

**UNIVERSITY OF ARIZONA**  
**COLLEGE OF AGRICULTURE AND LIFE SCIENCES**  
**AGRICULTURAL EXPERIMENT STATION**  
**&**  
**COOPERATIVE EXTENSION**

**Annual Report of Accomplishments and Results**

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## PROGRAMS

### Overview:

Research and Extension programs are integrated in the scholarship of discovery, integration and application at the University of Arizona. Extension Specialists carry a joint Research appointment and many Research Specialists carry a joint Extension appointment. In addition, where appropriate in our distributed educational system, many of our joint Extension/Research faculty have a formal teaching appointment. Our approach is to provide an integrated and multi-functional approach as we address the diversity of needs across the State of Arizona. We provide these select impacts as they reflect unique benefits to a diversity of clientele and stakeholders. Finally we provide our own assessment of accomplishments based on the 5-year Plan of Work for the appropriate report period.

### Goal 1: *An agricultural system that is highly competitive in the global economy*

Summary: As players in the global economy it is essential for agricultural producers to minimize input costs. Timely, critical information can often lead to significant reductions in costs. The information provided by our Arizona Meteorological Network provides an excellent example. Provisions of appropriate data allows producers to time planting and harvesting, predict pest development, monitor general crop development, and efficiently schedule irrigation thus effecting necessary savings. A comprehensive nitrogen strategy that has been developed over the past 12 years for cotton production allows farmers to use less nitrogen, obtain equivalent yields and reduce production costs by \$30 per acre. Healthy livestock are also critical for producers in that industry. A recently developed PCR assay allows for rapid diagnosis of *clostridium -perfringens* with significant reductions in laboratory costs. This new technology has already been adopted in more than 20 states. Finally, we have included a summary of progress on our corn gene identification project that is being conducted in collaboration with five other institutions. Thousands of scientists from around the world are accessing and using the more than 25,000 gene sequences that have been identified and made available.

## Key Theme - **Animal Production Efficiency**

### **Predicting Fertility of Bulls**

#### Issue

Fertility in a livestock enterprise is 5 to 10 times more important economically than any other production measure. Bulls with identical semen quality in terms of physical assessment vary in actual fertility. Means to identify bulls on the basis of fertility potential could result in higher pregnancy rates, leading to larger calf crops.

#### What has been done?

University of Arizona animal scientists assisted in developing a color-based diagnostic test to identify a protein on bull sperm. An antibody is used to detect presence or absence of that protein which is referred to as fertility associated antigen (FAA). Bulls with FAA on their sperm are 17 percent more fertile than herd mates lacking FAA over a 60-day breeding season. Heifers inseminated once to bulls with sperm-associated FAA had a 16 percent higher pregnancy rate than herd mates inseminated to bulls without FAA on their sperm.

#### Impact

A 1 percent increase in fertility in the U.S. beef industry would return a net profit of \$55-60 million to U.S. producers. Obviously, on a global scale, billions of dollars of income could result from identifying higher fertility bulls and males of other livestock species.

The King Ranch in Texas used high fertility bulls in their nucleus breeding herd for eight years and retained daughters of those bulls as mothers in the nucleus herd. They were bred to high fertility bulls each year. The payoff was clear in 1998, when 83 percent of the calves were born in the first 30 days of the calving season. This resulted in significantly more beef weaned and marketed per cow, which is a direct measure of profit.

The diagnostic test was released for commercial use in 1998, licensed for any rancher or veterinarian in the world to use. Since then it has been adopted by breeders across the U.S., and in at least a dozen countries worldwide, in the Pacific Rim, South America, Canada and Europe.

#### Funding

Hatch Act, National Research Initiative  
Local: Sire Power, Inc. and King Ranch

## Scope of Impact - National

### Key Theme - **Plant Production Efficiency**

#### **Arizona Meteorological Network (AZMET)**

##### Issue

The Arizona Meteorological Network (AZMET) was developed in 1987 to provide weather data and information in near real time to the state's producers of agricultural and horticultural crops. Properly tailored weather information can assist with important management decisions related to variety selection, planting dates, crop assessment, pest control, irrigation and harvest.

##### What has been done?

A network of 23 automated weather stations was established in southern and central Arizona to supply meteorological data from important agricultural production areas and selected urban locations. Meteorological data obtained by the stations are transferred to a Tucson-based data processing center each night where computers process the data into a variety of informational formats. AZMET data and reports are made available to the public free of charge via two Internet Web pages.

##### Impact

AZMET is now widely accepted as an important (and often the only) source of meteorological information pertaining to the production of agricultural and horticultural crops in Arizona. Use of AZMET information continues to grow; AZMET Web Page recorded in excess of 13,000 hits in 2000, an increase of about 20 percent over 1999.

**Crop Production:** Perhaps the most important impact of AZMET in production agriculture has been its ability to provide reliable information on heat units which are used to 1) time planting and harvest dates of horticultural crops such as melons and sweet corn; 2) predict pest development; and 3) monitor general crop development. The Arizona Cotton Advisory Program, which is produced and distributed by AZMET and supplies weekly production updates to growers, makes extensive use heat unit and other weather information derived from AZMET. Growers in a recent survey indicated they alter their management of cotton either occasionally or frequently as a result of information in the advisories; 96 percent of the growers would like the program to continue.

**Water Use:** AZMET generates daily turf water use reports for the Phoenix area and

distributes this information to the public via a turf water management web page, email and automated fax transfer system. Sixteen large turf facilities (with more than 10 acres in turf; mostly golf courses and parks) receive this information via email or fax daily. The turf web page was accessed in excess of 1600 times in 2000. AZMET also generates a lawn watering guide which is published daily in major newspapers in the Phoenix metropolitan area.

Consulting: AZMET information is also widely used by the consulting community for production agriculture, environmental impact assessments, insurance claims, legal disputes and water rights adjudication.

#### Funding

Arizona Cotton Research and Protection Council, Arizona Citrus Research Council  
Arizona Municipal Water Users Assn., Arizona Department of Water Resources  
City of Phoenix, Station sponsors: irrigation districts, NRCs, power districts, commodity organizations, etc.

