has become as integral to our lives as food and water. Yet many of our energy sources, such as petroleum, coal, natural gas, and uranium ore, are finite. Renewable sources of energy, including energy from biomass, are virtually inexhaustible.

Agriculture has always been focused on the production of human food, feed for livestock, and fiber for clothing. Agriculture is now expanding its contribution to society with energy production. The sun is one of the energy sources that is inexhaustible, proposed to last for about 4 to 6 billion years.

of “how much” and “what kind” of crops will be supplied and when it will be feasible. In the late 1970s, the ethanol market in the United States consisted of several million gallons. Today, U.S. ethanol capacity is more than 5 billion gallons annually and may reach 7.5 billion gallons by the end of this year. Corn ethanol and biodiesel production are currently well-established technologies. The Bush administration’s “Twenty in Ten” initiative calls for approximately 35 billion gallons of renewable and alternative fuel production by 2017.

Additionally, an increasing number of industries are looking to substitute biobased products for petrochemical

OVER THE PAST 150 YEARS, OUR OWN FOOD AND AGRICULTURAL SYSTEM HAS BEEN TRANSFORMED BY REVOLUTIONS IN MECHANICAL, CHEMICAL, AND BIOLOGICAL SCIENCES AND TECHNOLOGIES.

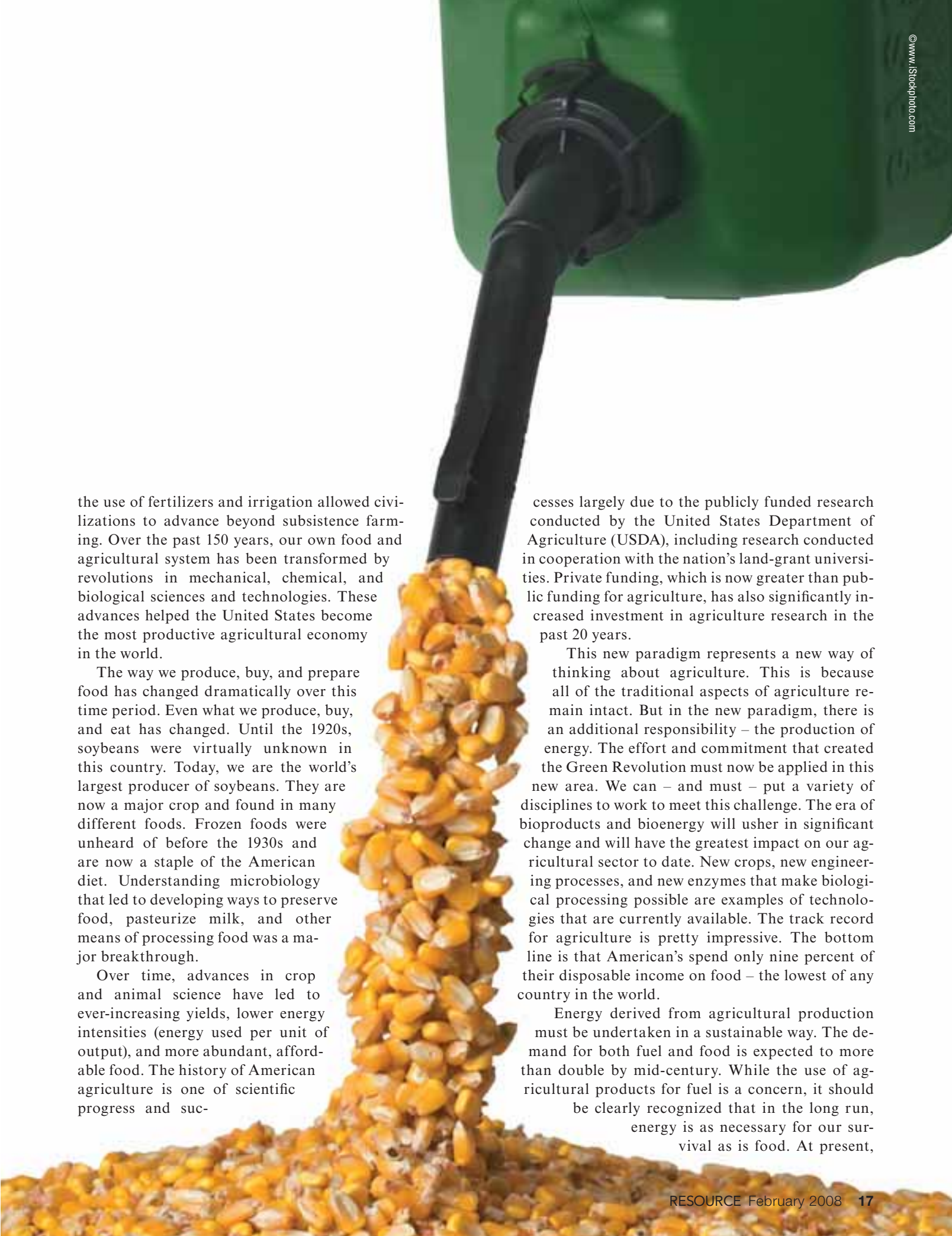
There are two major ways to capture the sun’s energy – photovoltaic cells and green plant photosynthesis. Harvesting the sun’s energy through green-vegetation photosynthesis represents a new paradigm for agriculture, as well as a new imperative. Even decades ago, the revered agricultural scientist George Washington Carver recognized that oil resources were limited and that “we must learn to synthesize materials for every human need from the things that grow.”

Agriculture is increasingly playing a role in our energy economy and is destined to become an even greater player in the future. It is no longer a question of “whether” agriculture will supply biomass for fuels and bioproducts but

products to reduce dependence on foreign petroleum. These industries are convinced that alternative products are largely cost-effective and environmentally sustainable.

For example, several national retailers, including Whole Foods and Wal-Mart, are now using polylactic acid (PLA) packaging. PLA is a compostable biopolymer that can be used to produce bioplastic packaging materials, clothing, and bedding products. PLA is currently being produced from corn by a biorefinery in Blair, Neb.

There have been previous paradigm shifts in the history of agriculture. The advent of animal power, along with elementary mechanical devices (e.g., the plow) and



the use of fertilizers and irrigation allowed civilizations to advance beyond subsistence farming. Over the past 150 years, our own food and agricultural system has been transformed by revolutions in mechanical, chemical, and biological sciences and technologies. These advances helped the United States become the most productive agricultural economy in the world.

The way we produce, buy, and prepare food has changed dramatically over this time period. Even what we produce, buy, and eat has changed. Until the 1920s, soybeans were virtually unknown in this country. Today, we are the world's largest producer of soybeans. They are now a major crop and found in many different foods. Frozen foods were unheard of before the 1930s and are now a staple of the American diet. Understanding microbiology that led to developing ways to preserve food, pasteurize milk, and other means of processing food was a major breakthrough.

Over time, advances in crop and animal science have led to ever-increasing yields, lower energy intensities (energy used per unit of output), and more abundant, affordable food. The history of American agriculture is one of scientific progress and suc-

cesses largely due to the publicly funded research conducted by the United States Department of Agriculture (USDA), including research conducted in cooperation with the nation's land-grant universities. Private funding, which is now greater than public funding for agriculture, has also significantly increased investment in agriculture research in the past 20 years.

This new paradigm represents a new way of thinking about agriculture. This is because all of the traditional aspects of agriculture remain intact. But in the new paradigm, there is an additional responsibility – the production of energy. The effort and commitment that created the Green Revolution must now be applied in this new area. We can – and must – put a variety of disciplines to work to meet this challenge. The era of bioproducts and bioenergy will usher in significant change and will have the greatest impact on our agricultural sector to date. New crops, new engineering processes, and new enzymes that make biological processing possible are examples of technologies that are currently available. The track record for agriculture is pretty impressive. The bottom line is that Americans spend only nine percent of their disposable income on food – the lowest of any country in the world.

Energy derived from agricultural production must be undertaken in a sustainable way. The demand for both fuel and food is expected to more than double by mid-century. While the use of agricultural products for fuel is a concern, it should be clearly recognized that in the long run, energy is as necessary for our survival as is food. At present,

about one-fifth of our corn production is used for ethanol production. In the future, research on the technical and economic development of ethanol made from the cellulose contained in stalks, wood chips, and leaves instead of corn kernels, could yield a large supply of biofuels without competing with food crops. Grasses such as miscanthus or switchgrass could be used to produce biofuels that sequester carbon in the soil and provide wildlife habitat and erosion control. Wastes are another potential feedstock.

Currently, most green plants make use of only a very small portion of the sunlight that strikes their leaves. New discoveries in chemistry, biochemistry, plant physiology, and crop science could make even more of that energy available. Technological advances in the fields of molecular biology and plant genetics, information and communications technology, microelectronics, process re-engineering, and computer-based management can give us the tools to expand the prominence of agriculture as a significant renewable energy producer.

Progress is being made. Many more talented people are working in the area of biofuels than ever before. What's happening is like a "perfect storm" or, on a more positive note, "a perfect opportunity" to bring about a new biobased, green economy. Agriculture is front and center in this opportunity as part of "a new paradigm for agriculture."

There is a much bigger push today when it comes to the available resources for biofuels, and this is

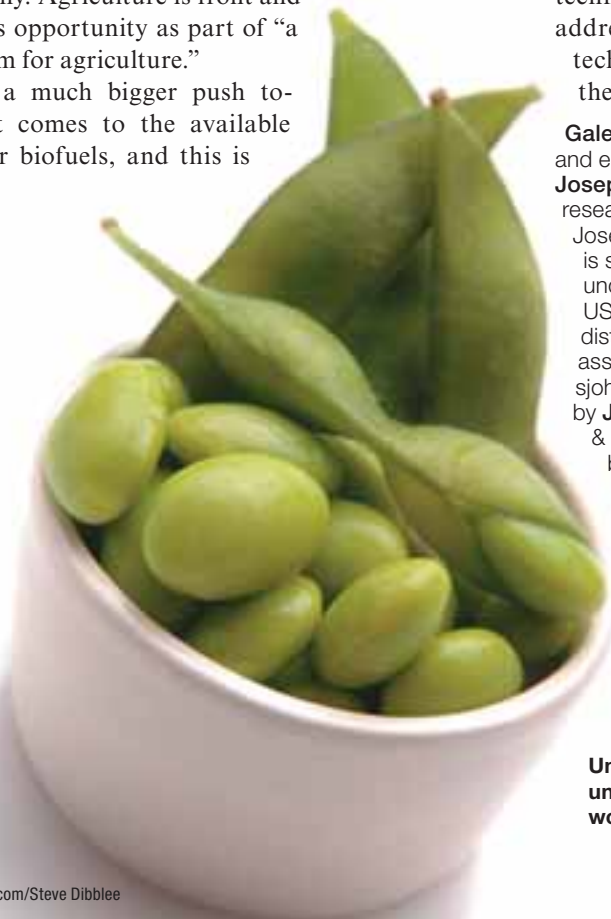
definitely pushing science further than it has ever gone in the past. Three new bioenergy centers were funded by the U.S. Department of Energy in 2007. There are also many ethanol companies, both small and large, that are receiving funds from venture capitalists to invest in biofuels production. The USDA is increasing its involvement in research, extension, and education related to biofuels. In addition, the Bush administration's Farm Bill proposals will dramatically expand the role of the USDA in renewable fuels. Proposals include the provision of \$1.6 billion in new funding for renewable energy research, development, and production focusing on cellulosic ethanol.