Scope of Impact - State

Key Theme - **Plant Production Efficiency**

### **Nitrogen Management in Irrigated Cotton**

#### Issue

The traditional approach to nitrogen management in irrigated cotton has been to push for maximum high yields by applying large amounts of nitrogen fertilizer. Historically, in many parts of Arizona, nitrogen application rates have exceeded 200 pounds per acre per season. Although yields may increase, there are serious drawbacks to this practice. Over the last 10-15 years the luxuriant vegetative growth resulting from these high nitrogen applications has harbored damaging insect populations and diseases in Arizona's cotton fields. Studies during the same period have shown that aggressive nitrogen fertilizer application can actually increase the loss of nitrogen from the soil. In the past, nitrogen fertilizer has been relatively inexpensive for southwest desert growers, but early in 2001 those costs rose approximately 30 percent.

#### What has been done?

To help Arizona cotton growers reduce their reliance on high nitrogen applications in their fields, University of Arizona researchers studied and documented nitrogen uptake patterns and requirements in the crop.

UA College of Agriculture and Life Sciences researchers then designed nitrogen management guidelines and recommendations that pinpointed the best times to apply nitrogen in the proper amounts. Over the last 12 years this comprehensive nitrogen management strategy has been implemented in a statewide extension education plan

for cotton growers that includes bulletins, reports, articles and grower meetings.

#### Impact

The cost of cotton production has been high during the last several years, but the market price has been low. UA demonstration projects on cooperating cotton farms have realized yields equivalent to commercial yields, using less nitrogen input, which has saved approximately \$30 per acre in nitrogen application costs. If adopted statewide, the annual savings, at February 2001 nitrogen prices, would be about \$15-\$20 per acre. If 200,000 acres of the total cotton acreage in Arizona were affected, this would equate to \$3 to \$4 million in savings to the growers. Growers would be using approximately 150 pounds per acre, compared to a more common rate of about 200 pounds per acre, a 25 percent reduction.

#### Funding

Water Quality Program, National Cooperative Extension

Hatch Act

Smith-Lever

Arizona Cotton Growers Association; Cotton Incorporated

Scope of Impact - Regional

Key Theme - **Animal Health**

### **Clostridium perfringens**

#### Issue

Clostridium-perfringens-induced intestinal diseases cause serious livestock losses annually in the U.S. and abroad. The organism is found wherever there are domestic animals, and infections are almost always lethal. Diagnosing the disease can be difficult because the bacterium exists as five types producing four different major toxins. The pathogen must be isolated and tested to determine which toxins are involved. Several earlier detection methods have yielded false negatives, false positives, and other problems. To assist veterinarians and livestock producers, a more practical diagnostic method was needed.

#### What has been done?

Veterinary scientists at the University of Arizona developed a PCR (multiplex polymerase chain reaction) assay that allows simultaneous detection of all the major toxin genes in one test. This represents a major breakthrough, since individual tests were previously needed for each toxin. The test has been up and running since 1994. The UA lab has used it to diagnose thousands of C. perfringens related illnesses at the request of community and scientific professionals. They have typed more than 6,000 isolates on request, from all across North America, and have published

instructions for veterinarians who wish to run the test themselves.

#### Impact

The PCR assay allows rapid diagnosis, which enables veterinary practitioners to quickly and logically institute control programs in affected herds. This method is cheaper than running individual tests for the four major toxins, and more accurate. It is approximately \$100 cheaper per test than the old method. Furthermore, this assay does not require the use of laboratory animals, unlike the assay it replaces. It has become the standard, most accepted laboratory method for diagnosing clostridial diseases; by 2000 it had been adopted in 20 states and Canada.

#### Funding

Hatch, SDA, Bayer Animal Health, Boehringer Ingelheim Animal Health  
Colorado Serum Company, Morris Animal Foundation

Scope of Impact - National

Key Theme - **Plant Geonomics**

### **Corn Gene Identification Project**

#### Issue

Cereal crops are the staple of most human diets worldwide. To improve crop yield and improve nutritive features in cereal crops, plant breeders need to know more about how specific genes work. Until recently, no one has ever attempted to characterize all of the genes in a single cereal crop.

#### What has been done?

In 1998 plant scientists from the UA and five other universities won a 5-year, \$12 million grant from the NSF to discover all 50,000 genes in corn, the nation's most important economic crop.

The scientists are using a new method for discovering and sequencing genes in corn, and are sharing project findings and material resources with public and private researchers working to develop improved traits in corn and many other agronomically important grasses, such as wheat, barley, rice and oats. Additional tools developed by this project will enable scientists to learn where and when each gene is active and how the gene functions. The corn genomics project is expected to lead to greater fundamental genetic understanding of cereals that worldwide contribute roughly 70 percent of the calories in the human diet. University of Arizona molecular geneticists have characterized about 25,000 corn genes thus far.

#### Impact

As the sequence of each targeted gene is characterized, UA researchers have entered this information into a computer database where plant breeders, plant genetic engineers and researchers in basic biology around the world are accessing this information so they can use these genes to learn more about how plants work. Slides, gene libraries and seed containing the mutated genes are available to the scientific community. The project is already having major benefits for plant research around the world, according to the researchers. Thousands of people are requesting these genes, and other resources .

#### Funding

Hatch, National Science Foundation (NSF)

Scope of Impact - National



## Goal2: *A safe and secure food and fiber system*

Summary: Food safety has become visible nationally and locally due to outbreaks of *E. coli* 0157:H7 and *Campylobacter jejuni*. Outbreaks in the future will likely be widely dispersed, intermittent, and geographically diffuse. Research and extension programs are addressing contamination from pre-harvest to post-harvest to retail. This year our report focuses on food safety education for government agencies, food retailers, supermarkets, consumers and other food service providers. In addition, our successful EFNEP program addresses food-borne illness in the home and has continued impact on clientele in select areas of Arizona.

### Key Theme - **Food Safety**

#### **Food Safety Education Program**

##### Issue

Increased outbreaks of foodborne illness have raised consumer awareness and concern about food safety in purchasing food, eating at restaurants, and food preparation and storage in the home. In 1999 alone, the top five foodborne diseases in Arizona totaled 1986 cases, including 33 cases of *E. coli* 0157:H7. With the high turnover in food service employees, ongoing food safety education and training is needed. A large percentage of these employees speak only Spanish, creating the need for food handler certification training and food safety education in Spanish. In Yavapai County, Arizona, the new county health code requires that at least one manager per food establishment have manager certification in food safety. In partnership with the county environmental health department, the UA Cooperative Extension in Yavapai County identified food safety education program needs through a food safety education consortium representing governmental agencies, food retailers, culinary association, supermarkets, churches, consumers, and other food service providers.

##### What has been done?

In 2000, the Food Safety Education Program offered through the Yavapai County Cooperative Extension featured educational programs for small retail food managers, employees, and consumers, to address the needs of food safety education from the farm to the table. Participants obtained research-based food safety information and education through one-to-one contacts, telephone, Internet, distance technology, publications, and community workshops. Two HACCP (Hazard Analysis of Critical Control Points) training conferences were held for 25 restaurant managers; managers also had the opportunity to participate in the statewide HACCP downlink. About 200 employees participated in food safety employee workshops. Fight BAC (fight bacteria) education workshops were held for 425 consumers, and 3000 Fight BAC brochures were distributed in the community. Extension handled 248 public service

calls related to food safety.

#### Impact

The partnership between the University of Arizona Cooperative Extension Yavapai County and the Environmental Health Department has resulted in the County Board of Supervisors' approval of 1.0 FTE to support the continuation of this program in the amount of \$38,000 annually. Survey responses from 1482 consumers, employees, and managers who participated in food safety education indicated they would save money by understanding and applying the principles they learned about food systems. Post surveys of consumers, on a scale of 1 to 5, with 5 as the highest, indicated a high (4.6) increase in the awareness and knowledge of food safety practices. And as a result of the HACCP training for retail food managers, 15 of the 25 food establishments represented in the training have implemented some of the HACCP guidelines in their restaurants.

#### Funding

University of Arizona Cooperative Extension Statewide Safe Food Initiative; State Department of Health; Yavapai County Board of Supervisors; Yavapai County Environmental Health Department; FDA regional office; American Culinary Federation; Safeway Market; Prescott Farmer's Market; Bashford Courts; Murphy's; Gurley Street Grill; New Frontiers Natural Foods; WIC Nutrition Program; National Fight BAC Campaign

Scope of Impact - National

### Goal 3: *A healthy, well-nourished population*

Summary: Our efforts this year have emphasized education programs for youth, adults and the elderly. The weight 4 life is highly effective and well received by the clientele. The bone builders program helps women by increasing knowledge and motivating behavior change on the issue of osteoporosis..

Key Theme - **Human Nutrition**

### **Improved Nutrition through School Gardens**

#### Issue

Obesity in youth has risen dramatically in the U.S. According to a recent issue of Science magazine, 25 percent of American children are overweight or obese, and

this figure is rising. Children are eating more and moving less. Gardening can teach children about healthier food choices, and encourage them to add more fiber-rich produce to their diets.

What has been done?

More than 3,000 students from ten Arizona schools, ranging from grades K through 8, participated in a school gardening program, with assistance from the UA Cooperative Extension, and a year-long grant for July 1999-June 2000. These schools are located in a variety of settings, both urban and rural, and include one school on the Gila River Indian Reservation, and a school for autistic children. All of the gardens included herbs and vegetables. Some had edible landscapes that the children ate from. One school had a chef who actually prepared lunchroom menus from the harvest. Cooperative extension faculty worked with more than 110 teachers, 500 parents and 50 new volunteers and staff to develop nutrition education activities and hands-on garden projects for their classes. They provided resources, education and training for teachers, staff and school personnel.

“It’s a great way to introduce the children to foods they might not otherwise try,” said Leslie Honaker, UA Cooperative Extension. “They take ownership of the food they grow and will try more of it. It’s a small step in opening their minds.”

Impact

More than 3,000 children added healthy, home-grown produce to their diets at school as a result of the program. Sample testimonials:

“The children at Desert Sonora Elementary are eating healthier, thus improving their quality of life and future eating habits. We in the Food Services Department know this because of the daily production records and the increase in the amount of fruits and vegetables need for each day at the campus.”

—Desert Sonora Elementary School

“We found less aggression from students who worked in the garden regularly. Parents began taking more interest in family nutrition. One overweight child lost 30 pounds with the change in diet.”

—Flor del Sol School

“Garden produce was shared at Indian Study Days, the reservation garden conference, school bingo, school lunches, with student families, and at the tribal employees recognition luncheon. Ten teachers and 15 parents remained active during the school year to participate in garden-based nutrition classroom activities.”

Funding

Arizona Department of Education/Child Nutrition

USDA: Team Nutrition 2000

Scope of Impact - National

Key Theme - **Human Health**

**"Healthy Weight 4 Life"**

Issue

Obesity affects more than 50 percent of the U.S. population, according to recent figures from the Centers for Disease Control. There is a critical need for effective weight management programs that integrate all the factors that contribute to obesity. A university environment can facilitate multi-disciplinary, collaborative approaches combining research and community outreach. At the University of Arizona, researchers in the College of Agriculture and Life Sciences, and the College of Medicine, are working together to develop and test a sound, scientifically-based weight loss program.

What has been done?

Faculty from the Department of Nutritional Sciences in the UA College of Agriculture and Life Sciences and the Department of Physiology in the UA College of Medicine developed a comprehensive weight loss program called "Healthy Weight 4 Life." One hundred twenty women enrolled. Phase One includes a weight loss curriculum emphasizing four elements: increased physical activity, healthy eating, developing healthy interpersonal relationships, and dealing with psychological and emotional barriers to weight loss. Phase Two features 18 months of subsequent online support that offers encouragement for participants in maintaining their weight loss. The Web-based format is more cost-effective than weekly face-to-face follow-up meetings. The UA researchers are testing this method for its efficacy and usefulness in promoting and maintaining long-term weight loss.

Impact

Of the 120 women who participated, the average weight loss during the first 16 weeks was 11 pounds. Some women lost 37 pounds. More than 75 percent of the women enrolled in Phase Two, the online support phase, have maintained their

weight or continued to lose more weight. (They had completed eight weeks of this support by early 2001). Some of the women in the program bordered on class II obesity when they started.

“I lost 44 pounds and now I am able to wear clothes I haven’t worn in years. How is this program different from others I have tried? It has all the elements to succeed. The nutrition, the hydration, the physical activity, mind and body, and the support groups. My physical activity grew from none to 500 to 600 minutes of activity a week or sometimes more. Thanks to this program, I started the New Year with a size 8, [down] from a size 16 or sometimes 18. Believe me, I do not miss my previous size.”