This feature is the first in a series that will examine how agriculture can play a significant role in America's energy economy, both as a producer and as a more efficient consumer. Follow-up articles will examine the potential for and challenges of bringing the bioeconomy to fruition, including feedstock research, harvesting and logistics, conversion to fuels, and the development of co-products and bioproducts. The contributions of other renewable energy sources, like wind and geothermal in providing energy and alternative incomes to rural areas, will be reviewed. Education, partnerships, and policies will play a critical role in encouraging the development and use of these new technologies. Lastly, the topic of sustainability will be addressed in order to examine how bioenergy and other technologies can be harnessed in a fashion that protects the environment.

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Until the 1920s, soybeans were virtually unknown in the United States. Today, it is the world's largest producer of soybeans.

Building a Culture of Honesty

This article is republished with permission from the July 2007 issue of *PE*, the magazine of the National Society of Professional Engineers, www.nspe.org.

A plagiarism scandal at Ohio University's Russ College of Engineering and Technology has led the university to revoke the master's degree of one mechanical engineering student and to review the work of many other engineering students. It has also sparked a discussion on the campus about ethics and academic honesty. In May 2007, Tim Dodd, executive director of Duke University's Center for Academic Integrity, spoke at Ohio University about changing a culture of dishonesty. He recently shared his thoughts with *PE*.

PE: It seems that every time we turn around, there's another college cheating scandal. There was the incident at Ohio University last year, and this year there have been cheating scandals at Indiana University's School of Dentistry, the Air Force Academy, and Duke University's School of Business. What's going on?

Dodd: Although each of these incidents has slightly different roots, there are some common threads that tie most large-scale cheating scandals together. We typically learn of cheating conspiracies within programs in which students' attendance is motivated more so by career considerations instead of intellectual curiosity. We also have seen large-scale cheating in courses or on assignments which students deem "trivial" or treat as a hurdle to clear before engaging the "important" coursework. Opportunity plays a large role, too. Where ease of cheating is facilitated (in large lecture hall testing environments or through abuse of technology) and the likelihood of detection or sanction is low, some students will be tempted to exploit that opportunity.

PE: If students have such a relaxed attitude toward cheating, what are the implications when they move on to the work world?

Dodd: There is research that correlates undergraduate attitudes and behaviors involving cheating with professional and workplace ethical viola-

tion. I have read the work of colleagues who refer to academic misconduct as one phase of a pattern of behavior they refer to as "deviant workplace adaptation." A cheating culture is nurtured in high school, refined in college, carried through to graduate and professional school, and applied in the workplace. Integrity doesn't come with an on-off switch; unless we vigorously promote academic honesty as a centerpiece of the ethical well-lived life in school, we will continue to send individuals into the workplace who value the expediency of shortcuts and cheating. Do any of us want the dental students who cheated at IU (or at the University of Medicine and Dentistry, New Jersey last year) performing our root canals? Well, they are out there.

PE: In your presentation at Ohio University, you said that to combat academic dishonesty, a university needs to establish an alternate culture that rewards right behavior. Explain.

Dodd: Culture, as one definition suggests, is the accumulation of overt and covert social messages that guide behavior. The contemporary culture has many messages that guide academic behavior: You have to cheat to get ahead, only grades matter, everyone else does it. Educators have to fashion counter-cultural messages: Integrity is a life skill

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A cheating culture is nurtured in high school, refined in college, carried through to graduate and professional school, and applied in the workplace, says Tim Dodd.



Convening in Providence

2008 Annual International Meeting

With a thriving arts district, a commitment to historical preservation, and sophisticated nightlife, Providence, R.I., blends urban sophistication with small town charm. It boasts a state-of-the-art convention center and several nationally acclaimed restaurants. Bring the kids to one of the country's best zoos. Tour one of the oldest cities in the United States, and visit scores of immaculately preserved colonial, federal, Greek revival and Victorian homes and buildings. Shop at funky boutiques or luxurious department stores. Night and day, Providence entices thousands of visitors annually.

ASABE is proud to host the 2008 Annual International Meeting in Providence, June 29 - July 3. The meeting will include technical sessions, technical and cultural tours, luncheons, a job fair, competitions, exhibitors, and more.

This year's annual Welcome Reception is scheduled from 4-6 p.m. on Sunday, June 29, which is a change from previous years. It has been timed to allow attendees to make dinner reservations with friends and colleagues following the reception. A member of the Providence-Warwick Convention and Visitors Bureau will be in attendance at this meeting to assist with reservations and restaurant recommendations.

Another new feature is the opening of the T-11 Energy Division sessions. The T-11 committee is organizing a day-long series of activities. The tentative format of the day is lecture-forum style sessions in the morning and a poster session in the afternoon. The morning forums will deal with technologies, policies, and programs. The afternoon poster session will feature bioenergy-related posters in soil, water, buildings, equipment, processes, instrumentation, emerging technologies, and education. Industry



Photo by Michael Melford

sponsorship is currently being offered for the afternoon poster session and for coffee breaks or prizes for selecting best posters in various categories.

A number of optional events are scheduled, as well. Participating colleges, universities, and alumni associations (who host breakfasts, luncheons, and dinner outings) include:

- Washington State University
- Iowa State University
- Zhejiang University
- University of Illinois
- Virginia Tech
- Purdue University
- Oklahoma State University
- Texas A&M University
- University of California-Davis

The Young Professionals Community will host a number of events including the annual Fountain Wars and Fun Run. The Senior Active Community will feature three presentations on "Challenges Facing Farm Equipment Businesses in the Northeast" by Spencer Givens, "The Greenhouse and Nursery Industry in New England" by John Bartok, and "Changes in the Dairy Industry in the Last 50 Years" by Robert Graves.

Continued Professional Development (CPD) credits are offered each year, generally on Sunday, and prior to the opening of the conference. These include "Conducting Education Research;" "WINPOND;" "Fluorescent Imaging for Machine Vision Application;" "Hyperspectral and

Multispectral Imaging;” “Implementing Wireless Sensor Networks – A Low Cost, Hands-on, Do It Yourself Approach;” “Interracing Wireless Sensor Network;” “KML for Google Earth” and many more.

A number of cultural and technical tours are being scheduled throughout the duration of the meeting. There will be tours that cater specifically to ASABE’s Active Seniors Community, Young Professionals Community, International Professional Community, spouses, and families. While tours are still being determined, topics may include history, nightlife, adventure, museums, ecology, shopping, and more.

The preliminary program, with more information about the 2008 Annual International Meeting, will be mailed in February. Please look for it in your mailboxes! For more information, please visit www.asabe.org/meetings/aim2008/index.htm. In the mean time, if you have any questions, the ASABE meetings staff can be contacted at (269) 428-6333 or at mtgs@asabe.org.

We’ll see you there!

Mark Your Calendar!

2008 Annual International Meeting
June 29 – July 2
Providence, Rhode Island, USA

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For conference and exhibit information, contact:

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Culture of Honesty *continued from page 19*

to be practiced, doing a few things well is better than doing many things poorly and dishonestly, the honest individual is a champion and not a chump.

In our colleges and universities, honest students must feel valued and empowered to catalyze a call to honesty among their peers. Instructors should model integral behavior in their own scholarship and teaching. Administrators need to demonstrate openness, transparency, and inclusion in their decision making. We all have a role to play; integrity is not someone else’s job or something to be learned in one course. As such, educational and administrative policies, the learning environment, and the organizational life (of students, faculty, and staff) have to present a vision of what honorable behavior looks like. And individuals must be held accountable for the consequences of their behaviors when those behaviors cheat or defraud our peers and colleagues or our institutions.

PE: What else should colleges and universities be doing to teach students honesty and integrity – characteristics contained in NSPE’s Code of Ethics for Engineers?

Dodd: I am a firm proponent of the “cradle to grave” approach to embracing integrity in the academic and social spheres. The application and admissions processes should demonstrate to prospective students that integrity matters in college. Discussion about expectations and practices of honorable behavior must inform – and not become buried in the minutiae of – orientation. Instructors must be clear in explaining guidelines surrounding academic work and be willing to invite students into a “compact” of mutual ethical responsibility. Co-curricular and extra-curricular activity can incorporate opportunity to practice empathy and respect for others. Student organizations should be encouraged to develop ethical guidelines. And, critically, the ethical aspirations of the on-campus community must be

“transported” to off-campus life. As I said in my presentation, there are no shortcuts and no exemptions in building a culture of integrity.

PE: If research has shown that cheating behavior is ingrained by high school, what can be done to change students’ tolerance for academic dishonesty before they even step on campus?

Dodd: Despite years of depressing statistics on cheating in high schools, most high schools have done little to push back on this rising tide. What is required in our high schools is a comprehensive discussion among teachers, parents, administrators, and students about forceful promotion of academic integrity and other ethical standards and the inclusion of students in those efforts. And here is where the value of investing college students with a large stake in promoting integrity pays enormous dividends beyond the walls of campus. They will take the integrity message to the high schools: as friends of classmates still in high school, as admissions representatives at “college nights” at their high schools, as teachers, and, eventually, as parents of high school students.

A quick example: A former student of mine at Case Western Reserve University who spent two years as chairperson of the Academic Integrity Board is now a math teacher at a high school in Pennsylvania. Guess who is leading the charge at his school to fashion an academic integrity policy and is a tireless advocate in his classes for the values of honesty, trust, and fairness?

Trickle-down is one key avenue: The students, faculty, and staff imbued with an appreciation for the values of academic integrity at our colleges and universities must also exploit their peer and parental ties to high schools to jumpstart the conversation and help forge policy at those schools.

New Smart Tire Senses Damage, Increases Safety

A new type of “smart” tire developed by a Purdue University professor is able to sense damage when a tire goes flat or loses treads, making it safer for road travel. The tire’s technology also can be used to detect impending defects before a tire is mass-produced.

A team led by ASABE member Gary W. Krutz, director of Purdue’s Electrohydraulic Center and a professor of agricultural and biological

engineering, has developed a tire system that senses failures in real time. The concept behind the technology is that the entire tire acts as a sensor that sends information to onboard computers.