—participant

“The program was a lot of things to me...fun, new friends, professional people to learn from, informational in terms of exercise and nutrition, but most of all it took me from feelings of isolation, despair and depression over my weight and physical health to feelings that I am not alone with my struggles and I can control my weight and to some extent my physical health.”

—participant

Funding

National Institute for Diabetes, Degenerative and Kidney Diseases

Scope of Impact - Regional

Key Theme - **Human Health**

### **Bone Builders**

Issue

It is estimated that one out of every two women over 50 will develop osteoporosis. Older men have also been identified as possibly at risk. This silent disease weakens bones, eventually causing fractures, disability and loss of quality of life for millions of people, especially the elderly. It is the number two reason for women’s admissions into nursing homes. More than 28 million Americans who have osteoporosis or at high risk because of low bone mass; eighty percent of those affected are women. Although osteoporosis is both treatable and preventable, studies show that awareness is quite low among the U.S. population. Simple changes in diet and exercise can improve calcium levels in the body and strengthen bones before osteoporosis occurs.

With the large baby boom generation now moving into the beginning life stage susceptible to osteoporosis, education and prevention is more important than ever.

What has been done?

A collaborative program called “Bone Builders” was developed as part of the University of Arizona partnership between Cooperative Extension in the College of Agriculture and Life Sciences and the UA College of Public Health. The program brings together several public and private partners to reduce risk for osteoporosis among women statewide ages 35-55 by increasing their awareness of the risks of osteoporosis and ways to prevent it from developing. The program recruits and retains community peer educators who teach local, community classes, and seeks to identify high risk women in each community and encourage them to get basic x -ray or ultrasound screening for bone density.

In 2000, eight of Arizona’s 15 counties had Bone Builders programs; more are on the way. Since the project began, 80 volunteers have been trained in Maricopa County alone, and 53 from other counties, including apache, Gila, Pima, Pinal, Mohave, Yuma, and Santa Cruz. An updated web site, was developed. In

1999-2000 the Bone Builders program was taught to hundreds of community groups statewide, with 5813 people participating.

Bone Builders displays were at 68 health fairs, community fair, health spa, two statewide conferences and communities libraries directly teaching more than 3100 women.

Impact

Bone Builders partners screened 1143 women in 2000 with ultrasound technology on a volunteer basis. More than 50,000 Like Mother, Like Daughter flyers and 2000 posters have been distributed through businesses, doctor offices, day care centers, churches, schools districts, Women’s Expo and numerous women’s groups. More than 500,000 women have been reached through feature media articles and TV segments.

In Maricopa County, Bone Builder education volunteers rated the training curriculum 4.7 (out of 5 point schedule with 5 excellent) and the total training as 4.8 (out of 5 point schedule with 5 excellent and 0 being poor.) Participants rated their knowledge before the training as 3.1 and as a result of the training 4.6 (out of 5 point schedule with 5 high). Members of the public taking the education classes taught by the volunteers in 2000 rated their knowledge as an average of 2.41 before the sessions and after the classes an average of 4.5 (out of 5 point schedule with 5 high). The number of hits on the Bone Builders web site averaged 750-800 users per month.

## Funding

UA Cooperative Extension; UA College of Public Health; Maricopa County Department of Public Health Services; Office of Nutrition Services, Dairy Council of Arizona; Mesa Lutheran Hospital, Arizona Osteoporosis Coalition; Danner Health Arizona; Motorola, Arrowhead Hospital; Phoenix Center for Clinical Research; Sun Health

Scope of Impact - National

## Goal4: *Greater harmony between agriculture and the environment*

Summary: Historically, Arizona has been an early adopter of new technologies, including laser leveling, drip irrigation, transgenic cotton, and insect growth regulators. A continuance of this type behavior by Arizona farmers with adoption of new, white fly control technologies resulted in a reduction of insecticide applications from an average of 11 per year to less than 2 with concomitant reductions in costs from up to \$145/acre to \$11/acre. Newly developed IPM programs for lygus control have created similar results and reductions in the cost of production. Water is a scarce and expensive commodity in the arid southwest. We have demonstrated a natural, sustainable system for reclaiming waste water that will not wear out and is much cheaper to build than a conventional treatment plant. Water savings have also been demonstrated through the use of a low-volume irrigation system that cuts water use by 83% and reduces annual operating expenses for the production of lemons by about 9%. These Research and Extension programs reflect sample outputs, impacts and clientele benefits relative to Goal 1.

## Key Theme - **Integrated Pest Management**

### **Reducing Insecticide Use in Arizona**

#### Issue

Insecticide applications in cotton typically account for about half of all insecticide use in the United States. New materials on the market are now enabling cotton growers to reduce their spray applications while maintaining competitive yields. These technologies also help growers implement more ecologically-based IPM programs and become less dependent on broadly toxic insecticides.

#### What has been done?

An integrated pest management program implemented two new tools in 1996 and continued their use through 2000: insect growth regulators (IGRs, effective against whiteflies) and transgenic cotton (containing Bt effective against pink bollworms). The

University of Arizona College of Agriculture and Life Sciences collaborated with growers, the USDA, the Arizona Department of Agriculture, the Arizona Cotton Growers' Association, Cotton Incorporated, industry and others. Both of these tools are highly effective against pests, but safe to humans and the environment. Based on insect hormones, growth regulators disrupt the growth and development of insects. Transgenic cotton is genetically engineered to carry its own biological insecticide, targeting lepidopterous pests, within the plant tissues.

#### Impact

Nearly 100 percent of the cotton acreage in Arizona was sprayed multiple times for pink bollworm and silverleaf whitefly in 1995; however, in 1999 and 2000 the majority of acres were never sprayed even once for these two pests. This success was mainly due to the efforts of the Arizona IPM program and the availability of IGRs and transgenic cotton in reducing the number of insects that appeared. Weather patterns and other factors may also have influenced the appearance of fewer numbers of insects in 1999; however these trends have been sustained through 2000. Annual cotton acreage in Arizona is usually over 250,000 acres.

As a result of this program, during 1999 the average foliar insecticide use in Arizona cotton was the lowest in 21 years, according to state records first kept in 1979. Overall, 1999 had the lowest number of foliar sprays against all insect/arthropod pests in cotton during the 90s, and the lowest costs per acre during the same period. In 1990, growers applied about 11 sprays during the season at an average cost of \$113.76. By 1999 this number had dropped to 1.91 (between one and two sprays) at an average cost of \$37.18.