The patented technology is available through the Purdue Research Foundation’s Office of Technology Commercialization.

“I became interested in this after I had to replace all the tires on my daughter’s and son-in-law’s car after

just 10,000 miles and suspected problems after seeing dozens of truck retreads along interstates,” said Krutz who earned his undergraduate degree in mechanical engineering. “This motivated me to do some research and find a way to improve tire safety. Our prototypes were tested, and the results showed significant damage can be quickly detected.”

Tires are consistently subjected to harsh and unpredictable conditions. Because of this, they become particularly susceptible to external damage.

“Some tire damage is not easily detected or prevented, even with proper maintenance and inspection,” Krutz said. “Occasionally, failures occur because of gap damage within the tread, and this type of damage is a particular hazard on all steel-belted tires. Tire damage on the road creates situations that are inconvenient and, more importantly, hazardous for drivers.”

Krutz’s research led to the development of a sensing system that can respond to significant changes in a rubber research tire. The prototype system was designed by determining critical aspects of tire design and performance.

Sensors that can alert operators when a tire condition has degraded can save time and effort in repairing or changing the tire. The sensors also can notify drivers of low air pressure



ASABE member Gary Krutz and graduate research assistants Timu Gallien and Alyssa Brune conduct research on a “smart” tire designed to sense tread damage before the tire goes flat or experiences tread loss. (Photo courtesy of Purdue University)

or unbalanced air pressure between tires, which can prolong the operable life of a tire.

“However, there are external injuries that can occur in tires that are not always propagated or affected by improper inflation, such as a road hazard like a rock or loose concrete, that can do damage to a tire without actually causing it to go flat,” Krutz said. “This sensor technology searches for these types of problems as well.”

Measurements on the tread, which includes the outermost layer of the tire and the layers beneath it, can be used to determine greater susceptibility to tire degradation. Examples of tire problems include cuts, punctures,

manufacturing quality, imbalance, impact, rubber hardening or degradation, or improper mounting or repair.

“Beyond the importance of safety, an added bonus to this sensor technology is that drivers can get their tires repaired before the condition has degraded to the point of where it needs to be replaced,” he said. “This can save time and effort in repairing or changing the tire during a highway emergency.”

The sensor technology developed by Krutz works for all rubber tires, such as those on passenger cars, trucks, construction equipment, lawn and garden equipment, mining vehicles, and airplanes. The technology has been tested

on other components and can be used in rubber products such as vehicle isolators, door and automotive seals, and orthopedic devices.

“It also can be used on most polymers, such as airplane wing composites, boat hulls and sporting goods,” Krutz said. “We’ve tested this technology on more than 100 different products from shoes to accumulators.”

Initial research funding for the tire technology came from Purdue University.

For more information, contact Gary Krutz; krutz@purdue.edu, or Purdue News Service; purdue news@purdue.edu

“Jekyll and Hyde” Bacteria Offer Pest Control Hope

New research at the University of York has revealed so-called “Jekyll and Hyde” bacteria, suggesting a novel way to control insect pests without using insecticides. Researchers studied the relationship between plant-dwelling insects and the bacteria that live in them – and discovered an unexpected interaction.

Plants are not “easy meat” for insects. In fact, many insects thrive on plant food only because of the presence of a third party: symbiotic bacteria that live in the insects and provide extra nutrients.

While studying interactions between black bean aphids and their associated bacteria, York researchers discovered an intriguing new category of organism that they dubbed “Jekyll and Hyde” bacteria.



Soybean aphids (*Aphis glycines*). (Photo courtesy of Bamphitlhi Tiroesele)

(continued on page 24)

Black bean aphids can live on a number of different plant species. In most situations, their internal bacteria are harmless or even beneficial – this is their “Jekyll” side.

But on certain plants, the relationship between insect and bacteria changes with the microscopic organisms, exhibiting a disruptive “Hyde” side. The insects grow and reproduce very slowly, while the bacteria themselves proliferate to very high densities in a short time – almost as if the bacteria were “betraying” their hosts.

Further experiments have suggested that the factor triggering this strange change is the composition of nutrients in the plants where the creatures live.

The results, published in the *Proceedings of the Royal Society B*, may point the way to new methods to control aphids and other insect pests.

Angela Douglas, of York University’s Department of Biology, said, “We now have the basis to explore precisely how these insect pests control their bacteria – and perhaps to develop ways to make the bacteria ‘turn nasty’ on the insects. These findings offer exciting new opportunities to control aphids and other pests without using insecticides.”

For more information, contact the University of York, pressoffice@york.ac.uk

Manure Management Helps Control Prevalence of Antibiotic Resistance Genes, Study Says

Simple modifications in agricultural practices can help diminish the spread of antibiotic resistance genes – a major health concern – in manure, a Colorado State University researcher has found.

Amy Pruden-Bagchi, an assistant professor in the department of civil and environmental engineering who has received national accolades for her work on antibiotic resistance genes, found that adding organic material (such as alfalfa and leaf compost) and watering and turning (e.g., composting) reduced the proliferation of the genes. Based on the findings, a treatment time of two to three months is recommended prior to land application to reduce the spread of resistance genes.

“More studies are required, but this is a successful first step in determining how we can keep reducing the spread of this new class of contaminant,” said Pruden-Bagchi, who was recognized by President Bush in November with a Presidential Early Career Award. “My research focuses on how antibiotic resistance genes spread and how we can develop ways

to treat them since there are currently no standard practices for removing them from water supplies.”

Pruden-Bagchi’s research has demonstrated that drug-resistant DNA itself is an environmental contaminant. This is based in part on the fact that, even if cells carrying the genes have been killed, the DNA still winds up in the environment and may get transferred to other cells.

Her most recent field studies on manure tested the genes’ reactions to high-intensity management, such as composting, and low-intensity management, such as stockpiling. With high-intensity management, researchers added materials to the manure, watered it and turned it. They found that all three antibiotics tested – chlortetracycline, tylosin, and monensin – dissipated more rapidly under the high-intensity management conditions. Tetracycline and sulfonamide are commonly used antibiotics in people and animals.

Antibiotic resistance genes are not regulated; there is growing interest in understanding and documenting if there are indeed human health ef-

fects from antibiotic resistance in water. They would likely have to exceed the background levels of resistance that are already present in humans and correspond to antibiotics that are critical to fighting antibiotic resistant diseases in humans.

Pruden-Bagchi has done previous studies on the occurrence of tetracycline and sulfonamide antibiotic resistance genes in sampling sites along the Poudre River. As expected, they found higher concentrations in more populated or heavily farmed areas but still detected low levels of antibiotic resistance genes in pristine areas as well. Pruden-Bagchi found that treated water and wastewater also carried the genes.

“Microbes carrying these antibiotic resistance genes are not effectively killed by antibiotics, and the presence of these drugs in the environment may stimulate them to proliferate,” Pruden-Bagchi said.

For more information, contact Emily Narvaes Wilmsen, Colorado State University, Emily.Wilmsen@colostate.edu

USDA Unveils New Business Plan for National Animal ID

The United States Department of Agriculture unveiled a new vision for the National Animal Identification System (NAIS) on Dec. 19, 2007. The plan focuses on the identification issues confronting each species and identifies seven key strategies to move the NAIS forward. Those strategies center on the need to improve data compatibility, technology, cooperation with livestock, and breed associations and with state governments as well.

According to the new business plan, the U.S. commercial poultry industry essentially already has the ability to trace individual birds back to their original premises within 48 hours. But the plan said the beef cattle industry has the farthest to go in achieving the goal of 48-hour trace back, largely due to its diverse segments and lack of vertical integration.

USDA Under Secretary for Marketing and Regulatory Programs Bruce Knight told Brownfield premises registration remains the key to making the NAIS viable. He urged

beef producers to “take the emotion out” of their decision to register their premises. And Knight pointed out there are compelling reasons for cattle producers to register their premises.

“If they want to see the importance of animal ID, look at how this summer, with an outbreak of foot-and-mouth disease (FMD) in the United Kingdom, how quickly that was able to be contained and how few animals died,” Knight emphasized. “And, but for the grace of God, we could go there as well.”

While the business plan stresses the importance of livestock traceability, nowhere in the document is it suggested that the NAIS should be or ever will become a mandatory program. And Knight says it doesn’t need to.

“It is a voluntary program,” Knight reiterated. “We think the merits of animal ID are such that folks will participate as a voluntary program.”

One directly affected by animal disease issues in the United Kingdom is Rob Wills, executive manager of the British



The National Pork Producers Council supports a mandatory national animal ID system.

Livestock Genetics Consortium, Ltd. He told Brownfield the only way animal identification helped successfully control this past summer's FMD outbreak is that the UK program is mandatory.

"Without a national mandatory ID system, we could be dead and buried," Wills said bluntly. And he cautioned that if FMD or a similarly contagious disease were to strike in the United States, the absence of a system to speed traceability could make eradication a difficult, costly, and lengthy affair with larger ramifications.

"Then you really, seriously are in a nightmare scenario, and your exports will be banned," Wills warned. "And if you don't watch out, they'll be banned forever."

Fear of losing export markets is one reason National Pork Producers Council (NPPC) President Jill Appell told Brownfield her group continues to support a mandatory national animal ID system. She also noted the U.S. pork industry had a positive and successful experience with the mandatory pseudorabies eradication program. For those reasons, Appell said pork producers may be more comfortable than cattle producers with a mandatory approach to animal ID.

"The pseudorabies program was not only mandatory, it worked," noted Appell. "And so we probably don't have the

same kind of reluctance as some other species may have to having a mandatory program."

But how can the hesitancy of beef producers to register their premises be overcome? According to Knight, USDA, state veterinarians and cattle and breed associations must all play an important role. But Knight suggested the most effective advocates for the NAIS may be other cattlemen.

"What we're seeing already in some of the partnerships we've done with the industries, where the industry leadership is saying, 'Guys, this is the right thing to do,' we're seeing a great deal of acceptance of animal ID and high levels of participation," Knight said.

The new NAIS business plan sets the bar differently for different species. For example, the plan calls for 100 percent of commercial poultry houses to be registered by March 2008. The plan expects 100 percent of swine premises to be registered by March of 2009. But the plan's objective for cattle is more modest, with a goal of just 70 percent of U.S. cattle on registered premises by December of 2009.

For more information, contact Peter Shinn and Bob Meyer, Brownfield Ag News for America, www.brownfieldnetwork.com



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Resource is published eight times per year: February, April, May, June, July, September, October, and November. The deadline for ad copy to be received at ASABE is four weeks before the issue's publishing date.

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For more details on this service, contact Melissa Miller, ASABE Personnel Service, 2950 Niles Road, St. Joseph, MI 49085-9659, USA; 269-429-0300 ext. 317, fax 269-429-3852, miller@asabe.org, or visit www.asabe.org/resource/persads.html.