For silverleaf whitefly (SWF) in particular, the number of sprays dropped from 6.6 per season in 1995 to 0.40 for the season in 1999. Lint quality went from "very sticky" in 1992 to "very clean" in 1999. In 1995 SWF sprays cost an all time high of \$145.20 per acre, and amounted to nearly 70 percent of the total foliar insect control budget. By 1999 growers spent an average of \$10.91 per acre on SWF, which was only about 30 percent of the total foliar insect control budget. This was the lowest amount of money per acre spent to control SWF since its introduction to the state in the early 1990s.

Along with resistance management, these IPM efforts reduced insecticide use, conserved biological control agents, and enhanced sustainability and profitability.

#### Funding

Hatch Act, Smith-Lever 3(b) and (c), Special Research Grants, Smith-Lever 3(d)  
Other CSREES: Western Region IPM; National Pesticide Impact Assessment Program,  
Western Region, PEST MANAGEMENT ALTERNATIVES; Cotton Incorporated; Arizona



Cotton Growers Association; Agrichemical industry

Scope of Impact - State

Key Theme - **Integrated Pest Management**

## **Lygus Management**

### Issue

Integrated pest management (IPM) plans must be flexible enough to accommodate different insect pest pressures from year to year. After years of lesser recognition as a cotton pest, Lygus bugs have become the number one pest of cotton since 1998. Among growers, typical control measures for Lygus have involved tank mixing combinations of broad-spectrum insecticides in the unfounded hope that this practice will give more control over the pest.

### What has been done?

The UA College of Agriculture and Life Sciences has developed an integrated pest management program (IPM) for Lygus in cotton aimed at reducing insecticide use through adequate field sampling, adherence to threshold guidelines, and using the right compound for the job. Above all, it emphasizes avoiding pest pressures wherever possible. These measures are being incorporated into the larger cotton pest management program, and focus on reducing spray applications from mixed broad-spectrum insecticides to more selective, targeted single insecticide applications. One key to the success of the program has been the accurate identification of single spray compounds that perform consistently against Lygus and knowing precisely when to use them. The education component of this program has assisted growers in implementing this strategy during the last four cotton seasons.

### Impact

In response to this IPM program, more than 50 percent of the region's cotton growers have changed their chemical tactics against Lygus by switching to single compounds used strategically and at appropriate rates as part of an IPM system. This has resulted in a two-thirds reduction in the number of acres receiving spray mixtures for Lygus, while increasing effective rates by about 20 percent. Arizona extension cotton specialists have been able to teach and demonstrate to growers that these single compounds are as effective or even more effective than broad-spectrum combination sprays, and that this practice helps reduce the risk of resistance in Lygus and other insects while minimizing negative impacts on beneficial insects. More growers are now aware of the specific timing (thresholds) required for the control of Lygus and for providing maximum economic return. In 1999, growers applied the fewest number of sprays statewide against Lygus in cotton since 1993, thus reducing

their costs per acre while protecting the environment.

The success of this program has led for the first time to efforts to control Lygus across multiple crops (Lygus are highly mobile and feed on several crops in addition to cotton). Growers have begun meeting with Cooperative Extension personnel to develop cooperative plans involving cropping sequences and cultural controls to reduce damage from Lygus.

#### Funding

Arizona Cotton Growers Association, Hatch Act, IPM 3-D Smith-Lever, Agrichemical companies

Scope of Impact - Regional

### Key Theme - **Water Quality**

#### **Reclaiming Wastewater through Soil Aquifer Treatment**

##### Issue

Water-short areas in the U.S. and around the world have turned to reclaiming wastewater as a way to increase water supplies. Some treatment methods use chemical additives to help purify the water. Charles Gerba, a University of Arizona soil scientist, tested a more natural method currently used in Tucson, and found that it produced high quality nonpotable water without additives at a low cost.

##### What has been done?

The soil aquifer treatment used a 37-meter layer of soil as a filter. Wastewater was purified as it passed through, and was then collected in underground storage tanks. This is a natural, sustainable system that will not wear out. It takes the place of building a conventional treatment plant.

##### Impact

The soil aquifer treatment significantly reduced enteroviruses as they passed through the soil. Groundwater samples held no Giardia. The two organic compounds present were reduced by 92 percent and 85 percent respectively, and total nitrogen leached out 47 percent during recharge. The project has now expanded to include the City of Phoenix in Arizona, and Los Angeles and Orange Counties in California, at the request of those communities.

In Tucson, the project grew to include studies on using artificial wetlands as a pretreatment before soil aquifer treatment. At Tucson's Sweetwater Wetland and

Recharge Facility the wetlands method reduced Giardia cysts and Cryptosporidium oocysts by more than 99.9 percent, and fecal coliforms and coliphages by 68 and 52 percent, respectively.

#### Funding

City of Tucson, American Water Works Association Research Foundation  
U.S. Environmental Protection Agency (EPA), Los Angeles County Sanitation District  
Agricultural Research Service

Scope of Impact - National

### Key Theme - **Natural Resources Management**

#### **Low Volume Irrigation in Lemons**

##### Issue

Increasing urban demand for scarce water resources in the western U.S. has led farmers to sell some of their water rights to metropolitan areas. This trend is expected to continue, eventually leading to reduced water availability for citrus production in Arizona, and to increased establishment of citrus groves with low volume irrigation systems. Current nitrogen fertilization practices will need to be modified for a low volume irrigation system and best management practices (BMPs) established.

##### What has been done?

University of Arizona research at the Yuma Mesa Agricultural Center has focused on 1) Quantification of the amount of water saved using low - volume irrigation, 2) the identification of physiological differences in lemon trees subject to low volume and flood irrigation and 3) development of BMPs for lemon under low volume irrigation.

##### Impact

Lemon trees are being grown using low volume irrigation while providing only 17 percent of the water normally required for flood irrigation (2000), with improved yield and no loss of fruit quality. Using current water prices, low volume irrigation would save growers about 9 percent of their yearly growing costs. The researchers have also grown lemon trees using low volume irrigation while providing about 50 percent of the recommended nitrogen. Based on this research, one large grower is now establishing all of his new groves with low volume microsprinkler irrigation.