The USDA, Agricultural Research Service, Southeast Watershed Research Laboratory in Tifton, Georgia is seeking a **POSTDOCTORAL RESEARCH ASSOCIATE**, (Research Ecologist/Soil Scientist/Research Engineer) for a TWO YEAR APPOINTMENT. Ph.D. is required. Salary is commensurate with experience (\$52,912 – 82,446) plus benefits. There are some citizenship requirements. The incumbent will carry out the testing, modification, and application of the Riparian Ecosystem Management Model (REMM) in the Jobos Bay Watershed in Puerto Rico. Specific objectives are to: 1) use REMM to assess how buffers can improve water quality entering Jobos Bay; 2) develop necessary modifications to REMM that will be needed in coastal and tropical environments such as those in Puerto Rico; 3) assemble new and existing data sets from the Jobos Bay Watershed for testing and evaluation of REMM. The incumbent will also test and modify improved nutrient cycling and pesticide transport algorithms of REMM in order to gain better understanding of the pathways of nutrient and pesticide transport in coastal environments where direct atmospheric deposition of nutrients and pesticides to coastal waters is important.

QUALIFICATION REQUIREMENTS: Skills in computer information technologies and use of high-end software tools; knowledge of nutrient cycling and environmental chemistry; knowledge of scientific principles of natural resource management; and experience in tropical agroecology are desired. Ability to work across disciplines and excellent oral and written communication skills are expected. For specific information on the duties and responsibilities of this position, obtain announcement number: RA-08-005H, and application procedures which are available at <http://www.afm.ars.usda.gov/divisions/hrd/hrdhomepage/vacancy/pd962.html>. Send application materials and references to:

Dr. Richard Lowrance
USDA-ARS-SEWRL, POB 748
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or email (Richard.lowrance@ars.usda.gov).

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ENGINEERING, BIORESOURCE MCGILL UNIVERSITY

The Department of Bioresource Engineering (<http://www.mcgill.ca/bioeng/>) is seeking outstanding individuals for a tenure-track position at the Assistant or Associate Professor level. The intent of the position is to address a number of closely-related fields in the discipline, the overall target area being composed of the following: GIS and precision agriculture, mechatronics, agricultural robotics, machine design, automation, instrumentation and control, remote sensing, satellite imagery, and hyperspectral analysis. Candidates should have expertise in at least one or more of these fields, are expected to have an earned Ph.D. in an appropriate, related discipline, and should have an excellent publication record for their level of experience. The successful candidate will develop a strong, independent research program supported by external research funds, will collaborate with other researchers, and teach at both the undergraduate and graduate levels. Applicants must be eligible for membership in a Canadian professional engineering association. The following materials should be included in the application: curriculum vitae, a statement of teaching and research interests, the names of three referees, and copies of relevant publications. Applications should be mailed to: Dr. R. Kok, Chair, Bioresource Engineering, Macdonald Campus of McGill University, 21111 Lakeshore Blvd, Ste-Anne-de-Bellevue, QC, H9X 3V9, Canada. Deadline for applications is April 15, 2008; an actual start date of June 1, 2009 is foreseen for the position.

McGill University is committed to equity in employment and diversity. It welcomes applications from indigenous peoples, visible minorities, ethnic minorities, persons with disabilities, women, persons of minority sexual orientations and gender identities and others who may contribute to further diversification. All qualified candidates are encouraged to apply; however, in accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada.

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Application deadline: March 1, 2008.

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PERSONNEL SERVICE

THE PENNSYLVANIA STATE UNIVERSITY DEPARTMENT OF AGRICULTURAL AND BIOLOGICAL ENGINEERING

POSITION: Assistant/Associate Professor, Synthetic Biology Engineer

QUALIFICATIONS: For this tenure-track position, candidate must have a Ph.D., a research background in biological, agricultural, or chemical engineering or a related engineering field, and at least one engineering degree (B.S., M.S., Ph.D.). Research experience at the interface of engineering and biology is important because the faculty member is expected to interact and provide leadership with teams of engineers and biological and physical scientists. Familiarity with biological processes and bio-nanotechnologies is very significant to this position. Ability to communicate effectively, to provide creative leadership, and to work cooperatively with students, faculty, staff, and industry groups is paramount. Professional Engineer (PE) registration, or adequate pursuit thereof, is desirable.

RESPONSIBILITIES: The successful candidate will assume a key role in a major energy initiative co-funded through the Penn State University's Institutes of Energy and the Environment (PSIEE), <http://www.psiee.psu.edu>. Opportunity exists to be part of the community of investigators in a second major Penn State initiative under the Huck Institutes for the Life Sciences, <http://www.huck.psu.edu>. Moreover, the candidate will be able to collaborate with investigators in the Biomass Energy Center (<http://www.bioenergy.psu.edu/>) This synthetic biology engineer will apply engineering paradigms of design, fabrication, and system synthesis to biological science with particular emphasis directed toward renewable biomass energy. The successful candidate should be a collaborative leader dedicated fully to the unlimited potential of interdisciplinary partnerships among biological scientists and biological engineers. Development of an internationally recognized research program with substantial external funding will be expected. The successful candidate will also be expected to develop and teach undergraduate and graduate courses on synthetic biology engineering principles and applications as well as to enhance several existing biological engineering courses. The position is anticipated to be jointly administered by the College of Agricultural Sciences and the College of Engineering, with potential adjunct faculty appointments in multiple departments.