#### Funding

Hatch Act

Commodity: Arizona Citrus Research Council

Scope of Impact - Regional

Key Theme - **Integrated Pest Management**

### **Environmentally Responsible Gardening in Maricopa County**

#### Issue

With close to 3 million people in Maricopa County, Arizona—a large percentage of them newcomers to the Sonoran Desert—there is a tremendous need for public education regarding appropriate selection, placement and care of plants. The Master Gardener program seeks to improve the health of plants and people while promoting environmental responsibility in the garden. It includes the efficient use of water, fertilizers and pesticides and the reduction of green waste.

#### What has been done?

Two 17-week training sessions were held through the Arizona Cooperative Extension in 2000; 120 new Master Gardeners were trained. Using the multiplier effect, training of Master Gardener volunteers expands the coverage of county extension agents to fulfill needs throughout Maricopa County.

#### Impact

Master Gardeners immediately give back to the community by teaching others what they've learned themselves about gardening and landscaping. In 2000, volunteers gave over 170 talks attended by more than 4,300 people. Participants said they improved their general knowledge about soils, turf, efficient irrigation, pruning, vegetables, native plants, wildlife habitats, citrus and fruit trees, ornamentals and botany.

As a result of educational outreach regarding pesticide use, Maricopa County Cooperative Extension learned, from a call-back survey, that 75 percent of patrons who had contacted them were willing to use alternatives to pesticides. Ninety-five percent of patrons contacted in the survey said they would contact Extension again with future horticultural questions.

About 400 Master Gardener volunteers donated 28,000 hours fielding 23,000 telephone calls at the main Extension office and three satellite locations in 2000.

#### Funding

Smith- Lever

## Scope of Impact - Local

### Goal 5: *Enhanced economic opportunity and quality of life for Americans*

Summary: Arizonans are challenged to deal with parent and youth issues such as teenage pregnancy, literacy, fiscal management, workforce preparation, poverty, parenting, and youth development. There is clear evidence that community efforts can help prevent teenagers from having babies, committing crimes, and dropping out of school. With this in mind, Research and Extension programs, in partnership with many state agencies and private sector organizations, have implemented a variety of programs to deal with some of these social challenges. This year we focus on money management programs and life skills training along with family and community connections. Partnership and teamwork are the keys to success.

### Key Theme - **Family Resource Management**

#### **Money 2000**

##### Issue

The standard of living varies widely across Arizona. While income levels are near national averages in Phoenix, they are below average compared to other large urban areas. Among other Arizona cities, the standard of living ranges 15 to 30 percent below the national averages.

Research shows that people with a financial plan have twice the money saved for retirement as those without. MONEY 2000+™ is an example of a comprehensive plan that supports the Federal Performance Goals to reduce consumer debt and to increase consumer savings. The program also supports the Cooperative State Research, Education, and Extension Service agency goal “to enhance economic opportunities and quality of life among families and communities.”

##### What has been done?

A task force was formed that comprised local, county and state partners from Arizona Cooperative Extension, public schools, volunteer organizations, government, Native Americans, and non-profit agencies. For a \$10 enrollment fee, Extension provided each participant with financial education: start-up kit, record-keeping materials, seminars, workshops, classes, home study course, educational materials, quarterly newsletter, video loan, ongoing support with six-month follow-up. Individual training sessions were provided to FCS agents preparing to implement the program in their counties.

Investing For Your Future (IFYF), a basic investor home study course developed by a partnership of five land-grant universities, the CSREES-USDA and the U.S. Securities and Exchange Commission (SEC) was released in July 2000. Five hundred copies of the course were copied and distributed to active M2K counties.

Since September 1, 2000, 55 households have also enrolled in Investing For Your Future. Because of the continued success and active participation by members of MONEY 2000+™, the program has been extended to December 31, 2002.

#### Impact

As of December 31, 2000, the total dollar impact of MONEY 2000+™ in Arizona, with three counties reporting impact data, was \$589,760 of financial improvement that included \$267,860 of increased savings and \$321,900 of reduced debt. There are 422 households enrolled in MONEY 2000 in Arizona.

County and state statistics were compiled and reported to Rutgers Cooperative Extension for a national impact. As of December 2000, the total dollar impact of MONEY 2000+™ nationwide, with 29 states reporting impact data, was just under \$20 million. That includes \$10,618,271 of increased savings and \$8,247,219 of reduced debt. Currently the program has over 13,000 households enrolled nationwide.

“Because of this program I am documenting all expenses and know where my money is going; working more hours; setting goals to reduce credit card debt and I don’t carry credit cards with me anymore.”

–participant

#### Funding

Cooperative Extension–statewide programming

Scope of Impact - National

### Key Theme - **Leadership Training and Development**

#### **JOLT: Journey of Opportunities for Leaders of Tomorrow**

##### Issue

Modern society is filled with negative attitudes and problem-causing teenagers. Programs like JOLT turn teens into positive role models and future community leaders.

What has been done?

JOLT (Journey of Opportunities for Leaders of Tomorrow) is an Arizona Teen Leadership camp held annually in Heber, Arizona in June. Activities promote trust-building, leadership, and communication skills. Arizona Cooperative Extension sponsors the camp which has been held for 14 years. Teenagers aged 14-18, of various backgrounds, gather from across Arizona to develop open-minded and positive attitudes, develop a strong sense of teamwork, and learn to reject selfish actions that only benefit individuals. Conflict resolution skills and relationship building skills help create the “JOLT team,” promoting life-long friendships that are uncommon in other camps.

#### Impact

More than 1,000 teens have attended JOLT over the past 14 years. Teens who were youth staff members have gone on to serve as state 4-H Ambassadors and state 4-H Teen Council officers and representatives, and about 25 percent report they have participated in school government opportunities. Two youth staff for the 2001 conference tried out for plays and sports leadership roles after JOLT. Participants reported increasing their leadership skills and abilities by 23 percent; ability to make new friends by 21 percent, ability to trust others by 26 percent, ability to logically solve problems in a group by 24 percent, and to participate in new activities and challenges by 22 percent. Many participants returned more than once.

“JOLT has taught me so many things. I have made the friends of a lifetime and have learned so many skills in becoming a great leader. I use these skills every day of my life away from JOLT and it just means so much to me. I will definitely be back next year.”

—JOLT participant

“JOLT means believing in yourself, making new friends, and becoming a leader. I think that it gives the kids another chance who have messed up in the past.”