SALARY: Competitive and commensurate with background and experience. An attractive benefits package is available.

CLOSING DATE/AVAILABILITY: Applications will be accepted until March 1, 2008, or until a suitable candidate is found. The position is available on June 1, 2008.

APPLICATION: Applicants should submit a letter of application, resume, academic transcripts, a letter of research and teaching interests, and the names and addresses of four professional references to:

Dr. Paul Heinemann, Chair, Search Committee
Department of Agricultural and Biological Engineering
224F Agricultural Engineering Building
The Pennsylvania State University
University Park, PA 16802

Email: hzh@psu.edu

For information about the Department, see www.abe.psu.edu.

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Senior Automated Systems Engineer. The Department of Biological Systems Engineering invites applications for a permanent, 12-month, tenured, 100% Research, Senior Automated Systems Engineer (Associate Professor or Professor). Required: Earned Ph.D. in an engineering discipline and proven experience in the development of a program in automation technologies of relevance to agriculture. Highly Desired: Strong record of research productivity and potential for extramural support; demonstrated ability to develop new processes, systems and opportunities for agricultural automation and mechanization; demonstrated experience in working with, and leading, multi-disciplinary research teams including physical and biological scientists; and strong oral and written communication skills. Desired: Knowledge of agricultural production/processing systems with emphasis on high value specialty crops; demonstrated ability to work with stakeholders; experience with technology transfer to end user groups; experience in mentoring young scientists or engineers; and registration as a Professional Engineer. Application: Letter addressing all qualifications, a statement of vision for the systems engineering program, a resume/vitae, and the names, addresses, and contact information for three references must be provided. Send to: Dr. Francis J. Pierce, Director, Center for Precision Agricultural Systems, Irrigated Agriculture Research & Extension Center, Washington State University, 24106 N. Bunn Road, Prosser, WA 99350, 509-786-9212, Fax: 509-786-9370, fjpierce@wsu.edu. For position description listing all qualifications and application process, visit: <http://www.hrs.wsu.edu/employment/fapvacancies.aspx> (Search #4900). Screening: April 1, 2008. EEO/AA/ADA.

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“Bravo!” for the Cooperative Standards Program

From outhouse and picket fence symbols to saving lives by signs

In the beginning, ASABE's early leaders recognized the need for standards. In *7 Decades that Changed America*, Robert E. Stewart reported that in 1909, just two years after ASAE's inception, the leaders appointed a Committee on Standards. And, in 1912, a committee proposed ASAE's first standard. It was adopted as a recommended practice: Conventional Signs for Agricultural Engineers. Published as a booklet in 1913, it included 202 signs (symbols) such as “outhouse” and “picket fence.” Thus, ASAE standards began.

Changing over time

Some early ASAE standards were also developed by the other organizations, such as the Farm Equipment Institute and the Society of Automotive Engineers, and were later adopted by ASAE. Gradually, ASAE expanded its initiatives and cooperative efforts with other engineering societies, trade associations, government agencies, and also national and international standards organizations. Thus, ASAE's standards program changed with the times to address the interests of all its divisions.

Adapting to standards

ASABE member Larry Gay recently loaned me “ASAE Bulletin No. 44: Farm Tractors Built or Convertible to ASAE Standard Dimensions.” Now get this! That 1944 bulletin included a 15-page listing of “conversion assembly numbers” to convert 18 brands of tractors to “ASAE standard [1941] dimensions for power take-off shaft, master shield, and drawbar hitch point.” Also, some implements were produced with several parts bundled for coupling them to various tractors.

Not many voters

Jimmy Butt, who became ASAE's executive secretary in 1956, recently told me that in early years, all members received proposed standards via ASAE's monthly “journal.” They were asked to vote by letter ballot, but only a few members voted. Beginning in the 1950s, a structure of division committees evolved to develop and approve standards. Later, staff was provided to support standards and other committee activities. I was on this staff from 1961 to 1967.

Industry's financial support

I recall a meeting at ASAE headquarters in 1965 when President Charles Morrison explained his plan to invite indus-

try's financial support of the Cooperative Standards Program. Stewart's book states that 157 manufacturers and other organizations contributed \$15,480 to the \$23,015 standards budget for 1966. Those funds also enabled ASAE to join United States of America Standards Institute, and that support continued.

Farm safety

A few of us “older types” recall increased efforts in the 1960s, '70s, and '80s by industry, engineering societies, farm safety organizations, state safety extension specialists, and others to help reduce farming injuries and fatalities. Many of those efforts led to standards published by ASAE, SAE, ANSI, ISO, and others to improve farm safety worldwide. Of the 56 safety standards and engineering practices in the ASAE Standards 1995 book, 48 were “adopted by ASAE” during 1960-1989.

Accomplishments of ASAE's standards program cannot be measured by merely noting that 200 standards were published in ASAE Standards 2004. And, there isn't space here to list all standards program accomplishments through the early 1990s, but consider a few general benefits:

- Consistent and efficient communications through standards serve our members, industries, and society.
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Members can be proud that ASABE is highly regarded as an effective and respected standards organization, nationally and around the world. Its impact has been significant. As ASABE

continues to embrace new disciplines and changing technologies, even more will be accomplished through the Cooperative Standards Program. Take a bow!

ASABE Fellow **Page L. Bellinger** was ASABE's Technical Coordinator, 1967-67. He then served as a product safety and engineering standards manager for Deere & Company and retired in 1992; bellinger@netexpress.net.



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