—JOLT participant

#### Funding

Arizona Cooperative Extension, 4-H Youth Development

Scope of Impact - State

Key Theme - **Workforce Preparation**

**The Extension Connection—Life Skills Training**

## Issue

There is a need in the Phoenix metropolitan area for “welfare-to-work” type programs. The Extension Connection is a major part of the “Project S.T.R.I.D.E.” (Successful Training Resources for Individual Development) program, a job linkage demonstration project. S.T.R.I.D.E.’s mission is to assist unemployed, low skilled, and disadvantaged Phoenix Enterprise Community (low-income) residents with training that promotes job readiness and self-worth to overcome barriers to entering the world of work and achieving job stability and advancement, and job placement. It is one of the first projects directed at employment for the very hard to employ.

## What has been done?

The Extension Connection provided a six-week life-skills program with components designed to help families become more conscious of healthy and nutritious meals; aware of food safety; self-sufficient; equipped to handle their families need and concerns; better at understanding that work is a means to achieving goals not the end all; more able to take better charge of their lives; more valuable to their community; acclimated to employment and education and better able to budget and plan their money.

Participants in the program ranged from former gang members to newly arrived immigrants to the United States whose lack of English and American job skills caused significant barriers to employment. Ninety-five percent of the program graduates were members of racial or ethnic minorities, 40 percent had less than a high school education; many had criminal records.

## Impact

Of the 146 participants who completed the program in 2000, to date 115 have secured employment. Positions paid from \$5.50 to \$12.60 per hour. Participants reported that the program helped them regain their self-esteem, get on track to a job and career and open the doorways to continue their education. Hadco, a firm in Phoenix which manufactures circuit boards, and was the first company to work with Project S.T.R.I.D.E, has gained 25 employees in its manufacturing facility. Hadco managers have commented, “The people that went through the S.T.R.I.D.E. Program were better prepared than most people, and they [the graduates of S.T.R.I.D.E.] had more stability than people [we have] hired off the streets.” This important statement is key because Hadco also declared that most of the S.T.R.I.D.E. graduates would not have qualified for job placement if they had just walked in off the street.

Forty-year old Khin San Myint was already employed at Hadco, but she sees S.T.R.I.D.E. giving her skills to someday obtain a promotion: “We can now face everything [we need to do] before employment: what are the requirements, how to



prepare for an interview, how to write a resume. We had to practice these things everyday before the group.”

#### Funding

EFNEP, Smith -Lever

Southwest Leadership Foundation

Scope of Impact - National

### Key Theme - **Workforce Preparation - Youth and Adult**

#### **Preparing for Careers in Retailing and Consumer Studies**

##### Issue

Demand exceeds supply for graduates who can fill jobs in the expanding field of retailing. According to the National Retail Federation’s Retail Industry Indicators, retail added 3.3 million new jobs between 1988 and 1998. Projections are for 3 million new retail jobs by 2008 for a grand total of 25.4 million jobs throughout the industry. One in five American workers is employed in retail—with register sales exceeding \$3 trillion last year.

##### What has been done?

The University of Arizona College of Agriculture and Life Sciences offers a program of undergraduate and graduate study in Retailing and Consumer Sciences. The rigorous, comprehensive curriculum offers courses in global retailing, services retailing, e-commerce, supply-chain management and leadership development. Eligible students complete structured internships in a variety of retail formats worldwide. These have included department stores, discount retailing and specialty retailers. In addition, the Students in Free Enterprise (SIFE) team is an extracurricular activity where students are given the chance to develop leadership, mentoring, teamwork and communication skills, by learning, teaching and practicing the fundamentals of free enterprise. The Southwest Retail Center that is affiliated with the Retailing and Consumer Studies Division facilitates the connection between academic instruction and experiential learning.

##### Impact

Between 70 and 80 percent of the retailing program’s graduates are placed in retail jobs upon graduation. Positions include merchandise analyst, assistant buyer, merchandiser, buyer, store manager, and HR recruiter. About 78 percent of the students completing an internship through the program said the experience was instrumental in developing their career expertise. These internships have in many

cases led to direct employment after graduation at the sponsoring firm.

#### Funding

College of Agriculture and Life Sciences, the University of Arizona

Corporate support: Bear Creek Corporation; Bridgestone/Firestone; Cracker Barrel; Discover Financial Services, Inc.; Distance Learning Venture; Enterprise Rent-A-Car; Federated Department Stores; International Council of Shopping Centers Foundation; JCPenney Company, Inc.; Kmart Corporation; KPMG; Macy's West; Mervyn's California; Mindmeld, Inc.; Nordstrom; Office Depot; Sears Roebuck & Co.; Strategic Mindshare; Target Corporation; Toys 'R' Us; Walgreens; Wal\*Mart Stores, Inc.

Scope of Impact - National

## STAKEHOLDER INPUT PROCESS

### 1) Advisory Boards

#### a) *Cooperative Extension.*

The Legislature of the State of Arizona accepted the provisions of the Smith-Lever Act in 1915. It authorized the Board of Regents of the University of Arizona, the Land Grant University in Arizona, to "organize and conduct agricultural Extension work which shall be carried on in connection with the College of Agriculture and Life Sciences of the UA in accordance with the terms and conditions expressed in the Act of Congress aforesaid". This State legislation also empowered county governments to appropriate funds for the county Extension program.

Currently, according to Arizona State Law *ARS 3-124-127*, each County Extension Board consists of seven persons, who are residents of the county, four of whom have as their principal business the production of agricultural commodities, and the other three of whom are representative of organizations or persons who utilize the county Cooperative Extension offices. Extension faculty are sensitive to including membership representative of their county regardless of racial or ethnic background. Names of Advisory Boards for each Arizona county are available at the Cooperative Extension web site (<http://ag.arizona.edu/extension/>).

The County Extension Boards have three responsibilities. First, in order to build educational program priorities that are based on needs of local people, the Extension Board must approve the Annual County Plan of Work. The county Extension faculty present a prioritized list of potential programs and the

Board may suggest others. In setting priorities, Cooperative Extension is interested in involving a broad-based, representative county group that may include commodity groups, 4-H councils, family consumer groups and community development groups.

Another role of the County Extension Board is to annually approve the county Extension budget, submitted to the Extension Board by the County Director. This budget covers all funds expended for Extension work in the county. According to the legislation, the Board of Supervisors of each county must provide reasonable rent-free office space for the conduct of extension work in that county.

Finally, the Extension Board approves the Annual Report of Extension work in the county. County reports are available at the Cooperative Extension web site.

#### b) *Experiment Station*

Individual advisory boards have been established for each of the following Agricultural Centers: Maricopa and Citrus, Safford, Yuma, Oracle, Santa Rita Experimental Range and the V-V Ranch. The boards have representatives from the agricultural community, the agri-business community and include consumer representatives who are appointed on a rotational basis. These boards meet from two to four times per year to review ongoing programs and make recommendations for change. In addition, the State 4-H Youth Development program, the Departments of Agricultural and Biosystems Engineering and Animal Science and the Schools of Renewable Natural Resources and Family and Consumer Studies have separate advisory committees that provide input to the programs of these units.

#### 2) State Program Evaluation

Accountability is increasingly important to secure new resources, maintain visibility, and market effectiveness. Every faculty member in the College of Agriculture and Life Sciences provides an Annual Performance Report (APR) of accomplishments and impacts for the previous year, and a plan of major commitments for the coming year. As of February 1, 2002, faculty prepare their APRs on-line, in a new system called APROL.

By the year 2004, the College of Agriculture and Life Sciences will have a searchable database of programs and their impacts. Key components of the database are: (1) college-wide reporting, linking extension, research and teaching; (2) agricultural experiment station reporting of federal project data; (3) Cooperative Extension reporting of federal clientele contact data and outreach activities.

In the past year, Cooperative Extension sponsored several program retreats focusing on two grass-roots generated initiatives: 1) natural resources and water and 2) sustainable communities. Programmatic support, monitoring support and political support are being generated to accomplish the goals of these programs. Statewide program priorities for the next three to five years were identified during these exercises. Extension faculty are committed to an on-going process of self-improvement in outreach programs.

### 3) Public Input for College of Agriculture and Life Sciences Programs

Public input is extremely important to the College of Agriculture and Life Sciences. Because we are a Land Grant College committed to serving the needs of the State of Arizona, the College regularly seeks stakeholder input, programmatic feedback, and advice on future directions from citizens. As noted above, Extension Advisory Boards provide stakeholder input to Extension faculty on a yearly basis.

This past year we have focused on getting input on our family and youth programs. In each county of the state, at the state capitol, and at the University we involved 174 adults and 144 youth along with 12 state officials in a conversation on the future of 4-H and youth programs. Over 1000 hours of staff and volunteer time were devoted to this public input.

### **PROGRAM REVIEW PROCESS**

There have been no significant changes in the program review processes submitted in the 5 - Year Plan of Work.

### **EVALUATION OF THE SUCCESS OF MULTI AND JOINT ACTIVITIES**

Continued progress has been made on nearly all of the goals and outcomes outlined in the 5- Year Plan of Work. Much of this can be attributed to our multi-state and integrated programs. We continue to be involved in more than 40 separate multi-state projects and coordinating committees which, coincidentally, allowed us to have direct interaction with scientists from more than 40 separate agricultural experiment stations from the various states and territories. This interaction also involves an increasing number of individuals who have their primary appointment with Cooperative Extension. The relatively small amount of federal dollars that are committed to this process leverages a very significant number of resources in terms of personnel and operations to solve many of our regional and national problems. Arizona is fully committed to this process and will remain a strong player in the formalized multi-state effort.

As noted before, Arizona has a fully integrated research and extension program. This is evidenced by the fact that nearly all of our extension specialists have split appointments as do many of the research faculty. The split responsibility model is carried up through the department heads, center directors and at the dean/director level where resource decisions are made jointly by research, extension and academic program leadership. Therefore, we have minimized distinctly separate extension and research programs. Rather we have a situation in which some activities are largely “extension” oriented, some that are largely “research” oriented and a very large body of activity in the middle that represents a combination of efforts. Much of our day to day progress can be attributed to the joint and collaborative efforts that emerge from this working model.

As noted above, most of the multi-state “research” activities are conducted through the formalized multi-state programming effort. In the Plan of Work we also outlined a formalized effort with New Mexico and Utah, involving mostly county extension personnel and designed largely to meet the needs of the Native American community. This activity is ongoing and productive.

**Appendix C**  
**U.S. Department of Agriculture**  
**Cooperative State Research, Education, and Extension Service**  
**Supplement to the Annual Report of Accomplishments and Results**  
**Multistate Extension Activities and Integrated Activities**  
**(Attach Brief Summaries)**  
**Institution University of Arizona**  
**State Arizona**

Check one:  **Multistate Extension Activities**  
 **Integrated Activities (Hatch Act Funds)**  
 **Integrated Activities (Smith-Lever Act Funds)**

**Actual Expenditures**

Title of Planned Program/Activity As described in report of accomplishments and results	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
	\$153,520		\$153, 520	_____	_____
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<b>Total</b>	<b>\$153,520</b>		<b>\$153, 520</b>	_____	_____

Form CSREES-REPT (2/00)

*Jim Christenson*

Appendix C  
 U.S. Department of Agriculture  
 Cooperative State Research, Education, and Extension Service  
 Supplement to the Annual Report of Accomplishments and Results  
 Multistate Extension Activities and Integrated Activities  
 (Attach Brief Summaries)  
 Institution University of Arizona  
 State Arizona

Check one:  Multistate Extension Activities  
 Integrated Activities (Hatch Act Funds)  
 Integrated Activities (Smith-Lever Act Funds)

Title of Planned Program/Activity	Actual Expenditures				
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
As described in report of accomplishments and results	\$98,090	\$98, 090	_____	_____	_____
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<b>Total</b>	<b>\$98,090</b>	<b>\$98, 090</b>	_____	_____	_____



March 1, 2002

**Appendix C**  
**U.S. Department of Agriculture**  
**Cooperative State Research, Education, and Extension Service**  
**Supplement to the Annual Report of Accomplishments and Results**  
**Multistate Extension Activities and Integrated Activities**  
**(Attach Brief Summaries)**  
**Institution University of Arizona**  
**State Arizona**

Check one:  Multistate Extension Activities  
 Integrated Activities (Hatch Act Funds)  
 Integrated Activities (Smith-Lever Act Funds)

Title of Planned Program/Activity	Actual Expenditures				
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
As described in report of accomplishments and results	\$152,100		\$152,100	_____	_____
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**Total**

**\$152,100**

**\$152,100**

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**Form CSREES-REPT (2/00)**

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**Director**

**March 1, 2002**

*Jim Christenson*